Aug. 19, 1941. E. J. GREIF 2,253,293

METHOD OF MAKING TUBS

Original Filed April 9, 1937 3 Sheets-Sheet 1

Fig. 7

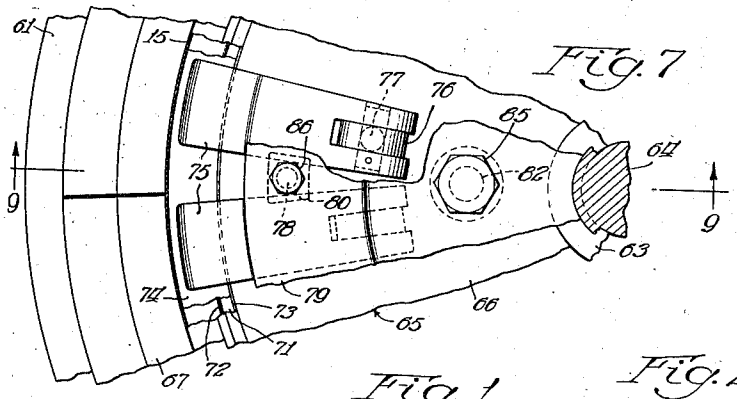


Fig. 1

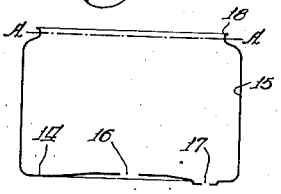


Fig. 2

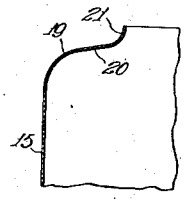


Fig. 6

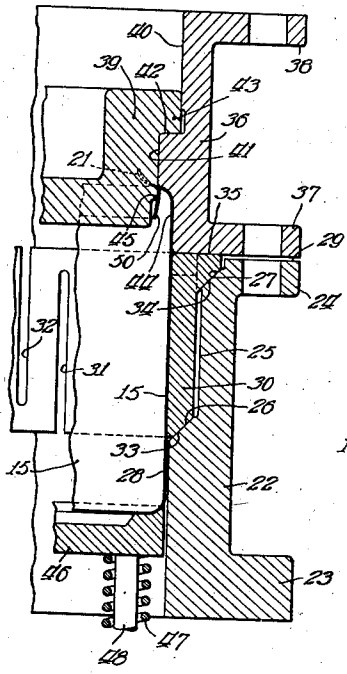


Fig. 3

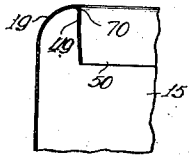


Fig. 4

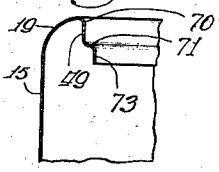
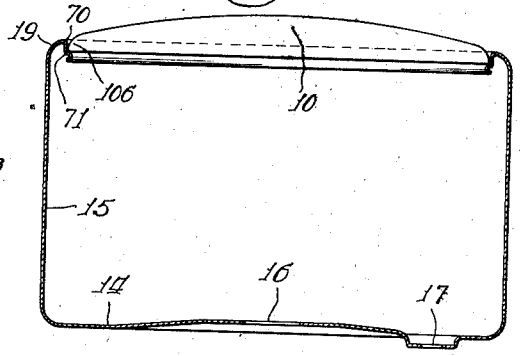


