June 10, 1947. H. PFLEUMER 2,421,847

HYDRAULIC CLOSURE FOR AUTOCLAVES

Filed Nov. 22, 1946 2 Sheets-Sheet 1

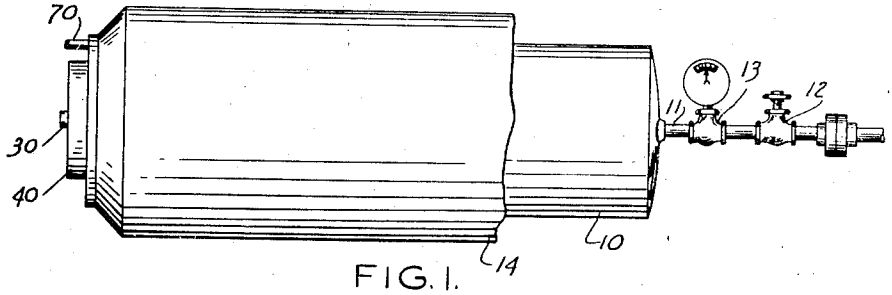


FIG. 1.

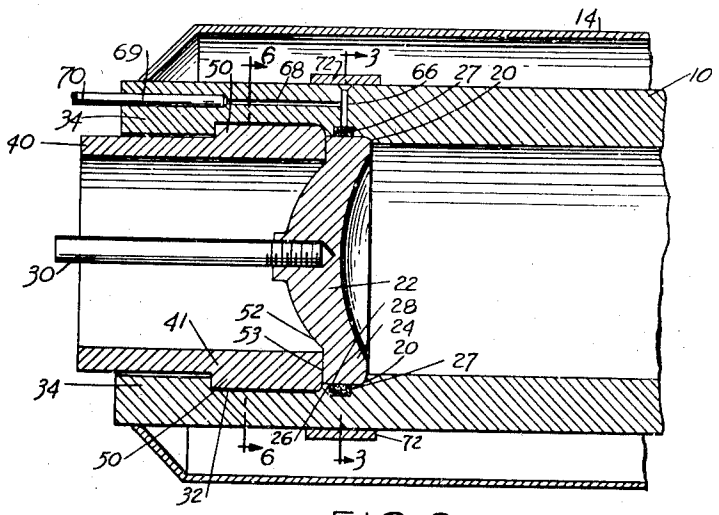


FIG. 2.

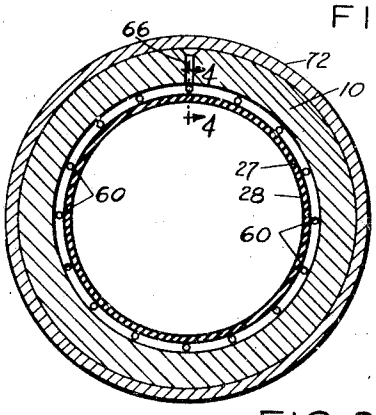


FIG. 3.

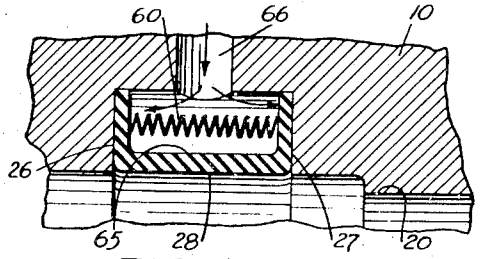


FIG. 4.

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HYDRAULIC CLOSURE FOR AUTOCLAVES

Filed Nov. 22, 1946 2 Sheets-Sheet 2

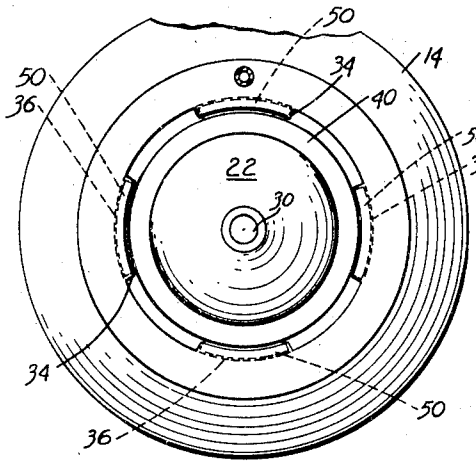


FIG. 5.

