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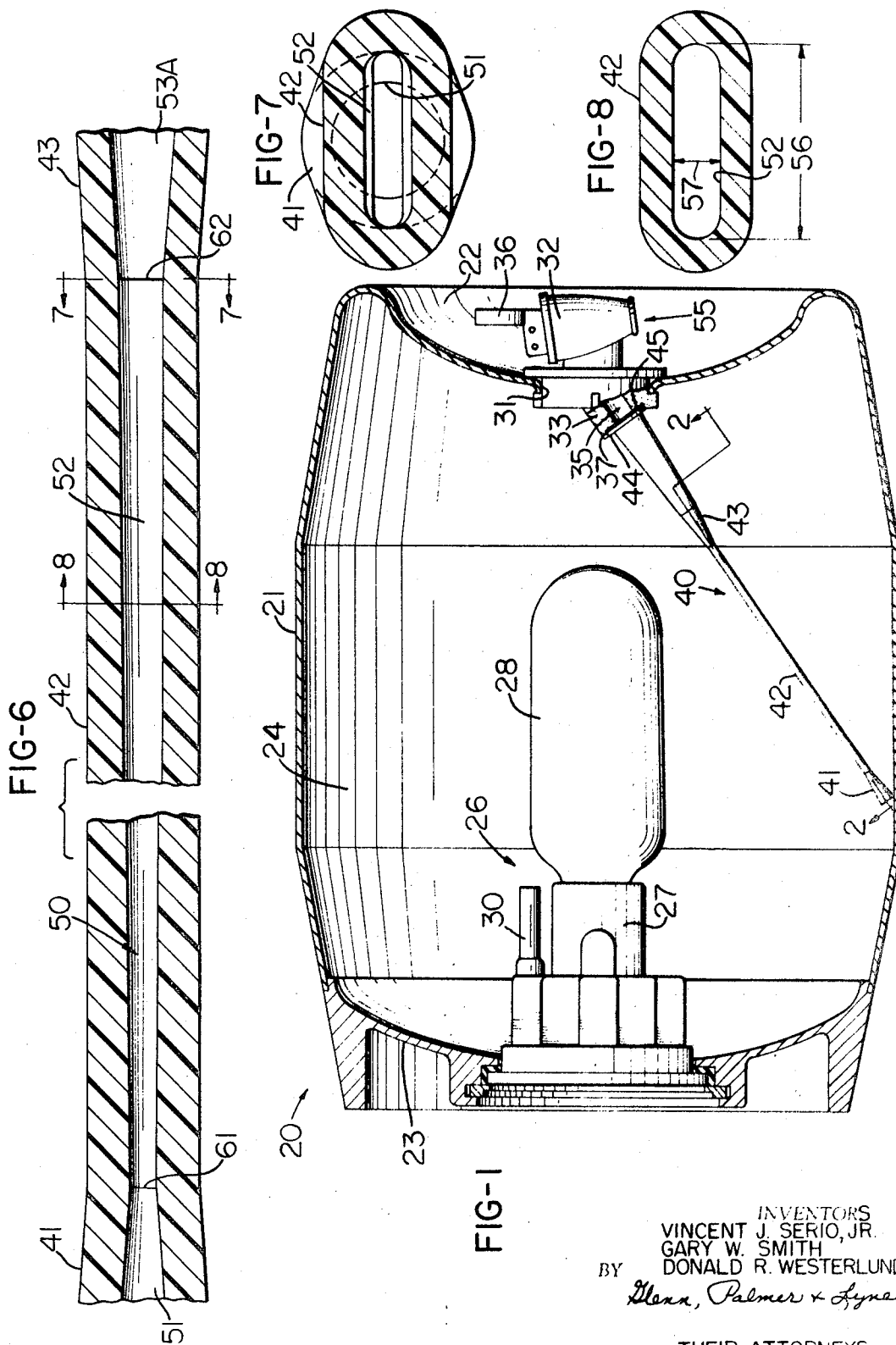
V. J. SERIO, JR., ET AL

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SIPHON TUBE AND METHOD OF MAKING THE SAME

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INVENTORS
VINCENT J. SERIO, JR.
GARY W. SMITH
DONALD R. WESTERLUND
BY
Glenn, Palmer & Lyne
THEIR ATTORNEYS

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SIPHON TUBE AND METHOD OF MAKING THE SAME

Vincent J. Serio, Jr., and Gary W. Smith, Henrico County, and Donald R. Westerlund, Chesterfield County, Va., assignors to Reynolds Metals Company, Richmond, Va., a corporation of Delaware

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ABSTRACT OF THE DISCLOSURE

This disclosure relates to a siphon tube particularly adapted to be used with an associated spigot construction to dispense a carbonated beverage, or the like, from within an associated container, wherein such siphon tube has a continuous passage provided therethrough which includes a central section defining a major portion of such passage and such central section has a roughly elliptical and substantially flattened outline which is tapered toward the inlet of such siphon tube. The central section of such passage cooperates with the inlet and outlet sections thereof to convey a carbonated beverage through the siphon tube substantially without foaming.

