

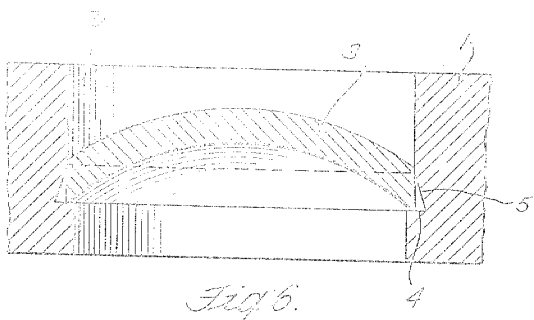
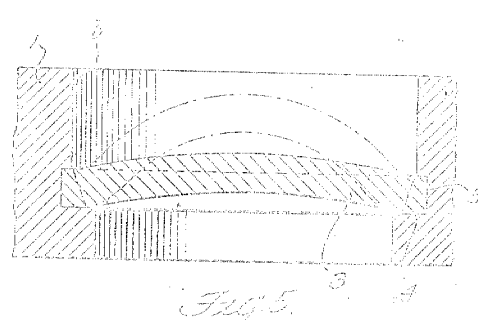
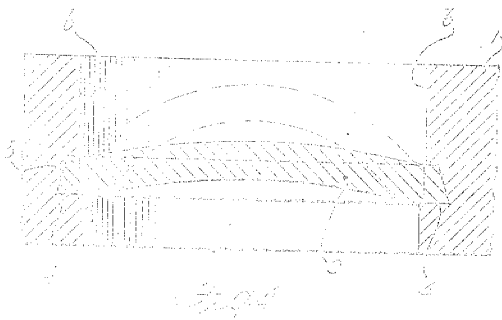
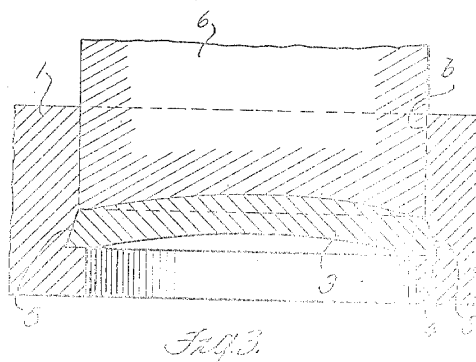
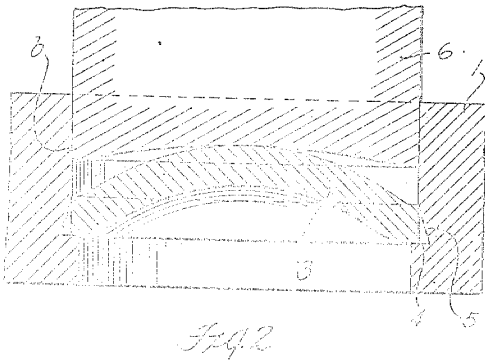
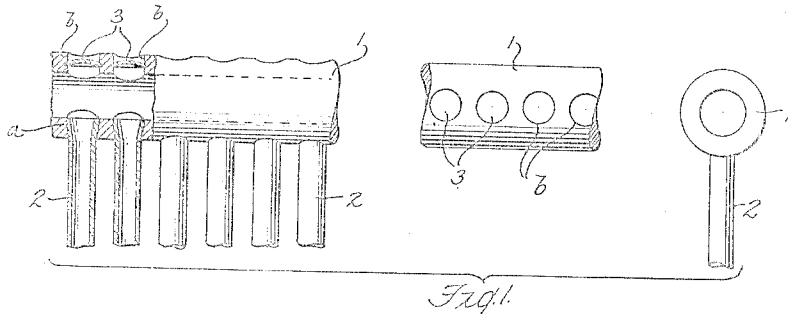
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SEALING CLOSURE AND METHOD OF APPLYING SAME

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## UNITED STATES PATENT OFFICE

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## SEALING CLOSURE AND METHOD OF APPLYING SAME

Application filed December 3, 1927. Serial No. 237,506.

This invention relates to a closure for sealing an opening against pressure of considerable amount and also to a process of applying the same. The invention is particularly applicable to boilers operating upon the La Mont principle as set forth in Patent No. 1,545,668, wherein a series of steam generating tubes is connected to a common header.

One of the objects of the invention is to provide a means and method whereby the tubes may be easily assembled in the header and the opening in the header afterwards sealed against leakage of steam, said sealing means being also secure against blow-out or disruption by the high pressures commonly used.