Fig. 5



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METHOD OF MAKING TUBS

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Fig. 9

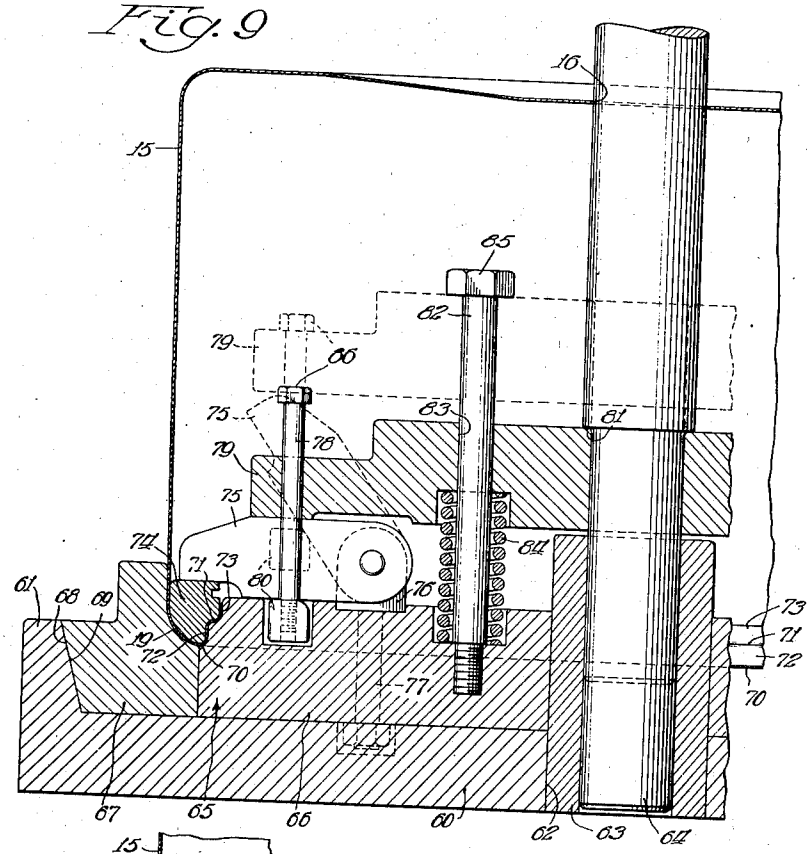
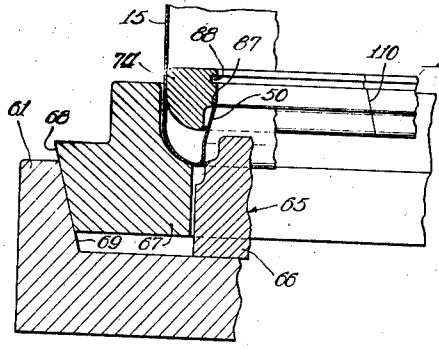


Fig. 8



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METHOD OF MAKING TUBS

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Fig. 10

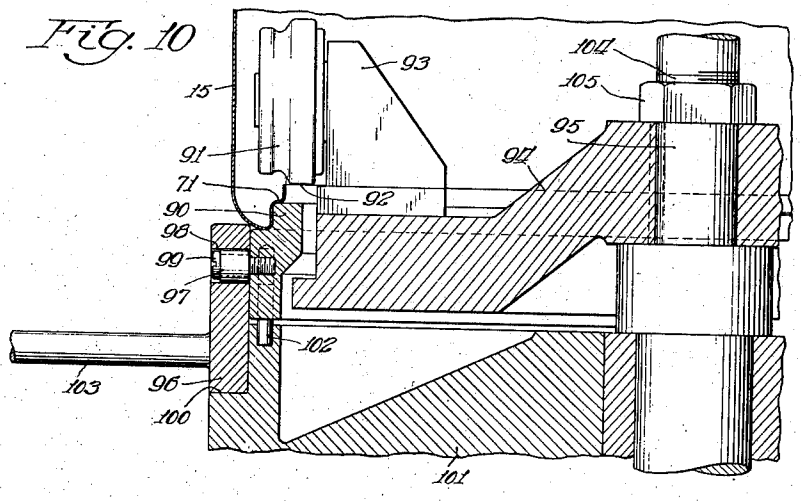


Fig. 12

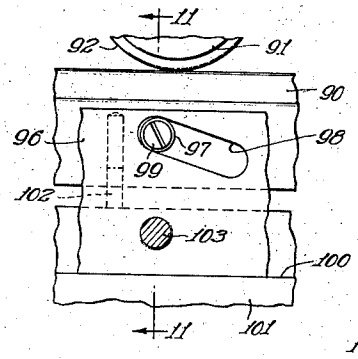
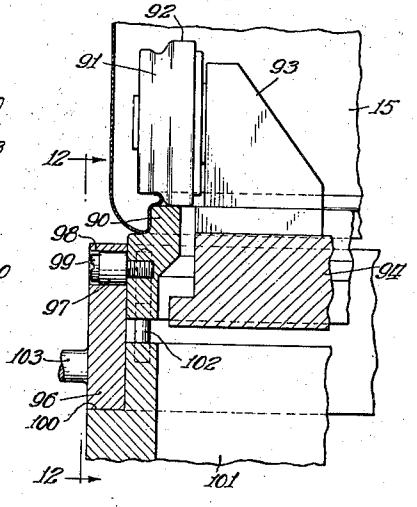


