Aug. 4, 1942. L. D. PIERCE 2,291,755

CONTAINER AND THE PRODUCTION AND NESTING THEREOF

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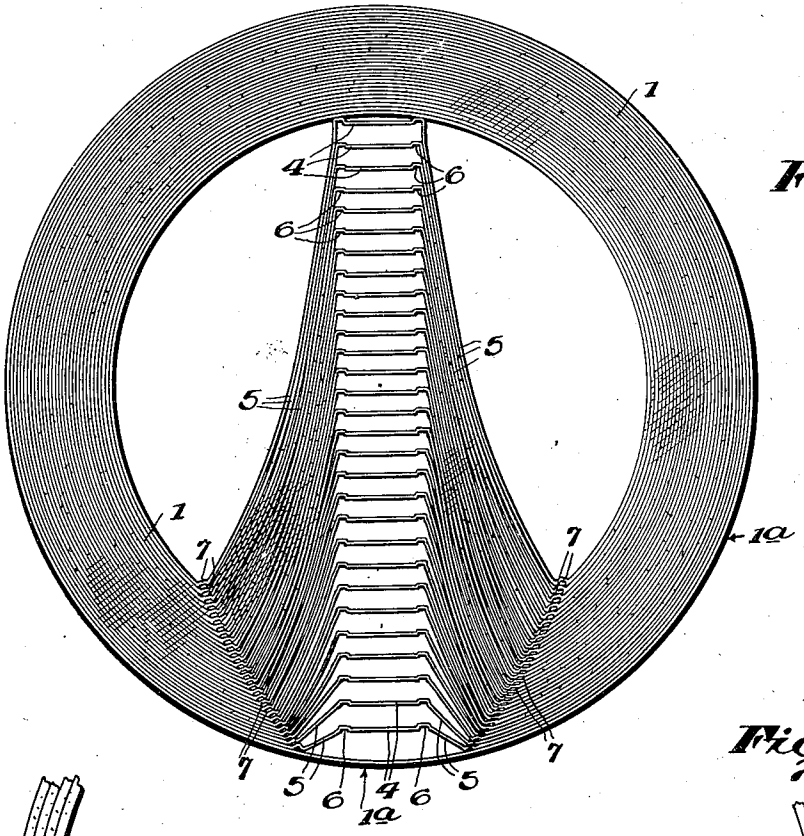
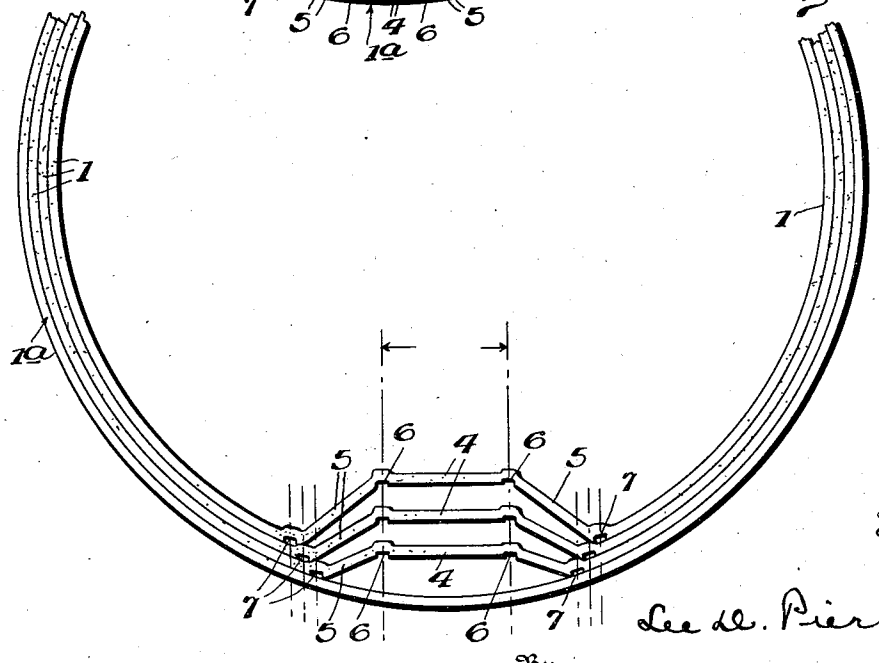


Fig. 1.

Fig. 3.



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Fig. 2.

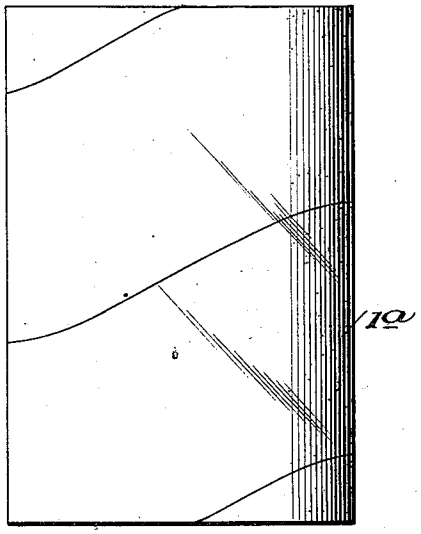


Fig. 4.

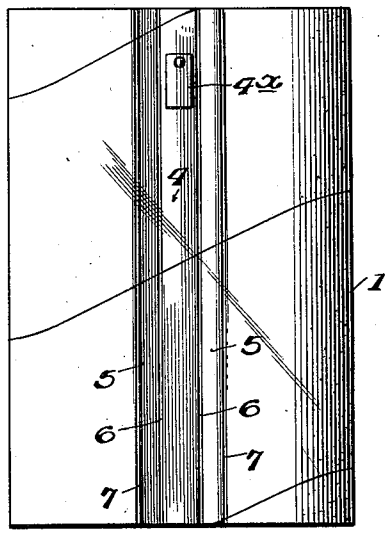


Fig. 5.

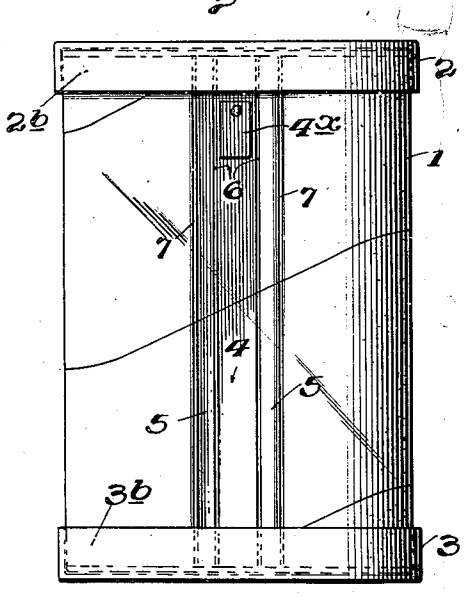
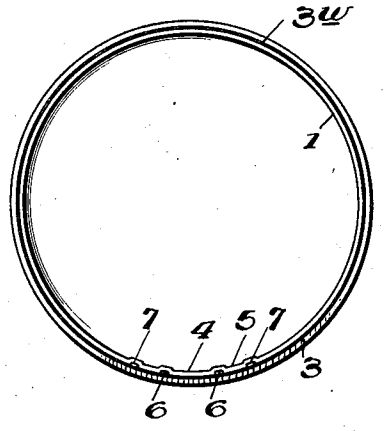


Fig. 6.



