The present invention relates generally to improved drip-preventing pouring means for use in conjunction with bottles, jars and like containers to provide improved pouring and drip-preventing characteristics to liquid and semi-liquid substances which may be packaged therein, and to effectively obviate the tendency of residual droplets of such substances to adhere or cling to the lip area of the dispensing end of the container and thereafter drip or run down the exterior surface of the container during and after each instance of pouring. To effect such a result, numerous types of pouring attachments or pour-out fittings, as they are sometimes called, have been designed to effect a sharp severance or cut-off of the liquid flow along the rim or pouring area provided on dispensing end of the container when pouring is concluded and the container is reverted to an upright position. Also in this respect, various types of specialized coatings have been applied on and around the dispensing end or pouring rim portion of containers for such purposes. Additional corrective measures which have been employed have involved providing such pouring lips, collars and neck rings with specialized configurations and fabricating such items from non-wettable materials.

Despite all of the various aforementioned types of preventative measures utilized to improve pouring characteristics and to prevent dripping, it has been found that in most instances the tendency still remains for residual droplets of many liquid and semi-liquid substances to cling and remain on the dispensing end or pouring rim of a container as an incident of pouring. This latter tendency appears to be the result of cohesive surface tension characteristics between the pouring surface and of the liquid or semi-liquid substance coming into contact therewith. Consequently, residual droplets of the liquid have an affinity for and tend to adhere to the rim of the container after it has been returned to its upright non-pouring position. With many types of liquid and semi-liquid substances, and as has been particularly observed with syrupy liquid substances, these droplets subsequently form an objectionable residue or deposit around the dispensing or pouring rim of the container. Often, instead of running or dripping on the dispensing rim of the container, the droplets are jarred loose or dislodged either during the attachment of a closure to the container or during handling when the container is reused or returned to the shelf, or the like. In instances where a closure is used, easy attachment and removal thereof is frequently hampered. Likewise it frequently becomes difficult to properly reclose the container. Also, the exterior surface of the container is subject to becoming unsightly, sticky and offensively odorous, all to the extreme disaste of the user.

Accordingly, it is a primary objective of the present invention to provide improved drip preventing and pouring means for use in conjunction with bottles, jars and like containers which are capable of effectively eliminating the usual tendency of residual droplets of liquid and semi-liquid substances to remain or adhere to the pouring or dispensing rim of such containers.

Another object of the present invention is the provision of improved drip preventing and pouring means for use on the dispensing or pouring end of a container characterized by the inclusion of an improved pouring surface which inherently tends to induce droplets of residual liquid and semi-liquid substances, such as may remain on the pouring or dispensing end of the container after pouring, to flow back towards and into the interior of the container.

A further object of this invention is to provide improved drip preventing and pouring means having the foregoing characteristics, which is further characterized by the inclusion of a pouring surface exhibiting differential surface tension characteristics which cooperate in such a manner as to attract or draw residual droplets of liquid and semi-liquid substances on the pouring or dispensing end of the container back towards and into the interior of the container.

A still further objective of the present invention is the provision of an improved pour in preventing and pouring device which is capable of being utilized in conjunction with the pouring outlet of a dispensing container, and which has a pouring surface effecting a sharp cut-off or severance of the container's liquid or semi-liquid contents when the container is returned from a pouring position to an upright non-pouring position, and which in cooperation therewith exhibits differential surface wetability characteristics along the pouring surface of the device so that residual droplets of the liquid or semi-liquid substances remaining on the surface of the device tend to be drawn back into the container at the conclusion of pouring.

A still further objective of the present invention is the provision of an improved drip preventing and pouring device which is capable of being utilized in conjunction with the pouring outlet of a dispensing container, and which has a pouring surface effecting a sharp cut-off or severance of the container's liquid or semi-liquid contents when the container is returned from a pouring position to an upright non-pouring position, and which in cooperation therewith has a pouring surface finish of reduced wettable characteristics adjacent to the outermost pouring edge thereof, and a pouring surface finish of relatively increased wettability at a location extending inwardly therefrom towards the container's pouring outlet.

