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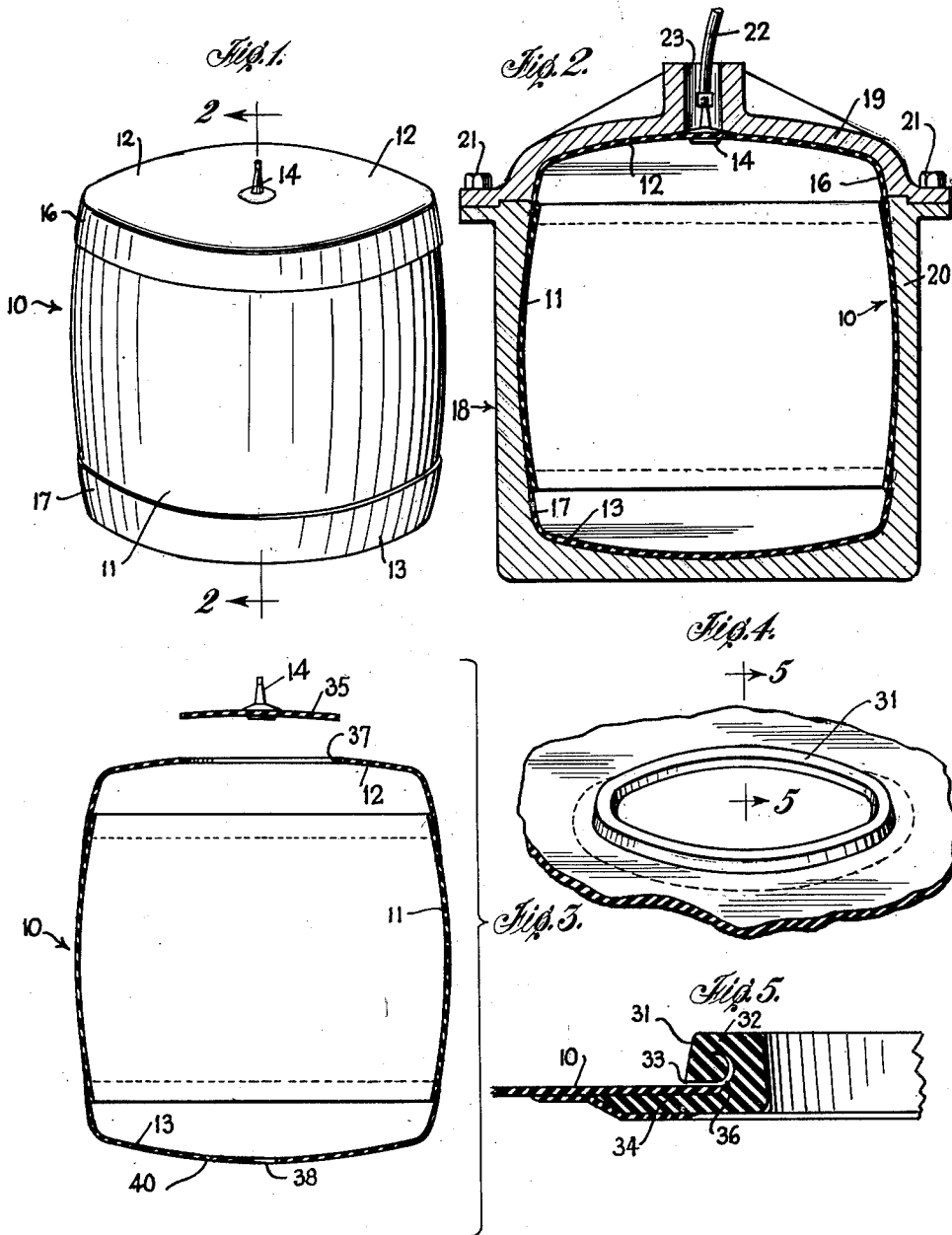
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2,626,885