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Fig. 18.

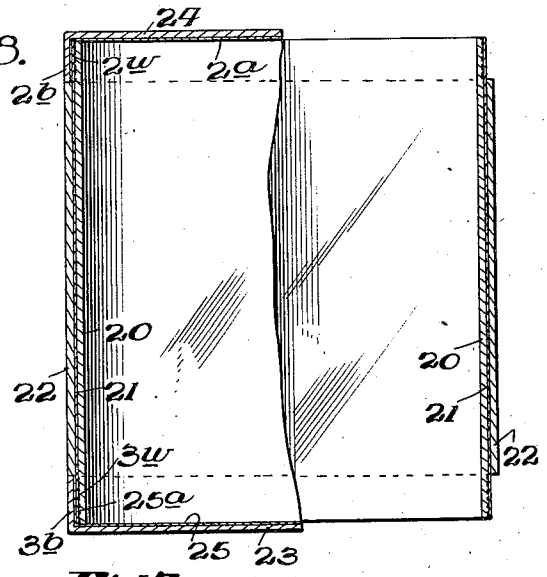


Fig. 19.

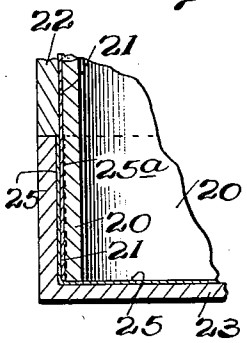


Fig. 7.

Fig. 8.

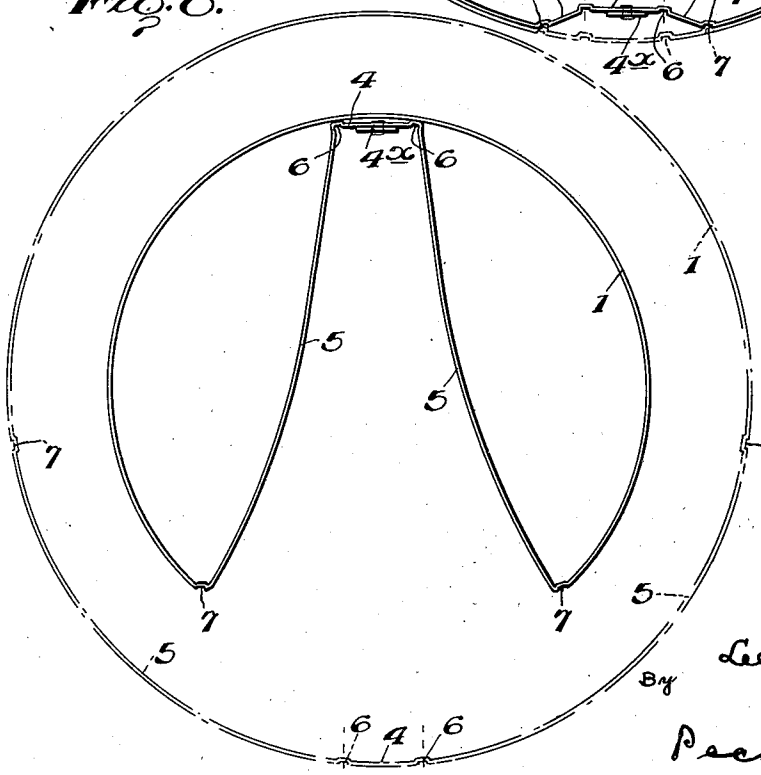
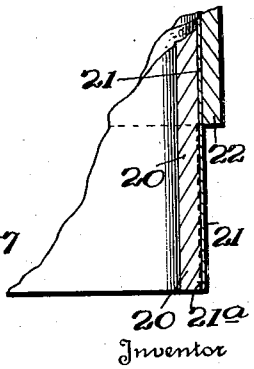


Fig. 20.



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Fig. 9.

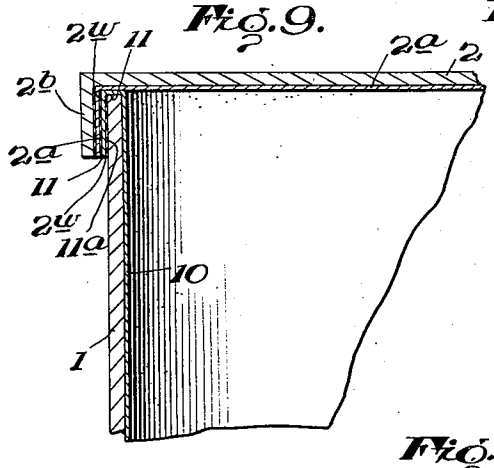


Fig. 11.

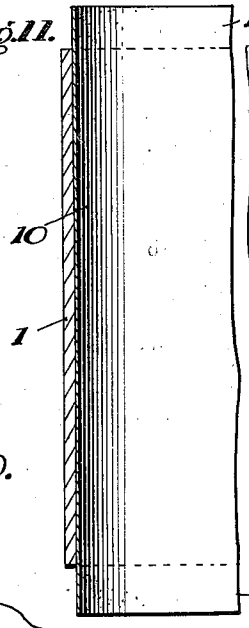


Fig. 12.

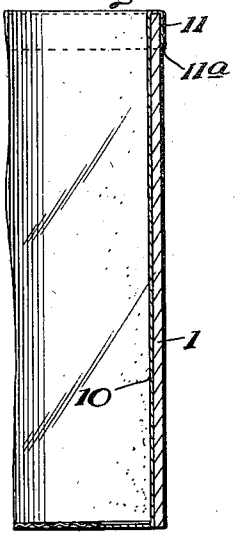


Fig. 10.

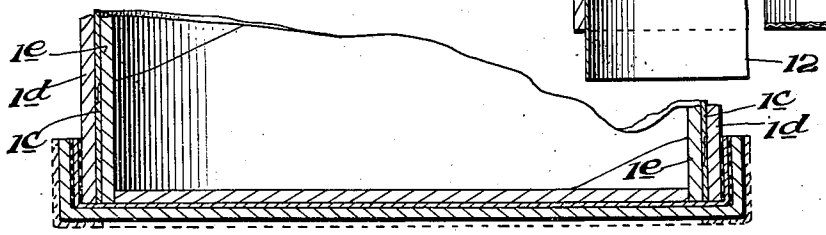


Fig. 13.