Other objects and advantages of the present invention will readily become apparent to those skilled in the art to which the present invention pertains from the following detailed description considered in conjunction with the accompanying sheets of drawings on which two preferred embodiments of the invention are illustrated, and wherein:

FIG. 1 is a fragmentary elevational view of the neck portion of a container, for illustrative purposes only being herein depicted as a bottle, in which one preferred embodiment of the present invention is represented; and

FIG. 2 is an enlarged plan view of the container neck portion illustrated in FIG. 1; and

FIGS. 3–5 represent schematic fragmentary elevational views of the container neck portion illustrated in FIGS. 1 and 2 and progressively depict the functional aspects of the present invention; and
FIG. 6 is a fragmentary central sectional view of a pouring device assembled on the dispensing end of a conventional container, and embodying another form of the present invention. Broadly, the present invention embodies the formation of a non-drip pouring surface exhibiting differential surface wettability characteristics. In this respect, a selected area of the pouring surface in the immediate vicinity of the pouring rim of a container is provided with a substantially non-wettable surface finish. Thus, negligible wetting, if any, occurs in such an area when the container's contents pass thereover during pouring. Cooperating with the non-wettable surface finish, there is a highly wettable surface finish which is formed in an area directly adjacent to the non-wettable area and stretching towards the interior of the container. By way of differentiation, the terms wettable and non-wettable as used herein, are meant to define a relative characteristic condition in which the wettable surface is by comparative relation substantially more wettable than the non-wettable surface finish. Consequently, residual amounts, fractions or droplets of the container's fluid contents that tend to remain on or cling to the outer pouring edge or finish portion of the container's pouring outlet are subjected to an attenuation drawing force which tends to influence and gravitate the droplets or the like back into the interior confines of the container. It is not intended that the theory giving rise to this compelling or attracting force be a limitation upon the invention herein since the theory is not completely subject to a full exacting explanation, but the mutual affinity of the various fractions or droplets of water remaining on the non-wettable surface finish and those remaining on the wettable surface finish are believed to possess a cohesive mutual affinity which is of sufficient magnitude to overcome the limited surface attraction of the droplets of fluid clinging or adhering to the non-wettable surface finish, but not of sufficient magnitude to overcome the greater surface attraction of the fluid to the wettable surface finish. As a result, the fractions or droplets of fluid remaining on the non-wettable surface finish are drawn inwardly toward the droplets of fluid on the wettable surface finish and thence by gravity toward the interior confines of the container. As a consequence, the edge of the pouring rim remains free from residual droplets of fluid and objectionable dripping or precipitation of such droplets down toward the exterior portion of the container is effectively obviated. As a further consequence, a smooth severance of the flow of the container's contents at the cut-off edge of the pouring rim may be effected during subsequent pouring. Also, a closure provided over the pouring outlet and attached to the exterior surface of the container's neck portion, as by neck threads, may be attached and removed without interference caused by dried-up residual fluid.

The concept of utilizing non-wettable coverings on various portions of the pouring surfaces of a container which have herefore been employed have not effectively prevented residual fluid in the form of small fractions or individual droplets from remaining or clinging to the sharp edge or cut-off lip of the pouring rim. Also, movement or jarring of the container tends to dislodge such droplets and cause them to precipitate downward over the exterior surface of the container. For example, attachment of a closure over the container neck portion frequently tends to cause such droplets to be displaced onto the exterior surface of the container. However, such objectionable tendencies are effectively obviated by the present invention by virtue of strategically located pouring surfaces having substantially different wettability characteristics cooperating to draw such residual droplets away from the pouring rim and back towards the interior of the container.