METHOD OF MAKING WASHING MACHINE LINERS

Filed Oct. 4, 1947

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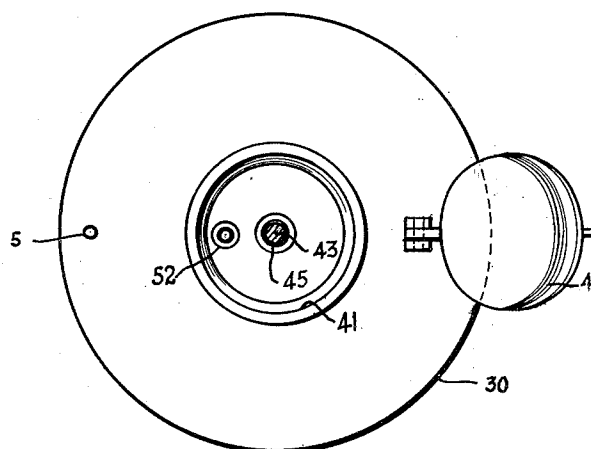
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# METHOD OF MAKING WASHING MACHINE LINERS

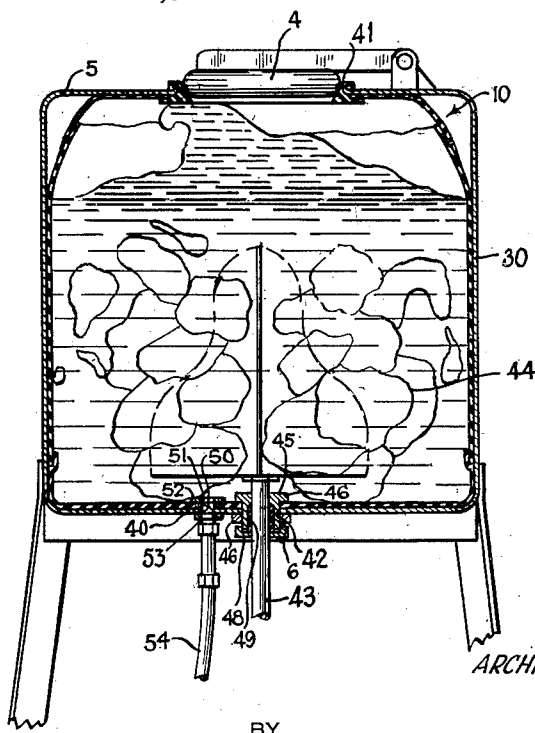
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*Fig. 6.*



*Fig. 7.*



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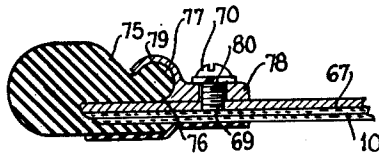
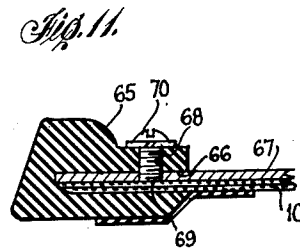
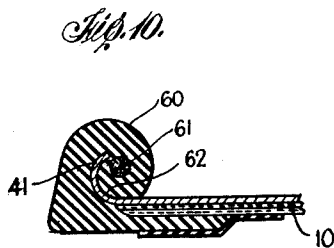
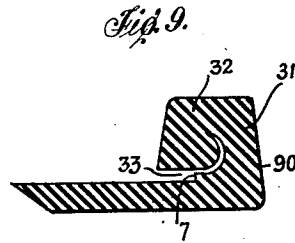
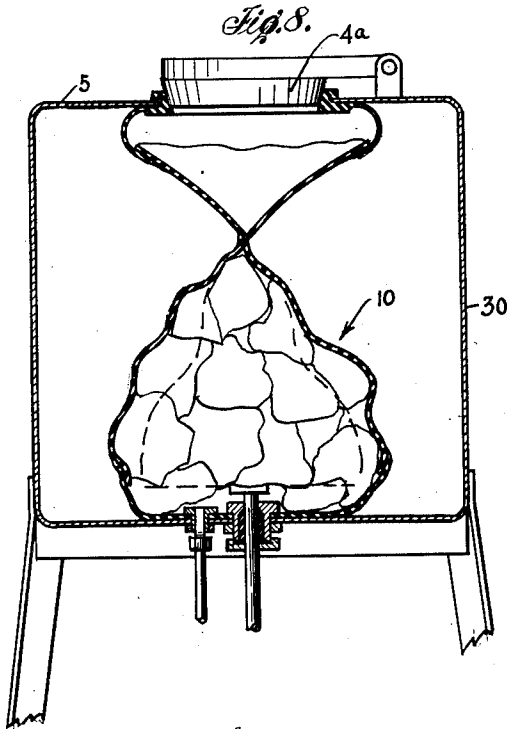
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METHOD OF MAKING WASHING MACHINE LINERS