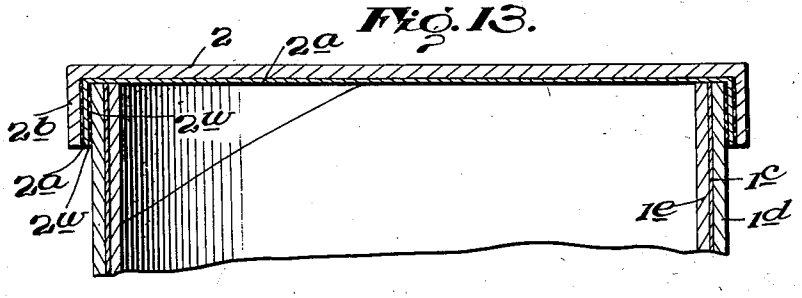
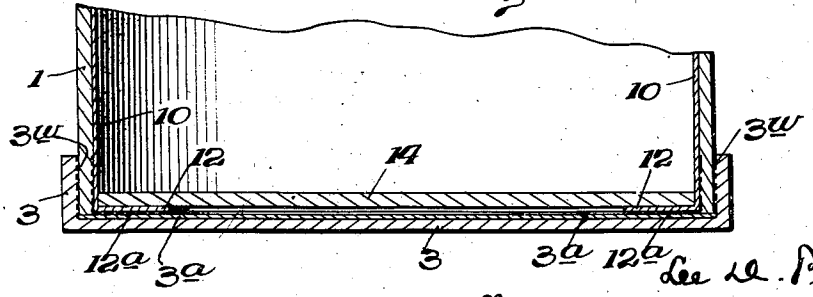


Fig. 14.



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CONTAINER AND THE PRODUCTION AND NESTING THEREOF

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Fig. 15.

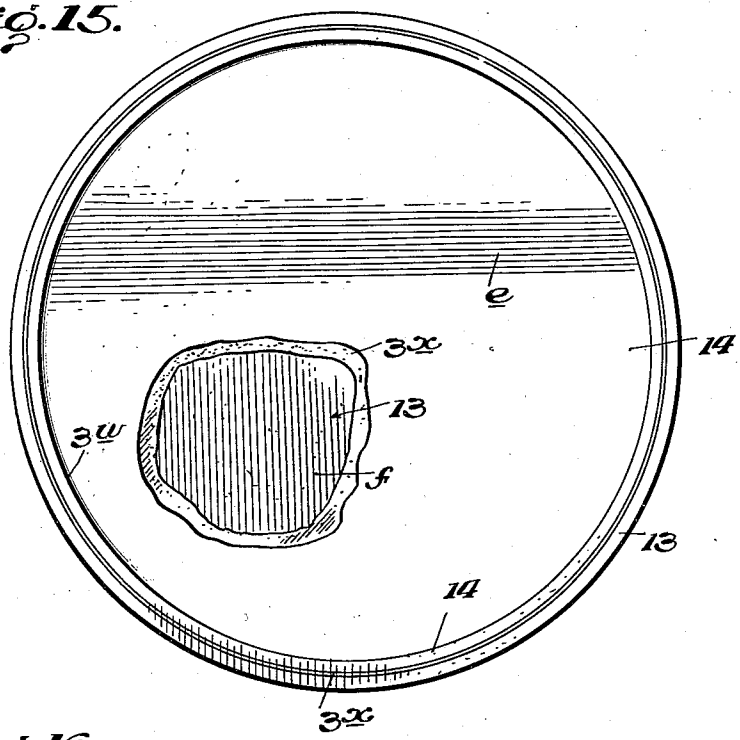


Fig. 16

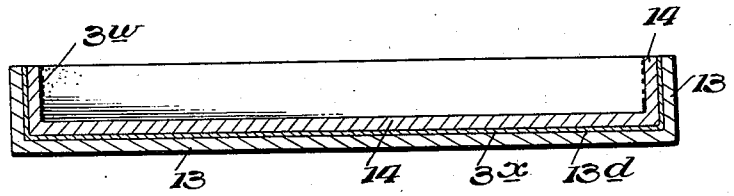
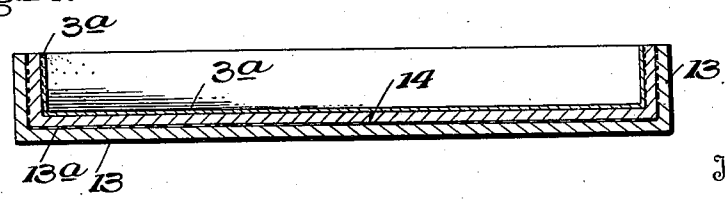


Fig. 17.



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Patented Aug. 4, 1942 2,291,755

UNITED STATES PATENT OFFICE

2,291,755

CONTAINER AND THE PRODUCTION AND NESTING THEREOF

Lee D. Pierce, Fulton, N. Y.

Application March 21, 1938, Serial No. 197,246

8 Claims. (Cl. 229—4.5)

This invention relates to containers and the production and nesting thereof; and the nature and objects of the invention will be understood by those skilled in the art in the light of the following explanations of the accompanying drawings that disclose preferred mechanical expressions or embodiments of the invention from among other forms, arrangements and structure within the spirit, and scope of the invention.

An object of the invention is to increase the nesting capacity of container shells or barrels, by improving the structure and formation of such shells, with particular reference to containers of the type where the cylindrical shells and their appropriate end heads or closures are separately manufactured and thus packed for sale or shipment with the shells in collapsed form, for assembly in operative condition with the appropriate end closures, usually at the situation where the containers are to receive the contents for which intended.

A further object of the invention is to so improve the structure and formation of collapsible fibrous and other material container shells as to materially increase the number of such shells that can be nested together within a given space or package, and to reduce to the minimum the size of the package formed by the increased number of such shells included in said package.

A further object of the invention is to provide certain improvements in container shell structures, and in paper containers and the like, with the ends in view of overcoming certain difficulties and disadvantages incidental to the manufacture and in the use of paper and like containers now on the market.

And a further object of the invention is to improve the methods of producing and in the art of nesting collapsible container shells.

With the foregoing and other objects in view, that will be apparent from the following description, my invention consists in certain novel features in form, structures, organization, and combination, and in certain novel method steps, as more particularly described hereinafter and defined by the appended claims.

Referring to the accompanying drawings, forming a part hereof:

Fig. 1 is an end elevation of a package of nested container shells, showing an embodiment of my invention.

Fig. 2 is a side elevation of the package of Fig. 1.

Fig. 3 is a detailed enlarged view of several successive collapsed container shells in the cylindrical carrier shell, dotted lines indicating the common width of the center panels of the infolding portions of the several collapsed shells, and also indicating the common difference of the arithmetical progression by which the width of the infolding portions increase from the outermost to the innermost collapsed shell.

Fig. 4 is a side elevation of one of the collapsible container shells of my invention, in normal cylindrical form.

Fig. 5 is a side elevation of a container embodying one of my collapsible shells in normal cylindrical form closed at the ends by end closures.

Fig. 6 shows the container shell of Fig. 5, in cross section expanded within its bottom closure.