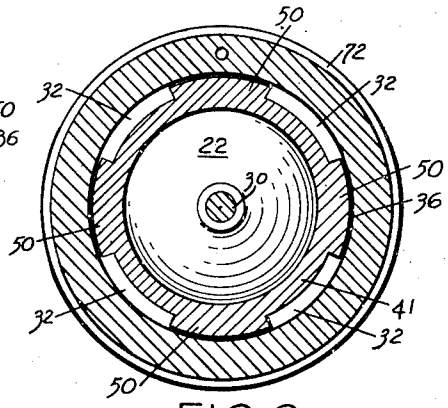


FIG. 6.

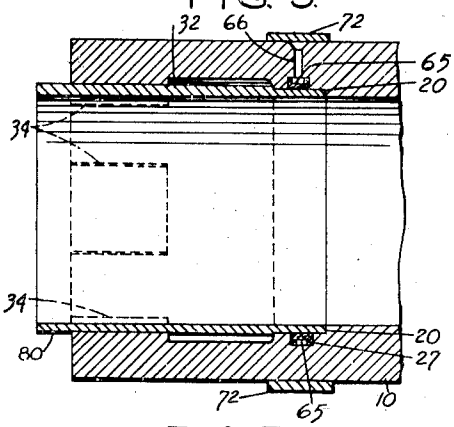


FIG. 7.

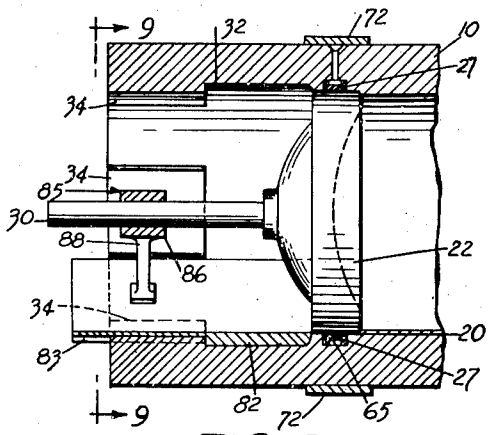


FIG. 8.

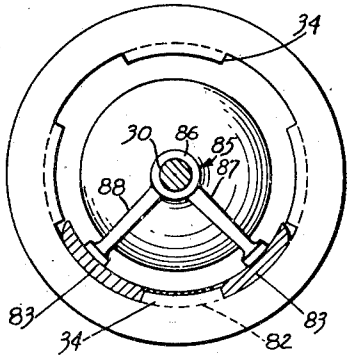


FIG. 9.

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UNITED STATES PATENT OFFICE

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HYDRAULIC CLOSURE FOR AUTOCLAVES

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Substituted for abandoned application Serial No. 445,249, May 30, 1942. This application November 22, 1946, Serial No. 711,577

1 Claim. (Cl. 220—46)

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My invention which is a substitute for abandoned application Serial No. 445,249, filed May 30, 1942, relates to a novel pressure chamber and means for closing and sealing the chamber. More specifically, my invention relates to a novel apparatus for effecting the secure closing and tight sealing of a pressure chamber or autoclave, whereby the sealing pressure is supplied by a hydraulic fluid.

However, in the practice of my invention, instead of applying the hydraulic fluid pressure over the area of the entire lid or closure member itself, the hydraulic pressure is applied over the relatively restricted area of the sealing gasket, and a direct rigid pressure member is provided to limit the outward movement of the lid or cover.