Now describing the invention in greater detail and referring to the drawings wherein two preferred embodiments of the present invention are illustrated, in FIG. 1 there is shown a conventional glass container, which for the purposes of illustration and explanation is illustrated in the form of a conventional narrow neck glass bottle 10. The bottle 10 has a hollow neck portion 10c extending axially outward therefrom which terminates at its outer axial end in an annular finished portion forming a neck or pouring portion 10a. The neck portion 10a is provided with suitable exterior neck threads 10b for accommodation of a threaded cap or closure of conventional detachable design, not illustrated, by means of which spillage, evaporation or other objectionable loss of the bottle's contents can be prevented when removal of such contents is desired. In accordance with the broad concepts of this invention a surface covering 11 preferably in the form of a thin annular skirt or membrane is superimposed over the surface of the pouring rim 10c and extends inward therefrom to at least the inner edge of the adjacent interior marginal surface of the pouring rim and preferably downwardly over the interior wall surface 11d of the neck portion 10a. In effect the covering 11 extends radially inward and downward from the pouring rim 10c and forms a depending skirt portion 11a covering the interior surface of the neck portion.

A unique differential wettability is exhibited by the surface finish of the covering 11. This differential wettability of the covering 11 tends to prevent dripping and to improve the pouring characteristics of the container 10 and is effected by providing the covering with a relatively non-wettable annular portion 11b and a wettable portion 11c which cooperate in an unusual manner to prevent the retention of residual drops or droplets of fluid from clinging to and remaining on the pouring rim 10c of the bottle 10 after pouring. The annular non-wettable portion 11b of the covering 11 exhibits a smooth, glossy surface finish which overlies the outer margin of the pouring rim 10c whereas the annular wettable portion 11c overlies the inner margin of the pouring rim 10c and extends outwardly to form a continuous annular juncture with the non-wettable portion at a location disposed intermediate the inner and outer marginal edges of the pouring rim, as at 11d, best observed in FIG. 2. The covering 11 is preferably formed of a plastic material, such as polyethylene or some other comparable corrosion resistant material capable of being fitted snugly over the pouring rim portion and the exterior surface of the neck portion of the bottle. Of course, polyethylene is merely representative of one preferable type of plastic material which may be used and other plastic and non-plastic materials having relatively similar physical properties such as being capable of formation with a high glossy surface exhibiting substantially non-wettable surface characteristics and being capable of having predetermined surface finish portions rendered highly wettable by methods in the nature of those to be subsequently described may be successfully employed. The formation of the covering 11 with the non-wettable portion 11b and wettable portion 11c may be accomplished in one operation by die-molding the covering. For example, the covering 11 may be molded or fabricated in the form of a thin skin or membrane shaped to conform snugly to the surface configuration of the neck portion with the desired differential surface wettability characteristics formed therein during the molding operation by impressing a die in conventional manner against the material. By virtue of the provision of a strategically located pouring surfaces having substantially different wettability characteristics cooperating to draw such residual droplets away from the pouring rim and back towards the interior of the container.

Also, the desired surface finish characteristics may be imparted to the covering 11 after it has been molded and
assembled on the neck portion 10a of the bottle 10. In the latter procedure, a heated die having the desired surface wettablity characteristics is imparted against the pouring surface of the assembled covering.

An alternative procedure for producing an effective differential wettability to the surface covering may be accomplished by flame treating that portion of the covering on which the wettable surface finish characteristics are desired. To impart this feature, the surface of polyethylene to a direct flame will impart highly effective surface wettability characteristics thereto. Flame treatment of a polyethylene plastic surface of the nature contemplated herein is fully discussed and described in U.S. Patent No. 2,648,097 issued to W. H. Krehl and entitled "Method of Surface Forming Polyethylene Plastics." An additional method by which the desired wettability may be imparted to the intended wettable surface portion involves directly subjecting that portion of the covering 11 to a grit-vapor blast process capable of producing an irregular roughened surface. A high pressure vapor or gas blast emitted under a blasting pressure of approximately 100-150 p.s.i., pressure, and containing a No. 100 size grit material has been found to produce an extremely effective wettable surface on polyethylene.

It is further recognized that in some instances it may be preferable to form the covering 11 directly on the bottle 10. In such instances the covering may be applied in the form of a coating by a dip-coating process, as by dipping the bottle while in an inverted or neck downward position into a bath of fluid or melted polyethylene. To prevent the polyethylene from adhering to the exterior surface of the neck portion, the neck portion may be enclosed in a masking mold or covered with a protective removable coating. Thereafter, the desired surface finish characteristics may be imparted to the coating by the applicable methods described above with respect to a preformed skin or membrane-type of covering.