Fig. 7 is a detailed end view of a portion of the first collapsible container shell, Fig. 3, shown collapsed in full lines and expanded in dotted lines.

Fig. 8 is an end elevation of the last or innermost collapsed container shell of a set, full lines showing the same in collapsed form and dotted lines showing the same in normal expanded cylindrical form.

Fig. 9 is a fragmentary view showing in part the upper end portion of a container shell of my invention provided with a secured-on top closure.

Fig. 10 shows in vertical section a container shell of my invention closed by an annularly flanged bottom closure, dotted lines indicating a metal protecting cap which encloses the exterior of the bottom flanged cap.

Fig. 11 shows in vertical section a portion of a container shell of my invention provided with an overlong inner sheet lining of Cellophane or the like.

Fig. 12 is a fragmentary view of the shell of Figs. 9 and 11 after the Cellophane liner has been folded over the top of the shell and secured to the exterior circumference thereof, with the lower overlong end of the liner folded inwardly across the bottom of the shell.

Fig. 13 shows the upper portion of a container shell of my invention provided with an annularly flanged top closure, the inner surfaces of which are lined by a sheet of Cellophane or the like cemented to the flange and also cemented to the outer circumferential surface of the shell.

Fig. 14 shows the bottoming construction of a shell of my invention having the inner liner such as disclosed by Figs. 9, 11, and 12.

Fig. 15 shows in top plan an annularly flanged cap or end closure for the container shell of my invention, a portion of the bottom wall of this end closure being broken away to show by the various cross lines perpendicular to each other that the paper grain of the innermost cap section is arranged transversely to the paper grain of the outermost cap section.

Fig. 16 shows the duplex cap of Fig. 15 in vertical section, without the Cellophane or the like sheet lining the inner surface thereof.

Fig. 17 shows the duplex cap of Fig. 15 in vertical section, the cap being provided with a sheet

of Cellophane or the like lining the inner surface thereof.

Fig. 18 shows in vertical section a container embodying the container shell of my invention and annularly flanged end closures sealed thereto.

Fig. 19 is a fragmentary enlarged vertical section of a bottom corner of the structure shown by Fig. 18.

Fig. 20 is an enlarged vertical corner section of the container shell without the end closure.

The completed closed assembled container of Figs. 1, etc. embodies, broadly, a hollow cylindrical shell or barrel 1, of peculiar formation, closed at its upper end by any suitable separately-made closure 2, and at its lower end by any suitable separately-made closure 3.

These containers are of the relatively large capacity or bulk type, although I do not wish to so limit all features of my invention. These bulk containers are generally produced in various sizes or capacities, among which sizes, the two and one-half gallon capacity, and the five gallon capacity, are the sizes commonly sold for packing bulk ice cream.

The container shells, and the end closures, are usually separately manufactured at the container producing factory, and packed and shipped to the situation where the container parts are to be assembled and the containers charged with the desired contents. To conserve space and reduce shipping costs, it is highly desirable to be able to pack the largest possible number of complementary container parts at the factory, in exceedingly compact form and into the smallest possible space. It is also highly desirable, that the complementary parts making up each container, be capable of quick and easy assembly to operative form, at the filling and assembly situation, by non-skilled attendants, without the employment of more or less complicated machine operations, or other manipulations requiring skill or experience.

Competition, and the fact that such containers are of no value to the packer after being once filled and sold, necessitate low cost production thereof by the container maker, and a consequent low price to the purchasing packer. The hard treatment to which such containers are subjected during filling, and to which the filled closed containers are subjected during shipment and thereafter during removal of the contents therefrom, necessitate strong and durable container construction and formation, to withstand such rough treatment without breaking and subjecting the contents thereof to damage, contamination, waste, or loss.

The container shell 1, of my invention is open at both ends, and of uniform diameter throughout its length, and unbroken and continuous throughout the complete circle of the cylindrical wall thus formed which preferably presents square cut annular end edges, i. e., the circular end edges of the cylinder preferably end in parallel planes, that are perpendicular to the longitudinal axis of the cylinder. This cylindrical wall is preferably imperforate and is preferably rendered grease, and water proof and of maximum strength by the inclusion therein of a very thin strong usually transparent film-like sheet 1*c*, of material that is water, grease and oil proof, such as a sheet of cellulose ester material, or of a rubber derivative, cellulose acetate, or commercially known "Cellophane." Hereinafter, the term "Cellophane" will be employed to typify, any suitable such film-like sheet possessing the desired characteristics, whether exteriorly or interiorly lining the shell, or included therein as an intermediate layer thereof.

The cylindrical wall of shell 1, is of substantially uniform radial thickness throughout, and is of the desired strength to resist collapse under radial stresses and blows. This wall is stiff and strong yet resilient and springy with a constant tendency to remain in its true cylindrical form and to snap back to such form when depressed inwardly or distorted therefrom. The maximum thinness of said wall of the cylinder, and its maximum strength and resiliency, are characteristics of this container shell of my invention, and these characteristics are aided by the fact that my shell is non-creased or non-scored throughout the full circle thereof, except at the longitudinal rectangular infolding segmental portion thereof, hereinafter described, which portion is defined by only a minimum number of parallel straight corrugations indented radially-inwardly of the cylinder, so formed and arranged as to add strength to the completed assembled container.

This shell can be formed of any suitable material that will produce the shell of the desired stiffness and strength combined with resiliency, although I prefer to make the same of paper or other fibrous board or material usually combined with sheet "Cellophane" or its equivalent. Usually, although not necessarily, the shells are produced on a tube winder, i. e., are composed of overlapping oppositely and spirally wound layers 1*d*, 1*e*, of suitable ribbons of paper material adhesively secured together to provide a two-ply wall, and if so desired a third ply 1*c*, can be provided by adding a ribbon of "Cellophane" during the tube winding operation, with suitable adhesive, to provide the two-ply paper shell with a third ply of "Cellophane" either as the inner, the outer, or an intermediate ply. The introduction of the "Cellophane" by the tube winding method, is preferably as an intermediate ply, and by reason of its strength, I am enabled to reduce the thickness of the two paper plies, while producing a shell of minimum thickness and maximum strength, which is desirable, where my nesting feature is employed, although I do not wish to limit all features of my invention to the use of "Cellophane" or its equivalent as a part of my shell.

In carrying out my invention, I provide each shell with a radially infolding portion, by which the shell can be radially contracted uniformly throughout its length, to a reduced diameter for nesting purposes. This segmental infolding portion is of parallelogram form and hence is of uniform width throughout its length, and extends throughout the full length of the shell and hence at its ends includes similar arcuate segments of both annular end edge portions of the shell. In the specific embodiment illustrated as an example, from among others, this infolding portion is defined and provided by four parallel narrow laterally-spaced hinge or bend lines extending longitudinally of the shell throughout the length thereof. Each such line is formed by a line of scoring preferably in the form of a corrugation formed by forcibly depressing the wall of the shell radially thereof to form a longitudinal narrow groove on one side of the shell and possibly a substantially corresponding projecting rib at the opposite side of the shell. The wall of the shell is preferably depressed and compressed radially inwardly to form the grooves in the outer

side or circumference of the shell and possibly ribs at the inner side surface of the shell.