In certain manufactures, the use of high pressure autoclaves is indicated where it is desired to effect treatment under pressure of the order of 4000 to 5000 pounds per square inch. Such pressures are employed, for example, in the manufacturing of gas expanded rubber.

It is exceedingly difficult to seal such high pressure chambers against leakage and even more difficult effectively to maintain a gasket as a lid seal without injury to the gasket or without leaks which may occur owing to unevenness in the abutting surfaces of the chamber and the cover which may be caused by heating or cooling effects.

I have devised a novel autoclave closure and sealing means therefor, whereby the chamber may be effectively sealed during the pressure operation, and readily opened after it is completed. I obtain this result by utilizing a rigid securing member to hold the cover firmly in place, and by placing a gasket between the cover and the chamber walls which will prevent the escape of the gases confined within the autoclave.

Appropriate pressure upon this gasket is maintained in accordance with my invention, by means of a hydraulic fluid which is brought to bear under pressure exceeding that within the autoclave, against the surface of the gasket.

The gasket is of such nature that it will prevent the flow of the hydraulic fluid therethrough and at the same time will prevent the escape of the gases under pressure.

It is therefore an object of my invention to provide a novel autoclave in which an effective pressure seal may be effected.

It is another object of my invention to provide an autoclave wherein a gasket is provided between the cover or lid member and the chamber wall.

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And as a corollary object of my invention, I provide a hydraulic sealing means for the aforementioned gasket.

It is another object of my invention to provide a high pressure autoclave for pressures of the order of 4000 to 5000 pounds per square inch, means whereby the gasket which effects the seal of the lid is maintained under appropriate pressure to prevent escape of the gases within the chamber by means of a hydraulic fluid acting directly upon the gasket.

These and many other objects of my invention will become apparent in the following description and drawings in which:

Figure 1 is a side view of a jacketed autoclave constructed in accordance with my invention.

Figure 2 is a longitudinal cross-sectional view through the autoclave of Figure 1 showing the arrangement of the cover member therein.

Figure 3 is a cross-sectional view taken on line 3—3 of Figure 2 looking in the direction of the arrows.

Figure 4 is an enlarged cross-sectional view showing a portion of the gasket member as seen at the upper center portion of Figure 2.

Figure 5 is an end view of the autoclave of Figure 2.

Figure 6 is a cross-sectional view taken on line 6—6 of Figure 2 looking in the direction of the arrows.

Figure 7 is a view corresponding to that of Figure 2, showing however, the cover member and its retaining breech block or sleeve removed, and a protective sleeve inserted therein.

Figure 8 is a view corresponding to that of Figures 2 and 7, showing a guide pad and alignment foot in place in the end of the autoclave for guiding the cover member into position.

Figure 9 is an end view partly in cross-section taken on line 9—9 of Figure 8 looking in the direction of the arrows.

Referring now to Figure 1, I have here shown an autoclave or pressure chamber 10, having a conduit 11 connected thereto with suitable valve 12 and indicators 13, by means of which gases may be caused to enter or be exhausted from the chamber. The chamber 10 is shown surrounded by a jacket 14 which is preferably a jacket for passing steam across the outer surfaces of the autoclave 10 in order to heat the same. A cross-sectional view of this jacket is also clearly seen in Figure 2,

The jacket 14 is provided with suitable inlet and outlet conduits in order to permit the entry

of steam or any other heating fluid for purposes of varying the temperature of the autoclave.

In Figure 2, I have shown a cover member appropriately positioned in the autoclave and the autoclave properly prepared for the purpose of pressure treatment.

The chamber wall 10 is, near its outer end, provided with an annular recess 20 against which the interior edge of the lid or cover member 22 may abut. The lid or cover member 22 as may readily be seen in Figure 2, is a concave member which is designed to resist the autoclave, and is provided with a cylindrical annular portion 24 which abuts against the annular recess 20 of the autoclave wall. Immediately exteriorly of the annular recess 20, the autoclave chamber wall 10 is provided with an annular groove 26 within which the gasket 27 may be positioned.