Fig. 11



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UNITED STATES PATENT OFFICE

2,253,293

METHOD OF MAKING TUBS

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Original application April 9, 1937, Serial No. 135,990, now Patent No. 2,225,988, dated December 24, 1940. Divided and this application November 30, 1938, Serial No. 243,170

5 Claims. (Cl. 153—2)

This invention relates to large volume receptacles such as washing machine tubs, and has as its primary object to provide in a washing machine tub of the type wherein the side wall of the tub is connected to a mouth of reduced diameter by an upwardly and inwardly curving integral shoulder region, a sunken, concealed cover seat in which the cover may be supported with its edges concealed and its upper surface forming a smooth symmetrical continuation of said curved shoulder region. The present application is a division of my application Serial No. 135,990, filed April 9, 1937, (Patent No. 2,225,988, granted Dec. 24, 1940).

Washing machine tubs of the type having the reduced diameter mouth and the integral broadly curving shoulder region, commonly called "bottle neck" tubs have been known and produced prior to the present invention. In such a tub, the mouth is defined by a neck region which curves upwardly and outwardly. The cover, resting upon this upwardly projecting neck region, is spaced appreciably above the curved shoulder region. The present invention aims to improve upon a tub of this type by providing one in which the neck region instead of projecting upwardly, projects downwardly into the tub and is formed with a cover seat which is depressed below the rim of the shoulder region.

Another object of the invention is to provide a tub wherein the edge of the neck region is completely concealed and removed from the region of probable contact with clothes being inserted into or removed from the tub, so as to improve the appearance and eliminate the possibility of cutting or tearing the clothes, or injuring the operator.

The problem of evolving a method for producing such a tub has proven to be an exceptionally difficult one. Accordingly, another object of the invention is to provide a method of successfully fabricating a tub having the characteristics above described, all from a single integral sheet of metal.

To this end, the invention provides a method wherein the tub is first formed with the "bottle neck" shape in acordance with known practice, and, utilizing the "bottle neck" construction as an intermediate stage in the formation of the "turtle neck" tub of the present invention, additional operations are performed upon the neck region of the tub by means of which the neck region is turned back into the tub and formed with the desired sunken cover seat.

Other objects, the advantages and uses of the invention will become apparent after reading the following specification and claims, and after consideration of the drawings forming a part of the specification, wherein:

Fig. 1 is a schematic sectional view of a "bottle neck" tub forming an intermediate stage of construction of the tub of the present invention.

Fig. 2 is an enlarged sectional view of the shoulder and neck region thereof after a trimming operation has been performed.

Fig. 3 is a similar sectional view of the shoulder and neck region after the latter has been folded into the tub.

Fig. 4 is a sectional view of the shoulder and neck region after the formation of the offset which constitutes the cover seat.

Fig. 5 is a vertical central sectional view of the completed tub.

Fig. 6 is a vertical sectional view of a portion of the apparatus employed to give the receptacle the form shown in Fig. 3.

Fig. 7 is a fragmentary plan view of the apparatus used to give the receptacle the form shown in Fig. 4.

Fig. 8 is a vertical sectional view of the apparatus of Fig. 7 shown in an initial stage of operation.

Fig. 9 is a vertical sectional view of the apparatus of Fig. 7, shown in its final position of operation.

Fig. 10 is a vertical sectional view of the apparatus used to give the receptacle its final form shown in an initial position of operation.

Fig. 11 is a similar view showing the apparatus of Fig. 10 in its final position of operation; and

Fig. 12 is a fragmentary side elevation of the apparatus of Fig. 10, showing the means for adjusting the apparatus to its final position.