The infolding portion of each shell, in this example, consists of a narrow center land or panel 4, extending throughout the length of the shell, and constituting but a minor fraction of the complete circle of the expanded shell of which said panel forms a segment.

The infolding portion of each shell extends longitudinally from end to end of the shell and constitutes an integral portion thereof as well as a segmental portion of the complete circle of the expanded shell. In the example shown, this infolding portion consists of a longitudinal narrow full-length center panel 4, and a pair of longitudinal full length side panels 5, 5, between which the center panel 4, is arranged and by which it is joined into the circle of the shell. The two side panels 5, are identical in form and dimensions. These panels 4, 5, 5, are formed and defined at their longitudinal boundaries by the four parallel longitudinal scores or corrugations; namely, the two parallel laterally spaced identical corrugations 6, 6, outline the center panel 4, and join the same to the inner longitudinal edge portions of the side panels 5, 5, and the two parallel more widely-spaced corrugations 7, 7, define the outer longitudinal edges of side panels 5, and the overall width of the infolding portion of the shell, and join the same into the complete circle of the shell.

This shell is collapsed from its operative cylindrical form, to a desired smaller diameter, for nesting purposes, by applying sufficient inward pressure against the center panel 4, to break or snap the normal circle of the shell, forcing said panel radially inwardly and thereby drawing the side panels 5, 5, inwardly and thereby pulling the opposite ends of the stiff resilient non-scored or non-corrugated remaining portion of the circle of the shell toward each other to a reduced shell diameter, against the tension of said shell portion tending to return the same to normal operative diameter. When thus collapsed, the infolding portion 4, 5, 5, will form a longitudinal hollow ridge within and throughout the length of the collapsed shell rising therein radially toward the center flat crown defined by the center panel 4.

This collapsed shell can be restored to its normal diameter and operative expanded condition, by applying sufficient outward radial pressure to the flat crown of said ridge, namely, to center panel 4, to expand the shell through the toggle action of the side panels 5, 5, and thereby cause the infolding portion to snap outwardly into its normal position forming a segment of the completed circle of the shell expanded to its full normal diameter, in which position the infolding portion is substantially locked by the circle formation and the toggle action of the three panels 4, 5, 5.

The reduced diameter to which the shell can be collapsed is determined by the relative overall distance between the two outer corrugations 7, 7, with respect to the normal circumference or diameter of the expanded shell.

Where the center panel 4, of fixed width, is employed as a center mark or guide, the reduced diameter to which the shell will collapse is predetermined by varying the width of the two identical side panels, which determine the distance between the two corrugations 7, 7.

Thus, in the formation of a package of nested shells according to my invention, I provide a carrier shell 1a, and a set or series made up of the required number of said shells 1, that can be nested in said carrier shell, all of like diameter when in operative expanded cylindrical form, the cylindrical walls of which are of like thickness, and all formed with infolding portions, such for instance as hereinbefore described, but with such portions of the shells of the set or series progressively increasing in width by a predetermined linear measurement, shell by shell, from the minimum width of said portion of the first shell to the maximum width of said portion of the last shell. The cylindrical shell 1a, is also preferably of like diameter and length and wall thickness as the shells 1, of the set, to constitute a holder, container or carirer for said set or series of shells when nested. In fact, this carirer shell 1a, is preferably for use in the formation of a container such as disclosed by Fig. 5. In other words, the carrier shell 1a, is preferably identical with the shells 1, but is employed in its cylindrical form, whether or not formed for collapsing by an infolding portion.

The following method is followed in packing a great multiplicity of container shells to form an exceedingly compact rugged small package, for storing and transportation, namely:

The cylindrical shell 1a, is of the same diameter and capacity as the collapsible shells 1, to be packed therein, and is herein termed the first shell of the package. The second shell of the package, is the first of the set of collapsible shells 1, and the one thereof having the infolding portion 4, 5, 5, of minimum width enabling said second shell to collapse to a reduced external diameter sufficiently less than the internal diameter carrier shell 1a, to freely slide thereinto when said shell 1, is collapsed as hereinbefore described. Said shell 1, of the set of collapsible shells is thus collapsed and then inserted in one end of carrier shell 1a, and pushed longitudinally thereinto until completely enveloped thereby, except at its ends which are flush with the ends of shell 1a. The outer surface of said collapsed shell 1, will then throughout its length snugly fit the inner cylindrical surface of carrier shell 1a, while the infolded portion 4, 5, 5, will form a radially-shallow longitudinal ridge within the collapsed shell 1.

The internal diameter of the carrier shell 1a, is equal approximately to the exterior diameter minus twice the radial thickness of the shell wall, and with this as a basis, after the common width of center panel has been determined, the common width of the two side panels 7, 7, of the infolding portion 4, 5, 5, of said second shell of the package, is figured, to gain the maximum permissible exterior diameter of said shell 1, when collapsed, to enable the same to freely slide into the shell 1a, as hereinbefore described. When the minimum width of the two similar side panels 5, 5, of said infolding portion of said section shell 1, is determined, a common difference will be found, for determining the increasing width of panels 5, 5, of succeeding shells 1, by arithmetical progression.

For instance, the panels 5, 5, of the third shell 1, will both be increased in width by one-half of this common difference, over the common width of said panels 5, 5, of said second shell 1, nested in shell 1a, and the panels 5, 5, of the fourth shell 1, will be each increased in width over the width of each of said panels of the third shell by one-half of said common difference, and so on from shell 1, to shell 1, throughout the remainder of the set of shells 1, that will fill the

carrier shell 1a, to capacity, as disclosed by Fig. 1, of the drawings.

The foregoing applies where the cylindrical shells 1a, and 1, of the package are all of like normal diameter with walls of the same radial thickness, with the center panels of all the shells 1, of like width, and with the duplicate panels 5, of each shell 1, in the package increasing in width by arithmetical progression, shell by shell from the outermost shell 1, to the innermost shell 1, of the package.

In the method of packing the shells 1, in the carrier shell 1a, the longitudinal ridge 4, 5, 5, of the second shell of the package, after collapse and insertion thereof in shell 1a, forms a guide for the corresponding but larger ridge of the third collapsed shell 1, when inserted within the said second shell 1, and as each collapsed following shell is inserted within the package, its ridge 4, 5, 5, covers and slides in on and is guided by the ridge of the shell 1, that preceded it into the package. Thus, in the completed package, the ridges 4, 5, 5, of the packed shells 1, are in effect telescoped radially of the package, and center the collapsed shells and tend to hold the shells in place and serve as guides for successive removal of the shells from the package, beginning with the innermost shell.

As a rule, the capacity of the package is reached, when the flat crown 4, of the ridge of the innermost, or last inserted shell 1, closely engages the inner surface of its own shell, for instance, as shown by Figs. 1 and 8, of the drawings.