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3 Sheets-Sheet 3



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## UNITED STATES PATENT OFFICE

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## METHOD OF MAKING WASHING MACHINE LINERS

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2 Claims. (Cl. 154—83)

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This invention relates to improvements in vacuum driers.

The invention is particularly directed to improvements in damp driers for washing clothes, and more particularly to driers adapted to be incorporated in machines for use in the home.

Vacuum driers heretofore employed in home type washers have not been entirely successful due to difficulties encountered in effecting a satisfactory seal between the washing machine lid and the liner.

An object of the present invention is to provide an improved flexible liner for a washing machine.

Another object of the invention is to provide in combination a flexible liner impervious to water and air and a washing machine so constructed and assembled that the lid of the washing machine when closed forms an air tight seal with the liner.

A further object of the invention is to provide a washing machine and a rubber-like liner therefor, said machine and liner being so constructed that the liner may be readily installed in, or removed from the machine.

Another object of the invention is to provide a practical method of manufacturing a thin flexible liner for the tub of a washing machine with said liner formed relative to the edges of a clothes-receiving opening of a washing machine to permit convenient and positive attachment to the tub.

Practical embodiments of the invention are represented in the accompanying drawings, in which:

Fig. 1 is a perspective view of a washing machine liner in the course of construction, shown assembled for molding and vulcanizing;

Fig. 2 is a sectional view showing the liner of Fig. 1 in a vulcanizing mold;

Fig. 3 illustrates the molded liner with pieces cut from its top and bottom to form openings therethrough;

Fig. 4 is a fragmentary view of the molded collar adapted for attachment to the liner about the aperture formed in the top thereof and shown attached thereto;

Fig. 5 is a sectional view taken on line 5—5 of Fig. 4;

Fig. 6 is a top plan view of a washing machine with the liner installed therein, the machine being shown with its lid open;

Fig. 7 is a vertical section of the machine shown in Fig. 6 but showing the lid closed with water and clothes in the liner as they may appear during a washing operation;

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Fig. 8 is the same as Fig. 7 except it illustrates the relative position of the liner and the clothes when the water has been withdrawn and a partial vacuum created in the liner;

Fig. 9 is a sectional view of the molded collar of Fig. 4 shown as it appears before its attachment to the liner; and

Figs. 10, 11, and 12 are sectional views of modified forms of molded collars embodying features of the present invention, and showing means of attachment of the collars to a liner.

Referring to the drawings in detail, and to Figs. 1 and 2 in particular, it will be seen that a liner referred to generally as 10, comprises in its original assembly, a body portion 11, top and bottom portions 12 and 13 respectively, and a valve stem 14 attached to the central portion of the top 12. The liner 10 is composed of a thin flexible material such as, for example but without limitation, rubber or rubber-like material, which may be reinforced with fabric or otherwise if found desirable, and may be constructed in any manner found satisfactory, as for example, the body portion may be built into a band on a drum from unvulcanized sheet rubber calendered to the desired width and thickness. Similarly the rubber for the top cap 12 and bottom cap 13 may be calendered into sheets and suitable discs for forming said top and bottom caps cut therefrom.

A small aperture, not shown, is cut through the center of the top cap 12 and a conventional pneumatic tire inner tube rubber valve stem 14 is cemented to the top cap 12 with the stem bore aligned with the aperture. The discs are of greater diameter than the drum on which the body 11 is built and a convenient way of attaching the top cap 12 to the body 11 resides in placing disc 12 centered against the end of a building drum, not shown, and turning the edge 16 (see Fig. 2) over and down against the edge of the body 11 where the tacky vulcanized rubber will adhere together. Of course rubber solvent may be used to restore the tackiness of the unvulcanized rubber, or rubber cement may be used to obtain better adhesion of top 12 to body 11 before vulcanization.