For the purposes of illustration, this invention will be described with reference to the formation of a washing machine tub, but it is understood that the invention can be embodied in other sheet metal receptacles which are of relatively large volume comparable to that of a washing machine tub, and accordingly involve the problems met in the formation of a washing machine tub.

In forming a washing machine tub in accordance with the present invention, a sheet of metal is first drawn with a straight cylindrical side wall 15 and a bottom 14 which may be punched to provide a central aperture 16 for reception of the agitator drive shaft and a drain cock aperture 17.

In the next step of formation of the tub, the upper region of the side wall 15 is curved upwardly and inwardly and thence curled outward-

ly to form a "bottle neck" 18 in accordance with the method described in my pending application Serial No. 91,269, filed July 18, 1936, entitled "Machine for forming bottle necks upon sheet metal tubs" (Patent No. 2,170,946, granted Aug. 29, 1939).

In the subsequent stages of formation of the tub, the material above the line A—A of Fig. 1 is superfluous, and the neck region, therefore, is trimmed along the line A—A to give it the form shown in Fig. 2.

Referring now to Fig. 2, it will be observed that the tub has been provided with a rounded shoulder 19, and a neck region including a substantially flat portion 20, and an upturned portion 21. Due to the fact that the neck region 21 is formed by decreasing the diameter of the tub, the thickness of the material in that region is accordingly increased. Even though this portion is subsequently increased in diameter by being forced downwardly and outwardly, it will not thereby regain its original thinness. Accordingly, the thickness of the metal in the neck region 21 is reduced, preferably by the rolls which form such neck region.

In the next step of operation, the neck region 21 is folded axially into the tub to form the intermediate stage of construction shown in Fig. 3. The apparatus for performing this step of operation is shown in Fig. 6, and reference thereto is now made.

The in-folding apparatus comprises a base 22 which is cylindrical and has a flange 23 by which it may be secured to a suitable press (not shown). In its lower region, it has the bore 28 adapted to loosely receive the lower region of the side wall 15 of the tub. In its upper region it has an enlarged bore 25 connected to the bore 28 by a frusto-conical surface 26 and to its top surface 29 by a frusto-conical surface 27.

Located in the upper bore 25 is a collet ring 30 which has alternating notches 31 and 32 in its lower and upper regions respectively, rendering it contractile. Its normal interior diameter is approximately the same as that of the bore 28 so that the tub may be freely inserted through the ring. It is provided with inclined surfaces 33 and 34 adapted to coact with the inclined surfaces 26 and 27 in the base 22. Downward pressure against its upper end will cause it to contract under the camming action of the surfaces 33 and 34 against the surfaces 26 and 27, into constricting frictional engagement with the exterior surface of the side wall 15 of the tub, as shown in Fig. 6.

The shoulder 19 of the tub is adapted to be engaged by an annular holder 36 shaped to receive the upper region of the tub. A bottom support or pressure pad 46, urged upwardly by a plurality of compression springs 47 and guided by pins 48, serves to urge the tub upwardly to maintain the shoulder 19 snugly against the holder 36, while the latter moves downwardly to engage the upper end of the collet ring 30 for moving said ring downwardly. The holder 36 is provided with ears 37 and 38 adapted to register with ears 24 on the base 22, and to be connected thereto by locating pins. When thus properly assembled, the holder and base are mounted in a press having two rams to the outer of which the holder 36 is secured, and to the inner of which is secured a die member 39, which is guided in the holder 36 by surfaces 40 and 41 in the holder. Downward motion of the member 39 is limited by a shoulder 42 on the holder 36, which abuts a flange 43 on the die member 39. The lower region of the holder 36 is shaped as at 44 to receive the upper end of the tub. The lower region of the die member 13 is recessed or cut away to provide a shoulder 45.