Preferably the seal is in the form of a cap or plug of cold rolled steel forming substantially a circular segment of a substantially spherical shell, the opening to be sealed being provided with an annular recess and the plug being inserted into the opening and expanded into the recess so that it then becomes a segment of a sphere of greater radius. Preferably such expansion is brought about by flattening the segment by a suitable tool, the flattening being carried to an extent beyond that necessary to cause the peripheral edge of the plug to abut the inner wall of the recess. The plug thus treated has a tendency to expand radially if permitted to do so.

This and other features and advantages of the invention will become apparent from the following description and claims taken in connection with the accompanying drawings, in which,

Figure 1 is a front elevation, plan and side elevation showing a header and a series of tubes with the openings into the header closed by a cap or plug of the present invention.

Figure 2 is an enlarged view showing the plug in position and ready to be expanded or flattened by a tool.

Figure 3 shows the condition of the plug after the tool has reached the limit of its downward motion.

Figure 4 shows a slightly modified form of groove; the dotted line structure showing the plug prior to its being expanded or flat-

tened; the full line structure showing it after being expanded.

Figure 5 is a slightly different form of plug from that shown in Figure 4.

Figure 6 is still another form.

Referring to the drawings, 1 indicates a header of cylindrical form provided with openings for the reception of a plurality of tubes 2. These tubes are of the general form and size described in La Mont Patent No. 1,545,668, although not necessarily limited to the tubes there shown.

The tubes 2 are preferably expanded into the wall of the header and for convenience in expanding these tubes a bore is made diametrically through the header. That portion of the opening which is to receive the tube is slightly tapered as indicated at *a*, Figure 1. The portion *b*, however, is cylindrical and is suitably grooved to receive a plug or cap 3, which forms the subject matter of the present invention.

Referring now to Figure 2, the part 1 indicates a section of the wall of the header. The bore of this wall is not the same throughout, the upper portion thereof being of somewhat greater diameter than the lower portion, thereby forming a shoulder 4. A circular recess 5 is also formed adjacent the shoulder and preferably contiguous therewith. The plug 3 may be made in a variety of ways but is preferably formed from cold rolled steel; its shape is substantially that of a circular segment of a substantially spherical shell. The peripheral edge may be cylindrical as shown in full lines in Figures 2 and 6 and in dotted lines in Figure 4 or such periphery may be tapered as in dotted lines in Figure 5.

The cap or plug is of suitable thickness to withstand the steam pressure to which the tubes 2 are subjected and, of course, this thickness will vary with the different installations. After the tubes 2 have been expanded into the header the plug is inserted in the upper part of the opening and against the shoulder 4 with its convex side uppermost, its diameter being such that it snugly fits the upper part of the cylindrical portion of the bore. A tool 6, which may be a plunger oper-

ating in any suitable way as by screws or hydraulic means, is then brought to bear upon the plug until it assumes the form shown in Figure 3, said plug being there  
 5 shown as having been flattened so that the radius of the sphere of which it forms a part is greater than the sphere of which it originally might be said to have formed a part. The plunger 6 is so shaped that pressure is  
 10 first applied near the center of the disc and at or near the end of its flattening stroke it bears upon the portions of the plug near its periphery.

The recess 5 is of such depth and shape and  
 15 so proportioned that the peripheral edge or rim of the plug fits very tightly against the walls of the recess when the plug has been flattened to the desired extent. In other words, the groove or recess is so designed that  
 20 the plug after deformation bears against the walls of the recess and contacts with said walls throughout substantially the entire extent of the adjacent surfaces of walls and plug, thereby giving a steam tight seal under  
 25 the pressures which are to be used.

Preferably, too, the peripheral edge of the plug engages the inner wall of the recess before the plug has been flattened to its final stage as shown in Figure 3, so that there is  
 30 an additional compression put upon the metal of the plug by contact with said inner wall, giving the plug a residual elasticity or tendency to expand, if permitted to do so. This is very important when the header is raised  
 35 to a high temperature as it is during the operation of the generation of steam. The header walls then expand and the residual elasticity of the disc permits it likewise to expand, so that there is no leakage of steam  
 40 through the plug even at very high pressures.