Background of the invention

In dispensing a carbonated beverage, or the like, from within a comparatively large container in which the beverage is forced by gaseous pressure and from within the container through a siphon tube and then through a cooperating dispensing spigot extending through a wall of the container, it has been found that with present siphon tube constructions there is excessive foaming during the drawing of a glass of beverage from within the container, which is very undesirable. In addition, it has been found that in order to provide acceptable performance present siphon tube constructions are generally specially designed for the particular beverage to be dispensed therethrough. For example, one siphon tube construction is used for beer and another construction is used for beverages, such as cola drinks, having a higher carbon dioxide content.

Summary

This invention provides an improved siphon tube and method of making the same wherein such siphon tube is particularly adapted to be used in dispensing a carbonated beverage therethrough substantially without foaming and wherein the unique configuration of such siphon tube assures that carbonated beverages containing different amounts of carbon dioxide may be efficiently dispensed therethrough with minimum foaming thereby eliminating the need for a special siphon tube construction for each particular application.

Other details, uses, and advantages of this invention will become apparent as the following description of the embodiment thereof presented in the accompanying drawings proceeds.

Brief description of the drawings

The accompanying drawings show a present preferred embodiment of this invention, in which

FIGURE 1 is a view with parts in section and parts broken away illustrating an exemplary embodiment of the siphon tube of this invention installed in position within a pressurized beverage keg;

FIGURE 2 is an enlarged view essentially on the line 2—2 of FIGURE 1 with parts in section and parts broken away;

FIGURE 3 is a top elevation of the siphon tube of

FIGURE 1 as viewed parallel to the edge of the sectioning plane of FIGURE 2;

FIGURE 4 is a view on the line 4—4 of FIGURE 2;

FIGURE 5 is a view on the line 5—5 of FIGURE 2;

FIGURE 6 is an enlarged longitudinal cross-sectional view with parts broken away particularly illustrating the tapered configuration of the central section of the passage provided through the siphon tube of FIGURE 1;

FIGURE 7 is a view on the line 7—7 of FIGURE 6; and

FIGURE 8 is a cross-sectional view on the line 8—8 of FIGURE 6 particularly showing the flattened elliptical configuration of the central section of the passage through the exemplary siphon tube of this invention.

Description of illustrated embodiment

In the exemplary embodiment of this invention illustrated in FIGURE 1 of the drawings, a beverage dispensing container or keg designated generally by the numeral 20 is illustrated and keg 20 is of the type commonly used to dispense a carbonated beverage such as beer, soft drinks, or the like. Keg 20 has a substantially cylindrical side wall 21, a recessed front wall 22, and rear wall means 23 which are suitably connected together to define a beverage receiving chamber which is designated by the numeral 24. In this example of the invention the front wall 22 is preferably formed as an integral part of the cylindrical side wall 21 and the beverage keg 20 is formed of a metallic material such as aluminum, or the like. However, it will be appreciated that the keg 20 may be made of a composite construction such as a laminated construction of paper and metallic foil, for example.

Beverage keg 20 is provided with a pressure-regulating device or assembly designated generally by the numeral 26 which comprises a pressure-regulating valve 27 suitably fastened to rear wall 23 and a charging container or bottle 28 which is interconnected to pressure-regulating valve 27 and supported thereby. The charging bottle 28 in this example of the invention contains a suitable gas, such as carbon dioxide, under pressure, which is dispensed by pressure-regulating valve 27 into chamber 24 through an outlet 30 to maintain a substantially constant pressure on the carbonated beverage within container 20 irrespective of the level of the beverage remaining within chamber 24 in a manner which is known in the art.

The front wall 22 of beverage keg 20 has a central opening 31 extending therethrough and central opening 31 is adapted to receive a spigot construction such as a spigot construction or spigot 32 therethrough. The spigot 32 is fastened to front wall 22 in fluid-tight relation in a known manner and has an inlet end portion designated by the numeral 33 which extends within chamber 24 of beverage keg 20 and is provided with connection means, which will be described later, adjacent its entrance end portion.