Although the present invention has been described in one of its preferred embodiments in relation to the formation of a pre-formed or coated polyethylene skin or membrane on the neck portion of a glass bottle, it is of the concept of this invention that it might also be utilized in conjunction with containers having neck portions fabricated directly from polyethylene. In the latter event, the polyethylene neck portion would be treated in accordance with the concepts already discussed and without the necessity of first applying a coating or covering on the neck portion of the bottle or container. For example the neck portion of the bottle or container corresponding to the wettable portion 11c of the bottle shown in FIG. 1 may be molded, flame treated or grit blasted so as to provide the neck portion with essential wettable characteristics in a similar manner as that previously described.

The functional aspect of the present invention is schematically illustrated in FIGS. 3-5. For example, as illustrated in FIG. 3, a residual droplet 12 of the fluid contents of the bottle 10 is shown as it clings or remains on the non-wettable portion 11b of the bottle's pouring rim 10c after pouring. As in FIG. 4, the droplet 12 is attracted to the fluid 12a adhering to the wettable surface portion 11c of the covering 11 by the mutual affinity between the droplet 12 and the fluid 12a. Due to the greater attraction of the fluid 12a to the wettable surface finish 11e the droplet 12 is drawn towards the fluid 12a and onto the wettable surface finish portion. Thereafter the combined droplet 12 and the fluid 12a travel, as in FIG. 5, under the influence of gravity down over the surface portion 11c into the interior confines of the bottle 10.

Another form of the present invention is illustrated in FIG. 6. As illustrated, a pouring device in the form of an insertable annular pour-out fitting 15 is preferably fabricated from a plastic material such as polyethylene or other material having similar characteristics of moldability, smoothness, flexibility, and surface finish. The insertable portion of the pour-out fitting 15 is defined by an elongated tubular extension 15e which is shaped to generally conform to the interior wall surface of the bottle's outlet opening. In order to better maintain the pour-out fitting 15 in proper assembled position and to better preclude accidental detachment thereof from the bottle, the exterior surface of the insertable portion 15e is preferably formed with an external protruding bead 15f which is diametrically larger than the outlet opening and which by virtue of its resilient construction is capable of yielding sufficiently under manual force to permit its insertion into the pouring outlet and into snap-fit relationship within the neck portion of the bottle. Forming the non-insertable portion of the pour-out fitting 15 there is an outwardly and upwardly flaring annular pouring rim 15c which terminates outwardly along its outer peripheral margin in a sharp-cornered cut-off edge or lip 15d which is effectual to accomplish a sharp severance or cut-off of the container's contents when pouring is terminated and the container is returned to an upright non-pouring position. Disposed radially inward from the lip 15d and beneath the underside of the pouring rim 15c there is a peripheral shoulder or ledge 15e. The ledge 15e projects radially outward from the outer axial end of the insertable portion 15c and defines a downwardly facing annular sealing surface 15f on the underside thereof arranged to seat in fluid-tight sealing relationship upon the inner marginal edge portion of the container's neck rim 16c.

In accordance with the principles of the present invention, the annular pouring rim 15c of the fitting 15 is molded or otherwise formed with a glossy non-wetting pouring surface 15g which extends radially inward from the cut-off lip 15d to the inner marginal edge portion of the pouring rim 15c, as at 15h. As previously described with respect to the embodiment of this invention illustrated in FIGS. 1 and 2, the glossy pouring surface 15g may be of a molded character, in which instance the mold used in forming the inner surface of the pouring rim is preferably formed with a very smooth highly polished and glossy molding surface which consequently imparts a similar glossy surface finish to the surface of the pouring rim 15c. Also, as described with respect to the previous embodiments the fitting 15 is additionally provided with a relatively wettable surface finish 15i which when wetted attracts residual droplets of fluid away from the pouring rim 15c. To further enhance the inward movement of residual droplets away from the lip 15d, the interior surface of the pouring rim may be tapered, as illustrated, downwardly and inwardly from the pouring lip towards the pouring outlet of the container.