By reason of the foregoing method and shell structure a surprisingly large number of collapsed shells can be thus packed in a cylindrical carrier shell, even though of the same diameter as that of the shells therein when expanded to their normal cylindrical form. These shells are thus packed throughout their full lengths, as each shell 1, collapses to a uniform diameter throughout its length, and hence in said package, where the carrier shell 1a, is of the same length as the collapser shells, all of the shells will be flush at their opposite ends, and the length of the full package will equal the length of the carrier shell or of each shell within the package. The maximum number of collapsible shells that can be nested into such package, increases as the common radial thickness of the shells is decreased.

To give an example, where the common diameter of the shells 1a, and 1, is, say, 9", and the common radial thickness of all of the shell walls, is, say, .028", and after selecting, say, about 1", as the common width of all the panels 4, although this panel width is of no particular moment, it will be found that the common difference between the circumferences of the successive collapsed shells 1, in the package is substantially .1812", that must be substantially followed in arithmetical progression in preparing the successive shells 1, of the set that can be nested in the carrier shell 1a. Thus, the distance between the corrugations 7, 7, of each collapsed shell 1, from the outermost shell 1, to the innermost collapsed shell 1, must increase about .1812", shell by shell in arithmetical progression. Where the formation is as per the specific embodiment shown, merely, as an example, but not as a limitation, employing the duplicate side panels 5, 5, the two panels of succeeding shells, are each increased in width one-half of the common difference .1812". Where the shell dimensions are as above noted, merely as an example, not for purposes of limitation, thirty-five shells, plus carrier shell 1a, have been packed together in the one package, nine inches in diameter and no longer than the length of any one of the container bodies or shells included therein. The end closures for these shells, can be separately packed, and shipped, with the package of shells.

Any suitable number of shells 1, all of the same length, diameter, and wall thickness, but without defined infolding portions, are prepared by tube winding or other shell or tube producing machinery, and cut to uniform lengths. These shells are usually after production as above mentioned, then subjected to the method of scoring or corrugating to provide each shell 1, with its infolding portion according to my invention, thereby rendering each shell 1, collapsible to a reduced diameter uniform throughout the length of the shell.

Usually all of said shells are first passed through suitable corrugating or scoring machinery, and the two parallel longitudinal corrugations 6, 6, that define the center panel 4, are permanently compressed and formed therein throughout the length of each shell. In the particular example illustrated, all of the collapsible shells 1, are alike in the matter of corrugations 6, 6, and center panel 4.

The corrugating machinery can then be indexed, to produce the two corrugations 7, 7, at the minimum distance apart or from the corrugations 6, 6, required for the first shell 1, to be collapsed and inserted in a given carrier shell 1a, of the same diameter as said first shell 1, when expanded. After any desired number of such first collapsible shells 1, previously provided with the permanent corrugations 6, 6, have been run through the machine and formed also with the permanent corrugations 7, 7, the minimum distance apart, such shells 1, having the completed infolding portion of minimum width, are usually separately stored for future use in forming packages of nested shells.

The scoring machine is then again indexed to slightly increase the spacing of corrugations 7, 7, say, .1812", the common difference, in this example of an arithmetical progression, to permanently impress said more widely spaced corrugations 7, 7, in any suitable number of said shells having the permanent corrugations 6, 6, these second completed shells are also usually separately stored for future use.

The corrugating machine can thus be adjusted or indexed step by step according to the common difference .1812", for example, to produce separate supplies of infolding shells 1, from which shells can be successively taken, to form packages of nested shells, as hereinbefore described. However, if so desired, the corrugating machine can be so arranged and rendered so adjustable, as to complete all of the corrugations of a shell 1, at one operation or one passage through the machine. Thus, any suitable number of duplicates of each shell of a set or series capable of nesting in one carrier shell 1a, can be run off to provide supplies of each such shell of such series.

The end closures 2, 3, whatever the material or structure thereof, are preferably of the slip-on type with closed end walls and annular projecting flanges, to surround the exteriors of the ends of the expanded cylindrical shells. The end closures for a set of nested containers forming a package, are alike as to diameters, for operative association with any one of said shells when expanded.

Thus, when a collapsed shell 1, is removed from said package, the collapsed shell is held in a vertical position with its lower end resting on the end wall of a closure 3, supported in a horizontal position, with its annular flange surrounding the lower end of said collapsed shell. The shell is then expanded to its full cylindrical form, Fig. 6, as hereinbefore described, into close fit in the closure flange, and this bottom closure and the shell end can be secured together by any suitable means or in any suitable manner. The shell is thus bottomed and can receive its intended contents. After which, any suitable cover or top closure 2, can be applied to the open top of the shell and secured thereto, if necessary, in any suitable manner or by any suitable means.

As hereinbefore explained my corrugated collapsible container shell, preferably, includes a layer or ply of very thin strong sheet material that is substantially water, oil or grease proof, such as "Cellophane" or its equivalent for this purpose. Where the containers are to be employed for certain purposes or to contain certain substances or products, I prefer to introduce such "Cellophane" or its equivalent material, as an intermediate adhesively-secured ply 1*c*, between inner and outer adhesively-secured relatively-thicker paper material plies 1*e*, 1*d*. By thus producing the shells 1, on a tube winder, two relatively thick ribbons of paper material are oppositely and spirally wound, to form the inner and outer plies, with the ribbon of one breaking joints with the ribbon of the other, the spiral convolutions of each ribbon abutting at the longitudinal edges of the ribbon. A wider ribbon of very thin Cellophane or the like, is introduced into the tube winder with suitable adhesive thereon, and spirally wound on the inner paper ply with the longitudinal edges of the Cellophane ribbon overlapping and adhesively secured together, Fig. 10. An impervious strengthening layer of "Cellophane" is thus introduced located entirely between the paper layers. The "Cellophane" is so thin that the overlapping united edge portions thereof will not produce objectionable or visible bulges at the exterior of the shell, and the paper and "Cellophane" layers or plies will all be tightly and adhesively secured together, producing an exceedingly strong wall that prohibits the passage of water and oil or the like.

Where the corrugated collapsible paper material shells are to receive contents that should not come in direct contact with the inner paper surfaces of the shells, or where it is otherwise desirable to provide the shells with an inner surface strengthening ply of "Cellophane" or the like, I prefer to construct said shells as follows. The stiff resilient shells 1, are formed of paper material on a tube winder or otherwise, and preferably before the shells are corrugated for nesting, each such shell is provided with an inner overlong cylinder 10, of very thin sheet "Cellophane" or the like, Figs. 9, 11, 12, and 14, snugly fitting and completely covering the inner surface of the shell and projecting beyond both ends of the shell. The upper projecting end 11, of this lining cylinder 10, is expanded outwardly to fit snugly over the annular top edge of the shell, and folded downwardly closely to and around the outer circumference of the upper end of the shell and is at its inner surface 11*a*, securely secured to the outer circumferential surface of the shell by a suitable adhesive, known to those skilled in the art, for securing "Cellophane" or the like to paper.