In order that the seal may be even more effective for high pressures, it may be sometimes preferable to use the construction of  
 45 recess shown in Figures 4 and 5. This construction differs slightly from that of Figure 2 in that the recess has an upper shoulder as well as a lower shoulder and the disc is forced in between and into intimate contact with  
 50 both shoulders and also with the inner wall of the recess. To permit the disc to more readily enter the recess without any danger of its lower edge cutting the lower wall thereof, the disc may have initially the shape  
 55 shown in Figure 2, wherein its edge is slightly flared. This is not essential, however, but may be preferable in some cases.

What is claimed as new is:

1. A process of sealing against pressure an  
 60 opening in a pressure retaining structure which consists in forming a concavo-convex disc of resilient yet deformable material, inserting said disc in the said opening and deforming said disc in such amount as to  
 65 expand it and bind it in the opening but not

sufficiently to make the disc flat, whereby the resiliency of the material is maintained.

2. A process of sealing against pressure an opening in a pressure vessel which consists in forming a concavo-convex disc of resilient  
 70 but deformable material of suitable thickness, providing a shoulder in the opening to be sealed, inserting said disc in said opening and against said shoulder, and deforming said disc in greater amount than that necessary  
 75 to cause the edge of the disc to abut the walls of the opening but not sufficient to make the disc flat, whereby the resiliency of the material is maintained.

3. A process of sealing an opening in a  
 80 pressure retaining vessel which consists in forming a concavo-convex disc of resilient and deformable material of suitable thickness, forming a groove in the opening to be sealed, inserting said disc in said opening  
 85 and deforming said disc by flattening it to a curvature flatter than that necessary to cause the walls of the groove to squeeze the edge of the disc while retaining sufficient curvature to maintain the resiliency.  
 90

4. A process of sealing against pressure an opening in the wall of a pressure retaining structure which consists in forming a concavo-convex metal disc of suitable thickness,  
 95 forming a groove in the opening to be sealed, inserting said disc in said opening and deforming said disc to substantially a spherical radius greater than that necessary to cause the edge of the disc to abut the walls of the  
 100 groove but of such radius that the resiliency of the metal is retained to maintain the sealing of the opening.

5. Process of sealing an opening against the pressure contained in a pressure vessel  
 105 which consists in forming a concavo-convex metal disc in the form of a circular segment of a substantially spherical shell of suitable thickness, forming a groove in the opening to be sealed, inserting said disc in said opening,  
 110 and deforming said disc to a substantially spherical radius greater than that necessary to cause the edge of the disc to abut the walls of the groove but of such radius that the resiliency of the metal is maintained by the spherical form.  
 115

6. A process of sealing an opening to be closed against fluid pressure which consists in forming a concavo-convex disc of resilient yet deformable material provided with a bearing surface arranged to be in contact  
 120 with an abutment within the opening when the disc is inserted therein, inserting said disc in said opening and deforming said disc to a curvature flatter than that necessary to cause its edge to abut the wall of the opening  
 125 but sufficient to retain the resiliency of the material of the disc, said bearing surface co-operating with said abutment to control the movement of that edge of the disc into pressure retaining contact with said wall.  
 130

7. The combination with a portion of a pressure retaining structure having an opening therein, of a closure for said opening comprising a plug of resilient yet deformable material in the form of a concavo-convex disc with its edge held firmly against the wall of the opening by the resilience of the material of the disc in the concavo-convex form.

8. The combination with a portion of a pressure retaining structure having an opening therein provided with a shoulder, of a closure for said opening comprising a plug of resilient yet deformable material in the form of a concavo-convex disc pressed against the shoulder with its edge held firmly against the wall of the opening by the resilience of the material of the disc maintained by the concavo-convex form thereof.

9. The combination with a portion of a pressure retaining structure having an opening therein provided with an undercut groove, of a closure for said opening comprising a plug of resilient yet deformable material in the form of a concavo-convex disc with its edge held firmly against the wall of the groove by the resilience of the material of the disc in its concavo-convex form.

10. A closure for an opening in a pressure retaining structure comprising a concavo-convex disc formed of elastic but deformable material and having an annular bearing surface on the concave side of the disc and adjacent its edge of sufficient width to receive pressure for deforming the disc and causing its edge to slide on a counter surface in the opening.

11. A closure for an opening in a pressure retaining structure comprising a concavo-convex disc formed of elastic but deformable material and having a flaring edge of sufficient width to receive pressure for deforming the disc and causing its edge to slide on a counter surface in the opening.

Signed at New York, New York, this 2nd day of December, 1927.

JOHN E. JACOBY.

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