After top cap 12 with valve stem 14 attached has been applied to body 11, the assembly is removed from the building drum. Next the disc forming the bottom 13 is applied to body 11 in marginally overlapped relation thereto, top 12 and the edge 17 of said bottom, as shown in Fig. 1, over against the outside with the disc 13 applied externally of body 11. The tacky character of the unvulcanized rubber provides the necessary adhesion between the body and said top

and bottom caps to maintain them in their relative position until the assembled liner 10 is placed in its mold and vulcanized.

A pot heater mold of the bolted type generally referred to as 18, shown in Fig. 2, may be used to mold and vulcanize the liner 10 as originally assembled. Preparatory to the molding and vulcanizing operations the lid 19 of mold 18 is removed from the body portion 20, bolts 21 being removed to permit such removal. Next, the assembled liner 10 is disposed in mold 18 with valve stem 14 vertically extending. Liner 10 is inflated slightly through valve 14 to take its substantially cylindrical shape. A valve cap may be placed on the valve stem to prevent the inflation medium from leaking from liner 10 previous to and during the assembly operation. The mold is then re-assembled, with valve stem 14 extending into a suitable bore 23, provided for that purpose. The valve cap is then removed from valve stem 14, and an air supply, or other inflation medium tube 22 attached to said valve stem. To facilitate such attachment a valve stem extension of any satisfactory type may be attached to stem 14 previous to replacement of lid 19. If desirable, metal valve washer rings may be placed on the valve stem 14 for marginal reinforcement of aperture 23, to prevent blow-out, all of which will be readily understood by those familiar with molding rubber articles by employing a fluid medium to obtain the necessary internal molding pressure. Mold 18 is next placed in a pot heater and hose 22 connected to a suitable supply of air, steam or other fluid pressure. The pot heater may be of any suitable type. The heater is then closed and steam is introduced to effect the required vulcanizing temperature, it being understood that sufficient internal pressure for molding has been created in the liner by a fluid medium being turned into the liner through tube 22 and valve stem 14 from connections of the type commonly used in similar curing operations. Obviously the mold 18 could be of the steam jacketed type instead of the pot heater type.

After completion of the molding and vulcanizing operation the steam is permitted to escape from the pot heater. The internal pressure medium is exhausted from the liner through suitable blow-off valves in the pressure supply line, after which the pot heater is opened and the mold 18 removed. Bolts 21 are loosened, lid 19 removed, and molded liner 10 removed from the mold.

Liner 10 is shaped in mold 18 to the proper size to be receivable within a washing machine tub 30 for attachment thereto as illustrated in Fig. 7. As shown in Fig. 3, a disc 35 is then cut from the center of the top cap 12 to provide circular aperture defined by margin 37 for the transfer of washable articles to and from the interior of liner 10. A collar or boss is then applied to the aperture margin 37 in the following manner. The collar 31, Fig. 4, may be of rubber or rubber-like material but is not necessarily so confined, and may be constructed or fabricated in any desirable manner. Boss or collar 31 serves several functions and is not necessarily limited to any particular cross sectional design as may be noted by referring to Figs. 5, 9, 10, 11, and 12. The collar 31, which may be applied to top cap 12 of container 10 by any suitable method, is preferably vulcanized thereto, as shown in Fig. 5. The metal wall container 30, Fig. 7, is of course provided with suitable centrally disposed aperture for the reception of collar 31 in complementary

engagement therewith. Tub 30 is preferably constructed of sheet metal rolled back marginally of the aperture in the top wall thereof as shown in Figs. 7 and 8, for engagement with collar 31 of container 10.