In the operation of the apparatus just described, in the starting position of the press, the holder 36 and die member 39 are raised above the collet ring 30 and base 22. Not being under compression, the ring 30 will be in its extended position. A tub in the intermediate stage of formation shown in Fig. 2 is inserted into the base 22 through the collet ring 30 until it rests upon the pressure pad 46. The press is then operated, whereupon the holder 36 descends, contacting the shoulder 19 of the tub and thereafter forcing the tub downwardly against the pressure pad 46 until it contacts the collet ring 30. During the remainder of its stroke, the holder 36 will force the collet ring 30 downwardly, and the latter will contract under the camming action of the surfaces 33 and 34 against the surfaces 26 and 27, into tight frictional engagement with the exterior surface of the tub. With the tub thus securely clamped, the inner ram of the press forces the die member 39 downwardly so as to fold the end region 21 of the shoulder region 19 axially into the tub. At its lower edge, the neck region thus formed will have the diameter of the reduced lower end region of the die element 39, whereas at the rim 70 formed by its junction with the shoulder region 19, it will have the slightly larger diameter of the intermediate region of the die element 39. Thus, the neck region is formed with a cylindrical portion 49 and a downwardly converging conical portion 50, in which there may be formed an offset to provide a seat, by die elements moving toward each other in a purely axial direction.

Pressure from the die element 39 is not transmitted to the pressure pad 46 owing to the absorption of such pressure by the frictional engagement of the collet ring 30 against the side wall of the tub. Accordingly, buckling of the side wall of the tub is completely avoided.

Upon the return stroke of the press, the inner ram raises the die element 39, stripping it from the tub while the latter is still held by the engagement of the holder 36 against its shoulder region 19. Subsequently, the holder 36 is raised, thereby relieving the collet ring 30 of downward pressure and allowing the latter to expand so as to release the tub, which may then be removed for further forming operations.

The seat forming apparatus is shown in Figs. 7, 8 and 9. It comprises a base 60 provided with an upstanding flange 61. The base 60 is apertured at 62 to receive a bushing 63 in which a post 64 is slidable. Threaded upon the bushing 63 is a lower die 65 which comprises two concentric annular parts 66 and 67, the latter encircling the former and both adapted to be supported in a common plane against the flat bottom of the base 60. The part 67 in turn is a split ring having a normal diameter greater than the outside diameter of the part 66. When expanded to such normal diameter, as shown in Fig. 8, it is adapted to loosely receive the shoulder region 19 of the tub in an inverted position. The outer surface 68 of the ring 67 and the inner surface 69 of the flange 61 are shaped conically, and conform to each other so that downward pressure on the ring 67 will cause it to contract under the camming action of said surfaces. The ring 67 preserves the form of the shoulder 19 of the tub.

An upper die 74, severed circumferentially into

several sections, so that it may be readily inserted into and removed from the annular space between the in-folded neck region and the side wall of the tub, is shaped to conform to the contour of the die element 66 so as to operate, when moved axially toward the part 66, to form in the conical portion 50 of the partially formed neck region of the tub, an inwardly offset region 73, providing a seat 71.

The means for forcing the upper die 74 against the lower die 65 comprises a plurality of jaws 75 pivoted in bearings 76 secured as by bolts 77 to the die element 66. As shown in Fig. 7, the jaws 75 are relatively closely spaced circumferentially, although the spacing is sufficient to permit a bolt 78 to pass between two adjacent jaws. The bolts 78 are extended through suitable apertures in a pressure plate 79 which overhangs the pivots 76, and thence between pairs of adjacent jaws 75. Their ends are provided with nuts 80 of sufficient diameter to straddle the two adjacent jaws 75 and to engage the same for raising them to the inoperative position shown in dotted lines in Fig. 9.

The pressure plate 79 receives the post 64 and abuts a shoulder 81 thereon, so that downward motion of the post will move the pressure plate downwardly. Guide posts 82 extending through apertures 83 in the pressure plate 79, and threaded into the lower die element 66, maintain the pressure plate 79 in proper position. Compression springs 84, interposed between the pressure plate 79 and the lower die element 66 and receiving the guide posts 82, maintain the pressure plate in proper position. The springs 84 serve to return the pressure plate 79 to its starting position after it has been lowered by the posts 64. The upward movement of the pressure plate is limited by the heads 85 of the posts 82. In moving upwardly, the pressure plate 79 contacts the heads 86 of the bolts 78 prior to being stopped against the heads 85, so as to lift the jaws 75. When the jaws 75 are in their raised position, shown in dotted lines, the tub may be lifted without its neck region contacting said jaws. On the contrary, when the jaws are lowered to their full-line position as shown, they extend radially over the neck region so as to engage the frictional upper die element 74 and to transmit downward pressure thereto.