The lower end 12, of this cylindrical inner lining 10, projects downwardly beyond the lower end of the shell 1, to perform an important hereinafter described function in the bottoming and sealing of the container. The impervious lining cylinder 10, is, in this example, composed of a thin sheet of Cellophane or the like rolled into cylindrical form with the sheet ends overlapping and welded or adhesively secured together to form a tight seam. The cylinder 10, snugly fits and covers the inner surface of the shell 10, and preferably is secured to the shell only by the upper end of the cylinder that is turned over and down at the exterior of the upper end of the shell, leaving the cylinder free from and not secured to the inner surface of the shell.

Fig. 14 shows the bottom closure for the collapsible paper shell 1, provided with the tough very thin flexible impervious lining cylinder 10, expanded over the top of the cylinder and secured down to and around the outer circumference of the shell, and preferably otherwise free from the shell and hanging from the upper end thereof with the lower end 12, of said cylinder projecting a substantial distance from the open lower end of the shell. In bottoming this shell to provide the same with a strong bottom closure sealed against liquid leakage, the shell 1, is expanded into tight fit with the upstanding annular surrounding flange and bottom wall of an annularly flanged slip-on exterior bottom closure cap 3, preferably provided with the impervious very thin tough lining sheet 3*a*. In thus assembling the shell and bottom closure, the thin flexible depending end 12, of the lining cylinder is folded inwardly to transverse or horizontal position across the open lower end of the shell 1, to rest flatly and smoothly on the top surface of the end wall of the bottom closure cap, to which it is secured by adhesive or cement 12*a*. Where the cap inner liner 3*a*, is employed, this infolded end 12, is cemented to the liner 3*a*. The comparatively thick stiff oversize inner bottom disk 14, is forced down through the expanded shell 1, and pressed tightly down on, and if need be, is cemented to the annular flattened out transverse end 12, of said cylinder 10. This oversize inner bottom disk also exerts radial outward pressure against the lower end of expanded shell tending to expand the same against the inner surface of the upstanding surrounding flange of bottom closure 3, preferably secured by cement or adhesive 3*w*, to the circumference of the lower end of the shell. By this arrangement, where the cylinder 10, hangs from its secured upper end 11, the weight of the container contents will be in part carried by cylinder 10, as the oversize disk plus the inturned end 12, in effect constitute the bottom closure of the cylinder 10, and relieve, in part, the bottom cap 3, from the weight of the container contents.

From the generic standpoint, my improved container shell, collapsible according to my invention for nesting, whether or not provided with the thin impervious sheet ply or liner, can, in the formation of a bottomed container, be provided with any suitable bottom cap or closure 3, secured to the shell in any suitable manner, and with any suitable top cap or closure 2, secured to the upper end of the container shell, if so desired, in any suitable manner.

I prefer, however, to employ annular flanged slip-on caps or covers 2, internally lined by thin sheet "Cellophane" 2*a*, or the functional equivalent thereof, cemented to and covering the inner surface of the end wall of each such closure and

cemented to and covering the inner circumferential surface of the annular depending flange 2*b*, of each such closure. Where so desired, such covers can be secured and sealed to and around the exterior surfaces of the upper ends of the container shells covered thereby, by suitable adhesive 2*w*, applied to the inner surfaces of the sheet Cellophane lining the inner surfaces of cover flanges 2*b*.

Likewise, the bottom closure 3, is preferably of the annularly flanged exterior slip-on cap type, with the inner surfaces of its end wall and laterally projecting annular flange 3*b*, covered by a preferably unbroken thin strong sheet 3*a*, of Cellophane or its equivalent, adhesively secured thereto, and secured to the lower end of the container shell by suitable means such as cement or other adhesive 3*w*, carried by flange 3*b*. Also, where the filled containers are of large capacity or for other reasons, the bottom closures can be surrounded by suitable exterior strong stiff protecting bottom rings, such as secured-on metal rings, shown by dotted lines Fig. 10, usually angular or approximately channel-shape in radial section.

In my effort to produce a strong, protecting, comparatively economical moisture and liquid proof and easily applied end closure for the bulk container shells 1, of my invention, particularly to serve as the bottom closure, I have developed the following annularly flanged slip-on cap, which I believe overcomes the difficulties incidental to the use of prior bulk-container end, closures with which I am familiar. This end cap, Figs. 15, 16, 17, is a stiff liquid-resistant strong multi-ply paper material cap having a closed end wall and a laterally projecting unbroken cylindrical annular flange, and is composed essentially of several complementary annularly-flanged concentric, one-piece, die-drawn cap fractions or sections 13, 14, tightly nested and cemented together into rigid unity. Each such section is die-drawn in one-piece from a single thickness of more or less heavy or thick paper board or material with the annular flange thereof preferably submitted to radial stiffening paper compressing pressure with the end in view of permanently fixing the final shape of such section against warping or distortion, or tendency of the annular flange to depart from its approximate cylindrical original form. Thus, the outer cap section 13, is accurately drawn from flat sheet paper material, by suitable dies to the annularly flanged closed end wall permanent shape and dimensions, predetermined. The inner cap section 14, is likewise accurately drawn from the flat sheet paper material, by suitable dies to the same shape as the outer section 13, but to predetermined accurate slightly less diameter and flange length, and is forcibly driven down in the outer section 13, while said outer section is accurately confined within a ring die or the like. Suitable adhesive 3*d*, is applied to either the inner surfaces of the outer cap section 13, or the outer surfaces of the inner cap section or to both, to permanently unite the two sections into a rigid or stiff structure. If so desired, a very thin flexible tough sheet 3*x*, of "Cellophane" or its functional equivalent, can be interposed and cemented to and between the outer and inner cap sections 13, 14, and the annular flanges thereof. Also, if so desired, the inner surfaces of the end wall and flange of this completed annularly flanged duplex cap, can be covered by a cemented on sheet of "Cellophane" 3*a*, or the like, whether or not the intermediate "Cellophane" sheet 3*x*, is employed.

The two cap sections 13, 14, are preferably so assembled to form the completed duplex cap, that the grain of the paper material of one section is arranged transversely of or at right angles to the grain of the paper of the complementary section, in the completed cap. This is indicated by the lines *e*, *f*, of Fig. 15. This arrangement of the overlying paper layers with the paper grain of one layer arranged perpendicular to the direction of grain of the other section tends to reduce to the minimum warping and distortion of the completed cap.

Where an exceedingly inexpensive yet strong and durable paper material container impervious to liquid, oil, grease, is required, a spirally-wound paper material cylindrical container shell 20, Figs. 18, 19, 20, can be provided covered from end to end and circumferentially at its outer circumference by secured on very-thin tough flexible impervious sheet material 21, such as hereinbefore specified, "Cellophane" being mentioned as an example. This shell 20, and its secured covering 21, can be exteriorly covered, except at the projecting opposite ends of the covering 21, by a relatively short spirally-wound paper material cylindrical sleeve or tube 22; the opposite ends of shell 20, thus project longitudinally beyond tube 22, with the covering material 21, exposed.