The cover member 22 is so arranged that the cylindrical side 28 thereof abuts against the surface of the gasket 27. The gasket 27 has a specific form and operation which will hereinafter be described.

The lid 22 is provided with a central pin 30 secured thereto in any suitable manner and, for purposes of the operations herein described, may be regarded as integral therewith. Pin 30 is, as may readily be seen in Figure 2, centrally located with respect to the lid 22, and thus should extend along the longitudinal axis of the end of the autoclave.

Immediately exteriorly of the groove 26 within which the gasket 27 is positioned, a wide annular recess 32 is provided, the said recess coinciding with the extensions 34 to form a breech block arrangement. Thus, as seen in Figure 5, the extensions or abutments 34 are four in number, each extending approximately forty-five degrees over the arc of the interior of the end of the chamber, spaced from each other by flutes 36 which are slightly wider than the abutments 34.

A breech block pressure sleeve 40 is provided having a similar breech block arrangement 41 at the inner end thereof. As is seen particularly in the cross-sectional view of Figure 6, the breech block end 41 of the sleeve 40 consists of a plurality of annular abutting members 50, each adapted to slide down the respective flutes 36, and to engage behind the abutment 34 in the end of the autoclave upon a rotation of the sleeve 40 through forty-five degrees.

When the lid 22 has been placed against the recess 20 in the manner hereinafter described, then the sleeve 40 may be positioned in the end of the autoclave in the manner above described, rotated through 45 degrees and locked in place. The annular ledge 52 of the lid 22 now bears against the interior surface 53 of the sleeve 40. The abutments 50 of the sleeve 40 bear against the abutments 34 in the breech block arrangement at the end of the autoclave enclosure.

Consequently, any direct outward pressure exerted upon the interior of the lid 22 from the interior of the autoclave will drive the annular portion 52 of the lid against the annular end 53 of the sleeve, and will drive the abutment 50 of the sleeve against the abutment 34 of the breech block arrangement at the end of the autoclave. This abutting arrangement will resist any force tending to blow out the lid.

It now becomes necessary to seal the space between the lid and the chamber wall so that any path for the escape of the internal gas pressure will be closed. For this purpose, I provide the gasket 27 in the annular groove 26 which thus bears against the cylindrical surface 28 around the entire lid.

The gasket is pressed tight against the lid by means of hydraulic pressure. As is seen in the enlarged view of Figure 4, the gasket 27 comprises a U-shaped member of any suitable gasketing or sealing material which rests in the annular groove 26. The sides of the U-shaped member abut the sides of the groove 26, and are spread apart and forced into this abutting arrangement by means of a plurality of spaced coil springs 60, the ends of which also may be seen in the end view of Figure 3. When the gasket 27 and the lid 22 is in position, then hydraulic fluid may be admitted into the annular area 65 within the gasket, and the pressure of the hydraulic fluid raised in order effectively to seal the space between the gasket 27 and the sides 28 of the lid 22.

A small radial bore 66 (Figures 2, 3 and 4) is made from the outer surface of the autoclave wall inwardly to communicate with the annular groove 26. This bore is intersected by a small longitudinal bore 68 (Figure 2) which in turn communicates with a larger longitudinal bore 69.

A conduit 70 for the admission of hydraulic fluid is secured in any suitable manner in the larger longitudinal bore 69. The outer end of the bore 66 opposite to the end which communicates with the annular groove 26 is sealed by a metallic band 72 which is welded in place around the autoclave wall 10 (see Figures 2 and 3). Thus, hydraulic fluid may be admitted from any suitable source through the pipe 70 into the small bore 68. Thence it flows into the small radial bore 66 and then into the space 65 on the interior of the gasket 27 within the annular recess or groove 26. The entire annular space 65 is thus filled out by the hydraulic fluid.

Spring pressure created by the multiplicity of spring 60 which spreads the walls of the U-shaped gasket 27 against the sides of the groove 26, creates sufficient pressure to initially retain the hydraulic fluid and prevent the same from leaking into the interior of the autoclave.