Collar 31 has molded into its body portion 32, Fig. 5, a narrow elongated recess 33 conforming to the general contour or shape of the margins of the container aperture, recess 33 having an extension 36, arcuate in cross section, for reception of the rolled back container aperture margins. Said collar 31 also has a relatively thin radially outwardly extending flange portion 34 bonded to the wall of the liner 10. It will be observed by reference to Fig. 9 that recess 33 extends for a first distance inwardly into the body portion 32 on a substantially horizontal plane to a shoulder 7 and of a width to receive therein the marginal rim of the apertured liner, the liner wall contacting the top surface of said shoulder.

Preparatory to attachment of the collar to the liner the contact area of both are buffed and cemented. After the cement has dried flange 34 of collar 31 is passed through the liner aperture 37 and drawn back against the inner surface of the liner wall with margin 37 extending into slot 33 to abut against shoulder 36, as best shown in Fig. 5. It will be seen, by further reference to Fig. 5, that the wall thickness of top cap 12 is such, relative to the width of the recess 33, to define recess 33 for reception of rolled margin 41 of apertured container 30. It has been found that certain self-curing cements will provide satisfactory adhesion between the wall of said liner and the collar, however, if desired, this union may be vulcanized. Suitable apertures 38 and 40 if required as fluid conduits or for the extension therethrough of agitation mechanism may be provided by cutting out plugs of a desired size.

The liner 10 may be readily installed in the washing machine container 30 by passing the liner through the top wall aperture while forcing arcuately flared margins 41 into recess 23 of collar 31 as shown in Fig. 7. Liner apertures 38 and 40 are brought into registry with corresponding apertures 42 and 50 of the washing machine container 30. A packing gland 6, through which a driven shaft 43 extends to terminate inside the washing machine in an agitator 44, has a flange 45 adapted to be drawn downwardly against the liner 10 marginally of aperture 42 by clamping pressure applied by means of nut 46. Packing nut 48 completes the fluid seal.

A drain tube 51 extends through aperture 50, a radial flange 52, fixed thereto, contacting liner 10 marginally of aperture 40. A clamping nut 53, tightened on a threaded portion of tube 51, clamps liner 10 between the bottom of the tub and head 52 to effect a fluid seal therebetween. Conduit 54 extends to a pump, not shown, adapted to first draw the water from container 30 after a washing operation, then creates a partial vacuum in liner 10. The walls of container 30 are provided with one or more apertures 5 to insure the existence of atmospheric pressure between the container walls and liner 10.

In operation, lid 4 is opened and clothes to be washed are placed in the machine with the desired amount of water and soap. The collar is of such design and has an opening of such diameter relative to the shape and diameter of the lid 4 that a fluid type seal is formed between said lid and the collar when the lid is closed. Furthermore, it will be seen by reference to the drawings that with said lid closed the recessed portion of

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the collar is locked upon the turned edges of the opening of the tub. With the lid closed the washing of the clothes is performed in the usual manner. That is, the agitator is actuated by the movement of its shaft. At the end of the washing of any particular charge of clothing the agitation is stopped and the pump to which the hose line is connected caused to operate, whereby the water is drawn out of the machine, after which the pump creates a vacuum within the liner. Since the space between the liner and the tub is open to the atmosphere it will be seen that the liner will be pressed, by differential fluid pressure, against the clothing as illustrated in Fig. 8. This pressure on the liner is sufficient to squeeze the excess water from the clothing. Next the pump is stopped and the lid opened, permitting the air in and about the liner to equalize whereupon the clothes are removed from the washer after which another charge of clothing may be placed in the machine and the operation as described above repeated.

Referring now to Fig. 10 there is shown a collar 60, similar to collar 31 of modified construction, inextensible endless annular element 61 located in the collar axially outwardly of the elongated recess or slot 62. Slot 62 is adapted to receive therein the flared edge 41 of the container 30. Element 61 is located within the radially projected area of the arced portion of slot 62. Fig. 10 illustrates collar 60 bonded to liner 10 and mounted on the flared edge of the container. It will be seen by reference to Fig. 10 that element 61 reinforces collar 60 and anchors it against slipping off the flared margin 41.