The post 64 may extend upwardly through the central aperture 16 of the tub, so as to be connected to a suitable press, for applying downward pressure thereto. For tubs not having such an aperture, the power can be applied to the lower end of the post 64.

The seat forming operation can best be described with reference to Fig. 8. A tub having the form shown in Fig. 3 is inverted, and the sections of the upper die 74 are inserted in the annular space between the in-folded neck region and the side wall of the tub. If the neck region were not made conical as at 50, downward pressure of the upper die would cause this portion to buckle. The conical form, however, causes the end of the neck portion 50 to rest upon the rounded corner 87 of the upper die 74 and to slide therearound without buckling when pressure is applied.

The inverted tub with the upper die 74 in place is then inserted into the supporting ring 67 of the lower die 65, the ring 67 at the time being expanded so as to readily receive the tub. The post 64 is then lowered, causing the jaws 75 to spread outwardly and downwardly into contact with the upper face of the upper die 74. Continued downward movement of the pressure plate 79 causes the upper die 74 to contact the rim 70 of the tub, pinching the same between itself and the supporting ring 67. From this point downward, the ring 67 contracts and the die 74 and die element 66 gradually form the conical portion 50 of the in-folded neck region between them until at the bottom of the stroke, the ring 67 is fully contracted and the die elements 74 and 66 have completely come together against the neck region 50 to form the same to the shape shown in Fig. 4. Upward movement of the post 64 then raises the jaws 75, relieving the upper die 74 of pressure, and near the top of the stroke, the ring 67 is raised by means of chains (not shown) thereby spreading it and simultaneously stripping the tub 15 from the portion 66 of the lower die 65. The upper die 74 is then removed from the tub 15 by inserting a suitable tool into groove 88 provided for that purpose and pulling it from rim 70 of the tub. The tub now has the form shown in Fig. 4 and is ready for the curling operation.

The last step in the formation of the cover seat is to curl the offset end region 73 of the neck radially outwardly so as to remove its edge from the region of probable contact with clothes being inserted into and removed from the tub. The apparatus for doing this is shown in Figs. 10, 11 and 12, and comprises a circular track 90 adapted to fit into the neck region 49 of the tub, and to abut the seat 71, and a curling roll 91 provided with a cylindrical portion 92 adapted to engage the track 90. The roll 91 is mounted on a bracket 93 secured to an arm 94 mounted on a shaft 95. The track 90 is supported on a camming ring 96 by means of rollers 97 which travel in cam slots 98 in the ring 96. The rollers 97 are journalled on studs 99 threaded into the track 90. The ring 96 is rotatably mounted in a machined recess 100 in the frame 101, while the track 90 is held against rotation with respect to the frame 101 by means of pins 102. An operating lever 103, secured to the ring 96, provides the means for oscillating said ring.

The arm 94 is secured on the shaft 95 by means of a nut 105 threaded on to a threaded portion 104 of the shaft 95.

Only one arm and one roll are used in the apparatus so that the tub 15 may be readily slipped between the roll and the track.

In the curling operation, the tub, which now has the form shown in Fig. 4, is placed upon the track 90, again in an inverted position. The shaft 95 is rotated, carrying with it the arm 94 and the roll 91, and the operating lever 103 is gradually advanced until the cylindrical portion 92 of the roll 91 contacts the track 90, as a result of the raising of the track 90 under the camming action of the roller 97 in the slot 98. At the end of the movement, the edge 73 will have been turned outwardly by the sloping contour of the roll 91.

When the curling is completed, lever 103 is moved in the opposite direction, thereby lowering the track 90 and permitting the tub 15 to be removed from the apparatus. The tub now has the completed form shown in Fig. 5.