When the interior annular recess within the gasket 65 is completely filled with hydraulic fluid, then pressure is applied to said hydraulic fluid to raise the pressure thereof to a sufficient extent to form an efficient seal against any internal pressure which may be expected within the autoclave. Thus, should it be desirable to raise the pressure within the autoclave to 5000 pounds per square inch, the hydraulic pressure within the annular interior 65 of the gasket 27 is raised to say 5050 pounds per square inch, thus pressing the gasket 27 against the sides of the lid 28 and forming an efficient seal between the lid and the chamber walls to prevent the escape of any of the internal gases.

When the process has been completed, the hydraulic pressure may be relaxed thus loosening the gasket 27 and permitting the withdrawal of the lid 22.

In order to facilitate the leading of the autoclave and in order to simplify the placement of the cover thereon, I have found that the following steps may prove advantageous.

In Figure 7 I have shown the end of the autoclave completely open with the breech block sleeve 40 and the lid 22 completely removed. A tubular sleeve 80 has been inserted in the end of the autoclave so that it covers up the end breech block arrangement as well as the gasket 27. The interior of the sleeve 80 is smooth, so

that the sleeve provides a smooth path for loading or unloading the autoclave.

When it is desired to load the autoclave with material which is to be subjected to pressure, the tubular sleeve **80** is placed in position against the annular recess **20**, and the material is loaded. When loading has been completed, the tubular sleeve **80** is removed and a guide pad **82** is inserted in the breech block end of the autoclave (see Figures 8 and 9). The guide pad **82** consists of a part cylindrical member having a smooth internal surface with a pair of longitudinal extensions **83**, **83** thereon. These longitudinal extensions are spaced apart by the width of one of the abutting members **34** of the breech block arrangement at the end of the autoclave. The members **83** have a form and shape permitting them to slide readily down the flutes **36** between the breech block abutments **34** and be positioned thereby.

Thereafter, an alignment foot **85** as seen in Figures 8 and 9, consisting of a circular member **86** which closely engages the pin **30** and angularly spaced opposed feet **87**, **88** which rest against the base of the guide page **82**, is placed in the position shown in Figures 8 and 9.

The lid **22** may now be slid into the autoclave and without any twisting or disalignment thereof, which may result in a jamming thereof in the end of the autoclave. This is so since the passage of the pin **30** through the opening **86** in the alignment foot **85**, maintains the lid exactly normal to the axis of the longitudinal autoclave.

When the lid **22** is in place against the annular recess **20** in the manner shown in Figure 8, then the alignment foot **85** may be slid off the pin **30** and the guide pad **82** may be removed, and the breech block **40** may be inserted in the position shown in Figure 2. Thereupon, hydraulic fluid may be admitted into the interior annular portion of the gasket **27** and the pressure thereof raised to counteract any internal pressure which may occur. The joint between the lid and the chamber wall is now made gas tight. The interior of the autoclave may now be evacuated so that any pure gas, as for instance nitrogen, which is utilized for the treatment of closed cellular gas expanded rubber, may be admitted.

When the interior of the chamber is evacuated, the lid **22** may be pushed only slightly inwardly against the shoulder or annular recess **20** by the external atmosphere. Such movement, as may be obvious, will be so slight that no frictional damage will be done to the gasket. After the air within the chamber has been completely evacuated, the pressure is then let in, and the lid is now pushed into engagement with the end of the sleeve **40** which absorbs all the end thrust.

The gasket which is maintained at efficient pressure by the hydraulic fluid in the manner previously pointed out, provides a perfect seal between the chamber wall and the edge of the lid.

By means of the foregoing it will be seen that an appropriate seal may be made between a chamber wall of the autoclave and the lid. The end thrust against the lid is taken by a strong structural member, while a seal is effected by a gasket which is maintained under pressure hydraulically.