Fig. 11 illustrates another embodiment of the invention as it applies to the collar portion of the liner 11. In this embodiment a collar 65 has a slot 66 in which the aperture margin of the liner 10 has been inserted and attached to the collar 65. Slot 66 extends circumferentially of the collar and is wide enough also to receive wall 67 of a tub, and wall 67 being shown in position within slot 66. In this embodiment the edges of the tub wall are not flared outwardly as in the embodiments previously discussed. Circumferentially spaced bores 68 extend through that portion of collar 65 overlying slot 66. Bores 68 are aligned with threaded bores 69 in wall 67 and bolts 70 extend through bores 68 to threadedly engage collar 65 for attachment to wall 67.

Fig. 12 illustrates another embodiment of the invention, in which the collar is molded with a slot 76 to receive liner 10 and wall 67 in the same manner as explained in reference to Fig. 11 above. However, collar 75 has a beaded portion 77 molded marginally of slot 76. A clamping member 78 having a rib-like extension 79 is adapted to enclose bead 77. Said rib is provided with circumferentially spaced bores 80 so positioned relative to the ribbed portion 79, the bead 77 and threaded bores 69 provided to permit clamped assembly of the elements as above mentioned, with bolt 70 extending through bore 80 to threadedly engage wall 67 thereby securing collar 75 to wall 67. It will be noted that in Fig. 9, the inner face of the collar 90 is of frusto-conical configuration, whereas the embodiment of the collar as illustrated in Fig. 12 includes an inner face of circular configuration in cross section. As shown in Fig. 8, the mating face of lid 4a is frusto-conical to permit a wedging action between the cover and associated collar to effect a positive fluid seal therebetween, the resilient collar being displaced radially under pressure. It is optional whether or not a

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surface contact is initially established, resulting for example from mating the collar of Fig. 5 with the lid of Fig. 8, or a line contact, resulting from employing the collar of Fig. 12 with the same lid, since the attendant wedging action results in a flattening of the contact area with resulting surface contact. Conversely, a lid, marginally arcuate in cross section, as shown in Fig. 7, may be employed with any of the illustrated collars to produce a similar result.

While there are shown herein several embodiments of the invention and the manner in which the same may be carried into practical operation, it is to be understood that the invention is not limited to the specific constructions disclosed, since it will be apparent that the same may be varied within the range of engineering skill without departing from the spirit of the invention, or from the scope of the appended claims.

What is claimed is:

1. A method of making a washing machine liner adapted to fit the inside of a tub comprising the steps of forming cap-like bottom and top closure elements and a tubular body element from unvulcanized rubber sheeting, providing one of said closure elements with a fluid transfer valve stem, assembling said closure elements in marginally overlapped relation to said body element to form a fluid tight container, disposing said assembled container within a suitable mold the interior shape of which conforms to the exterior contour of the said container after molding, applying fluid pressure to the interior of said container through said valve stem to maintain the walls thereof in pressure engagement with the inner walls of said mold, and heating said mold to effect vulcanization of the rubber and a permanent fusion bond throughout said marginally overlapped areas thereof and to mold the container to predetermined configuration, removing the molded container from the mold, cutting a circular piece from the said closure member containing the valve stem forming a circular opening therethrough, said piece including said valve, forming an annular collar of resilient material adapted for attachment to the edges of the opening formed by the removal of said valve stem containing wall portion, to effect fluid tight sealing engagement between said collar and the walls of said container and to provide means for removable attachment of said collar to said tub.

2. A method of making a washing machine liner adapted to fit the inside of a tub comprising the steps of forming a fluid tight container of unvulcanized rubber sheeting, providing said container with a fluid transfer valve stem, disposing said container within a mold the interior shape of which conforms substantially to the exterior contour of the said container after molding, applying fluid pressure to the interior of said container through said valve stem to maintain the walls thereof in pressure engagement with the inner walls of said mold, and heating said mold to effect vulcanization of the rubber and to mold the container to predetermined configuration, removing the molded container from the mold, cutting a wall portion from said container thereby forming an opening therethrough, said portion including said valve, forming a collar of resilient material adapted for attachment to the edges of the opening formed by the removal of said valve stem containing wall portion, to effect fluid tight sealing engagement between said collar and the walls of said container and to pro-

vide means for removable attachment of said collar to said tub.

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