It will be apparent from the foregoing description that by the practice of my method it is possible to form a washing machine tub or similar receptacle with a sunken cover seat of smaller diameter than that of the side wall of the tub, connected to the side wall by a smoothly in-

curved shoulder, all in one integral piece. Prior to the present invention, it was considered necessary to employ a separate sheet of metal for the neck and seat regions of a receptacle of this general shape. Furthermore, the invention provides for curling the edge of the seat, which is usually sharp and rough as a result of the forming operation, radially outwardly to a position where it will not come in contact with clothing or other materials which may be pulled across the seat. The metal of the seat is not unduly strained and is free from undesirable wrinkles. The invention utilizes dies of greater diameter than the diameter of the seat and arranges for the insertion of them and the means for applying pressure to them through the reduced mouth of the tub.

One of the big problems solved by the invention is that of folding the neck region axially into the tub without buckling or otherwise deforming the side wall of the tub under the tremendous pressure required for such folding operation. This problem is solved by frictionally engaging the side wall of the tub by mechanism operated in timed relation with the stroke of the drawing die, so as to absorb the axial pressure of the drawing die in the upper region of the side wall of the tub, and prevent its being transmitted to the bottom of the tub.

The finished tub, shown in Fig. 5, is adapted to receive a cover **107** having a suitable reinforcing rim **106** adapted to be entirely concealed within the neck region **49** of the tub when resting upon the seat **71**, so that the upper surface of the cover may be flush with and form a smoothly curving continuation of the shoulder **19**, thereby presenting a very artistic and stream-lined contour of the tub as a whole. This effect is very desirable, and the present invention makes it possible and practical.

I claim:

1. The steps in the method of forming a cover seat in a large-volume receptacle, consisting in forming a bottle-neck in the open end of the receptacle by rolling said open end inwardly, and thereafter folding the end region of said bottle-neck axially into the receptacle by means of purely axial pressure directed toward the bottom of the receptacle, while frictionally engaging the lateral exterior surface of the receptacle so as to absorb said axial pressure to prevent deformation of the side wall of the receptacle under said pressure.

2. The steps in the method of forming a receptacle from a single sheet of metal which consists in forming a bottle-neck in the open end of the receptacle by rolling said open end inwardly, thereafter folding the end region of said bottle-neck axially into the receptacle, by purely axial pressure directed toward the bottom of the receptacle, thereafter forming the end region of the in-folded neck portion in a forming die to form an inwardly projecting offset therein, and thereafter rolling the end region of the offset portion radially outwardly so as to remove the edge thereof from the region of probable contact with articles being introduced into and removed from the receptacle.

3. The steps in the method of forming a large-volume receptacle from a single sheet of metal in a cup-shaped initial stage of formation which consists in forming a bottle-neck in the open end region of the partially formed receptacle by rolling the said open end region inwardly, thereafter folding the end region of said bottle-neck axially into the receptacle by purely axial pressure directed toward the bottom of the receptacle, to form a cylindrical portion and a conical portion, thereafter forming the conical portion in a forming die to form an inwardly offset region therein providing a seat, and thereafter rolling the end portion of said offset region radially outwardly so as to remove the edge thereof from the region of probable contact therewith by articles being introduced into and removed from the receptacle.

4. The steps in the method of forming a cover seat in a receptacle which consist, in the order named, in rolling the open end region of the receptacle inwardly to from a neck region, folding the end portion of said neck region axially inwardly in spaced relation to the side wall of the receptacle, inverting the receptacle, supporting an upper die between said in-folded neck region and the side wall of the receptacle, and directing downward pressure against said die and thereby forcing said in-folded neck region against a lower die to form an inwardly offset region providing a cover seat therein, and thence rolling the end portion of said offset region radially outwardly.

5. The steps in the method of forming a cover seat in a relatively large-volume receptacle, which consist, in the order named, in rolling the open end region of said receptacle inwardly to form a bottle-neck, trimming said neck, folding the end region of said neck axially into the receptacle in spaced relation to the side wall of the receptacle, inserting a sectional annular die between the in-folded neck region and the wall of the receptacle, and directing downward pressure against said die while the rim of the receptacle is supported in a lower die, whereby to form said neck region between said dies with an offset region providing a cover seat.

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