It has been ascertained that among other advantages the present invention in any of the foregoing embodiments obviates the tendency of residual portions or droplets of fluid from clinging or adhering to the pouring rim or lip of the container following pouring of the container's contents. Further, the present invention is capable of being embodied either in a pre-formed pour-out attachment or in the form of an integral coating bonded directly to the rim and interior surface of the container.

Although the present invention and its various embodi-
ments have been described in substantial detail, it is not intended that the invention herein be limited to such details or otherwise restricted in any extent other than may be necessitated by the scope of the appended claims, and having now described the invention in full detail, I claim:

1. Drip-preventing means for surfaced the pouring outlet of a dispensing container, said means comprising an annular membrane having one end portion snugly insertable in the pouring end of said container and an opposite radially enlarged end portion forming a lip overreaching the marginal edges of said pouring outlet, the interior wall surface of said insertable end portion and the outer surface of said radially enlarged end portion being substantially different surface wetting characteristics, the interior wall surface of said insertable end portion being substantially more wettable than the outer surface of said lip, whereby residual fluid droplets tending to remain on said lip after pouring are attracted away from said lip towards said insertable end portion.

2. Means according to claim 1, wherein the outer surface of said lip defines a smooth polished surface finish and the interior surface of said insertable end defines a substantially rougher surface finish.

3. A method comprising the steps of superimposing over the inner wall surface and upper rim surface of said pouring outlet a continuous annular covering of smoothly surfaced plastic material to thereby form a plastic pouring surface on said container, flame treating the pouring surface of only that portion of said plastic material covering said inner pouring outlet wall surface by directly exposing said surface to a flame to render such surface substantially more wettable than the surface of that portion of said plastic material covering the upper rim of said pouring outlet.

9. A method for forming an improved drip-preventing and pouring outlet for a dispensing container and rim of said container, comprising the steps of molding an open ended plastic pouring fitment with at least one surface shaped to snugly conform to the inner wall and upper rim surfaces of said pouring outlet and defining an inner pouring surface on said pouring fitment, said molding step including molding a smoothly polished finish on said inner pouring surface adjacent to the pouring end of said fitment and molding a relatively rough textured finish on said inner pouring surface adjacent to the other end of said pouring fitment.

10. A drip-preventing and pour-out fitment for use in combination with a dispensing container having a pouring outlet therein, said fitment comprising an annular body portion defining a generally Y-shaped axially cross-sectional configuration, said body portion having a tubular end portion snugly insertable in said pouring outlet in fluid-tight sealing contact with the inner wall surface of said pouring outlet and an opposite flared end portion arranged to extend over the lip of said pouring outlet, said flared end and said tubular end cooperating to define a continuous internal pouring surface having surface portions possessing substantially different surface wettablility characteristics, said tubular end of said internal pouring surface being substantially more wettable than the internal pouring surface of the flared end thereof, whereby said fitment tends to attract residual fluid droplets back into the confines of the container after pouring.

11. A drip-preventing and pour-out fitment as defined in claim 10, wherein said fitment is fabricated from a plastic material.

12. A drip-preventing and pour-out fitment as defined in claim 10, wherein said fitment is fabricated from polyethylene.

13. A container neck portion having improved drip-preventing and pouring characteristics, said neck portion having a hollow interior and terminating outwardly in an annular marginal pouring rim, the upper surface of which is formed with a smooth glossy pouring surface exhibiting a non-wettable surface finish, said neck portion also having a rough textured pouring surface extending radially inward from said non-wettable surface finish, said rough textured surface exhibiting a relatively wettable surface finish cooperating with said non-wettable surface finish to draw residual fluid droplets away from the upper surface of said pouring rim and back into the interior of said neck portion.

14. A container neck portion having improved drip-preventing and pouring characteristics, said neck portion having a hollow interior defined by an inferior wall surface and terminating outwardly in an annular marginal pouring rim surface, said inferior wall surface and said annular marginal pouring rim surface cooperating to define a continuous pouring surface portion possessing substantially different surface wettablility characteristics, said inferior wall surface being substantially more wettable than said annular marginal pouring rim surface and said operating therewith to draw residual fluid droplets away from said annular marginal pouring rim surface and back into the interior of said container neck portion after pouring.

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