Exterior annularly flanged closed end-wall closure caps 23, 24, can be provided to close the bottom and top of said container shell. If so desired, although I do not desire to so limit the invention, these two end closure caps can be alike in organization and structure. Each such cap consists of an end closure wall rigid with a laterally projecting unbroken annular flange adapted to snugly fit on and surround the projecting end of shell 20, and abut against the adjacent end wall of exterior tube 22, with the closure end wall closing the container shell end opening. The inner face of the cap or closure end wall and the inner surface of the annular flange are covered and faced by a secured on sheet 25, of "Cellophane" or the like, and the exposed surface of the "Cellophane" covering the cap flange is provided with suitable cement or adhesive 25*a*, that will unite said surface to the exposed portion of the sheet 21, around the shell end. I prefer for this purpose to employ a thermo-plastic cement or adhesive, a known commercial product for uniting "Cellophane" to "Cellophane" or "Cellophane" and the like to paper when rendered tacky by heat, quickly setting and remaining set at normal temperatures.

With the two end caps thus applied to and closing both ends of the shell, the annular ends of the "Cellophane" covering 21, will be united to the "Cellophane" linings 25, of the two end caps by sealed joints, and hence the container shell 20, will be completely surrounded at both ends and circumferentially by an impervious wall of "Cellophane."

All of the end closures disclosed hereby are preferably those disclosed by Figs. 15, 16, 17, and preferably are at the place of container manufacture, provided at the inner circumferential surfaces of their annular flanges with adhering deposits or layers 3*w*, 25*a*, etc. of suitable thermo-plastic cement or adhesive that remains set at normal atmospheric temperatures, and that is rendered tacky and plastic for adhesion by heat. Thus, a heating plate or tray

is usually provided at the situation where container shells and their end caps are to be assembled to produce closed containers, on which a supply of heated caps provided with tacky adhesive, is maintained, so that heated caps are ready for use as needed.

A tightly fitting flanged top cover 2, can be applied to the top of the expanded shell 1, if the upper end of the loaded shell is held slightly collapsed to slightly reduce the diameter of the upper end of the shell. To enable the operator, to then fully expand the upper end of the shell, to the cylindrical form, I provide the upper end portion of the infolding shell part, with an accessible exterior pull handle. For instance, I show a flexible free-end pull tab 4x, stapled or otherwise secured to the upper end portion of central panel 4, below the cover flange, and located and exposed at the outer side of said panel. By thus providing the shell with a pull handle, the upper end of the shell can be expanded into tight fit with the surrounding cover flange and into sealing contact with the adhesive on the inner surface of said flange. These tabs 4x, at the outer faces of panels 4, will not interfere with shell nesting.

I prefer to apply tacky adhesive of substantial body to both sides of the Cellophane sheets within the flanges of the end closures, to close and seal all spaces between the overlapping folds and wrinkles of the Cellophane, and thereby seal the same against liquid passage and seepage.

Also, the Cellophane liquid end closures can be provided with transparent windows for inspection and display of the container contents. These windows can be formed by cutting out the central portions of the paper end walls of the end caps or closures, and then covering or bridging such openings with imperforate Cellophane sheets, i. e., the sheets interiorly lining the paper caps. These sheets can be cut through, at said openings, for removal of container contents, from time to time. Each such container, can if desired, be provided with the closed wall over-size extra flanged cover, to slip over the end cover provided with the window.

What I claim is:

1. A package consisting of an outer carrier container shell of an open end cylindrical form, and a multiplicity of collapsed container shells all of the same diameter when expanded to cylindrical form and nested longitudinally throughout their lengths one within the other and within said carrier shell, said multiplicity of container shells within said carrier shell being of successively reduced diameter in arithmetical progression from the outermost collapsed shell to the innermost collapsed shell.

2. A package consisting of a multiplicity of container shells all of the same diameter when in normal cylindrical form, said package consisting of a carrier container shell in normal cylindrical form, and a set of collapsed container shells nested throughout their lengths within said carrier shell and successively within each other, each collapsed shell provided with an infolded portion forming a ridge extending longitudinally throughout the shell, with the ridges of said collapsed shells arranged longitudinally one on the other with the ridges nested together radially of the package.

3. A set or series of nested container shells, all alike in radial wall thickness and in normal cylindrical form diameter, each shell having an infolding portion to permit collapse of the shell to a uniform diameter throughout its length, the infolding portions of the shells of said set increasing in width in arithmetical progression, from the first shell to the last shell.

4. A container shell of normal cylindrical form, said shell having an infolding portion extending throughout its length and foldable inwardly a uniform radial distance throughout its length to cause collapse of the shell to a predetermined reduced diameter, said infolding portion forming a longitudinal ridge within the shell when the shell is collapsed, said ridge having a longitudinal substantially flat crown of uniform width throughout the shell.

5. A container shell of normal cylindrical form having an unbroken annular wall of uniform radial thickness, said shell being collapsible to a reduced diameter to snugly and longitudinally slide throughout its length into a similar second shell of like normal cylindrical form and diameter and wall thickness, said first named shell having an infolding longitudinal wall portion of predetermined uniform width throughout its length determined by the exterior circumference of the second named shell minus twice the radial thickness of the second shell wall.

6. A package of temporarily nested container shells all of normal unbroken cylindrical form of the same diameter; said package including a container shell in its normal cylindrical form constituting the package carrier shell, and a multiplicity of collapsed shells of like wall thickness, all nested longitudinaly throughout their lengths one within the other within said carrier shell, said collapsed shells within said carrier shell decreasing in diameter by a common difference shell by shell from the outermost collapsed shell to the innermost collapsed shell in arithmetical progression, said collapsed shells capable of being successively slipped longitudinally from said package and expanded to normal cylindrical form.

7. In the method of assembling a multiplicity of similar container shells of like diameter normal expanded cylindrical form, into a package, those steps which comprise providing an open end container shell in normal unbroken cylindrical form throughout its length as a carrier shell; and providing a multiplicity of collapsible container shells all of normal unbroken expanded cylindrical form of like diameter and wall thickness, collapsing the first of said last named shells and longitudinally slipping the same throughout its length into said carrier shell in snug fit with the interior cylindrical surface thereof; and successively collapsing the remainder of said shells each to a diameter less than that of the preceding shell by a common difference in arithmetical progression, and thus sliding the same one by one into the preceding nested shell throughout the full length thereof.

8. In the method of preparing a set of container shells all of substantially like normal unbroken cylindrical form, diameter and wall thickness, for longitudinal and successive nesting one within the other throughout the length thereof, that step which comprises providing each shell throughout its length with an infolding portion of its cylindrical wall, with said portions increasing in width from shell to shell throughout the set of shells by a common difference in arithmetical progression.

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