The fluid pressure as above pointed out may, as desired, be only slightly higher than the internal pressure which is to be generated, although it may be as high as is necessary. Thus, for instance, while I have found that a gasket pressure of 5050 pounds per square inch will be sufficient to withstand an internal pressure of 5000 pounds per square inch, this gasket pressure may be raised to as high as 6500 pounds per square inch or 7000 pounds per square inch.

The type of seal herein set forth is very flexible in use. Thus, it has been sometimes found desirable to vary the gasket pressure, particularly when the temperature of the chamber proper, and of the closure becomes somewhat uneven, as for instance, by the force arising in the cooling or extreme heating of the chamber wall. The method of sealing the gasket as herein set forth, is independent of any internal pressure which may be generated; and is so arranged as to permit the variations of the external hydraulic pressure to counteract any leakage which might otherwise occur owing to unevenness in expansion and contraction of the chamber wall and of the cover.

My invention thus provides for an extremely simple positive seal which is independent of internal pressure and in which a slight surplus of pressure is sufficient to maintain an effective seal.

The closure part need not be heavier than required for the internal gas pressure because of the location of the gasket itself. Light construction of the chamber end permits, therefore, an even heat distribution.

It is possible also by means of my invention, as is seen particularly in Figure 2, to steam jacket the chamber up to very end.

The breech block arrangement which provides the necessary physical and mechanical force to hold the cover in place is extremely simple to operate. The lid or cover is positively guided into position so that no jamming can occur during the placement of the lid in position. The foot and guide plate which are utilized for guiding the cover into position are very simply inserted and just as easily removed. The gasket itself is protected against damage; and in fact, the corner edges of the gasket, may, if desired, be reinforced to prevent them from getting squeezed between the lid and the chamber.

In the foregoing, I have set forth my invention in connection with one preferred embodiment thereof. Many variations and modifications should now be obvious to those skilled in the art. Accordingly, I prefer to be bound not by the specific disclosures herein, but only the appended claim.

I claim:

In an autoclave closure device, the combination, with an autoclave having its head end provided with a cylindrical bore having at least three different interior diameters stepped to increase outwardly toward the extreme head end to provide two shoulders, the portion of said bore of smallest diameter serving as a part of the pressure chamber of the autoclave, the portion of the bore of largest diameter serving to receive a holding device, and the portion of the bore of intermediate diameter serving to receive a cover; said autoclave having inward extending arc-shaped lugs, spaced apart, at its head end, the diameter of the inner concentric arcs of said lugs being greater than that of the portion of the autoclave bore of intermediate diameter, said autoclave also having a groove in the inner wall of that portion of the bore of intermediate diameter, and a conduit for fluid pressure extending from said groove to the exterior of the autoclave; of a cover having a cylindrical periphery arranged to fit in the portion of the bore of intermediate diameter and extend across the said groove, the inner face of said cover being ar-

ranged to make contact with the shoulder formed between the portions of the bore of intermediate and smallest diameters, said cover having an axially arranged guiding and supporting stem extending outward from the cover; a cylindrical holding device having a face arranged to make contact with the outer face of the cover and also having arc-shaped lugs, on its outside, spaced apart, the exterior diameter of the concentric arcs of said lugs being such as to fit in that part of the bore of largest diameter, that portion of the holding device exterior to its lugs having a diameter such that it will be received within the inward extending lugs carried by the autoclave, said holding device being rotatable within the head end of the autoclave, to bring its lugs in

register with the spaces between the inward-extending lugs of the autoclave, and to allow its lugs to interlock behind said lugs of the autoclave while in contact with the outer face of the cover, and an annular elastic gasket located in the groove, said gasket being U-shaped in cross section with its cylindrical base wall of substantially the same diameter as that of the periphery of the cover and its annular flanges in contact with the respective side walls of the groove, the said base wall of the gasket being of such width as to make a packing engagement with the periphery of the cover when said cover is in place and fluid pressure is applied to said conduit.

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