Liquid flow through spigot 32 is controlled by an integral valve provided within such spigot and which is normally held closed in any suitable manner. In this example such integral valve is normally spring loaded closed and is opened by a lever 36 provided on spigot 32 which is grasped and pulled outwardly by a user to open such valve and allow beverage flow through spigot 32.

The spigot 32 has a bore 35 provided in inlet end portion 33 and a cylindrical counterbore 37 is also provided concentrically around bore 35 and the surfaces defining such counterbore define a female connector in end portion 33 which is adapted to receive a cooperating connector provided on the outlet end portion of the siphon tube of this invention.

The siphon tube of this invention is designated generally by the numeral 40 and in this example is made as an integral unit using a single piece of material. However,

siphon tube 40 is comprised of three main portions, an inlet portion, a central portion, and an outlet portion designated by the numerals 41, 42, and 43 respectively for ease of description and ready reference thereto, see FIGURES 2 and 3.

Siphon tube 40 has a cooperating connector provided on its outlet end portion which is defined by an annular fastening flange 44 projecting radially outwardly from the terminal end of the outlet end portion 43. Flange 44 is adapted to be received within the counterbore 37 and is fastened in position as shown at 45 by any suitable means such as the use of adhesive means, welding techniques including ultrasonic welding, and the like. The flange 44 is fastened so that an annular planar surface defining its terminal outer end is sealed against a corresponding planar surface in the inlet end portion 33 of spigot 32, see FIGURE 1.

The siphon tube 40 has a continuous passage provided therein and extending through its full length and such passage is designated generally by the numeral 50. Passage 50 is comprised of an inlet section 51 extending axially through inlet portion 41, a central section 52 of non-circular cross-sectional outline adjoining inlet section 51 and extending axially through central portion 42, and an outlet section 53 adjoining central section 52 and extending axially through outlet end portion 43.

The passage section 53 provided in outlet end portion 43 of the siphon tube 40 in this example of the invention is comprised of three integral portions aligned end-to-end to provide smooth diverging flow axially therethrough and in a manner to be described in detail subsequently.

The central portion 42 of siphon tube 40 comprises a substantial length of siphon tube 40 and thus central passage section 52 provided therethrough defines a substantial part of passage 50. Section 52 has a substantially reduced cross-sectional area and unique configuration, as will be presently described, which helps assure that upon installing siphon tube in position within beverage keg 20 and drawing a carbonated beverage through the siphon tube 40 by actuating lever 36, the beverage is drawn through siphon tube 40 with a minimum of foaming and in a substantially clear stream into a receiving receptacle such as a glass arranged in position beneath the spigot construction 32 at 55.

As seen particularly in FIGURES 6 and 7 of the drawings, the central section 52 of liquid passage 50 has a tapered configuration and is tapered toward inlet section 51. In addition, central section 52 has a roughly elliptical cross-sectional outline, see FIGURE 8, having a major axis and a minor axis and the distance across its major axis indicated at 56 is substantially greater than the distance across its minor axis, indicated at 57. In particular, the distance across the major axis shown at 56 is generally several times greater than the distance across the minor axis shown at 57. The elliptical outline shown in FIGURE 8 is for one cross-sectional position through the central portion of siphon tube 40. However, it will be appreciated from viewing FIGURES 6 and 7 that section 52 of passage 50 has a non-circular or substantially elliptical cross-sectional outline (essentially as described above) at each position along its length.

The tapered central section 52 of liquid passage 50 provides a gradual reduction in flow velocity of a liquid such as a carbonated beverage flowing through siphon tube 40 and cooperates with the inlet section 51 and outlet section 53 of the passage 50 to assure that the carbonated beverage flowing through the siphon tube 40 will flow without foaming.

To minimize foaming tendencies of the beverage entering the siphon tube 40, the inlet section 51 of the passage 50 has an integral gradually decreasing or converging flow area, i.e., decreasing cross-sectional area in the direction of fluid flow, which is substantially frustoconical in configuration. The total included angle of convergence of the converging flow area inlet section 51 is approximately 8 degrees in this example of the invention.

As previously indicated, the central section 52 of passage 50 extends along a substantial portion or length of the siphon tube 40. In one application of this invention in which a straight siphon tube having an overall length of 6.383 inches was utilized, a central tapered passage section 3.156 inches long was provided and arranged so that it was tapered toward the inlet of the siphon tube 40 essentially as illustrated in FIGURE 6 of the drawings.

As previously indicated the single piece siphon tube 40 is divided into three main portions to enable a more thorough description thereof and is comprised of inlet portion 41 extending from the entrance end of the siphon tube to a position indicated at 61, see FIGURE 3, central portion 42 extending from position 61 to a position indicated at 62, and outlet portion 43 extending from position 62 to the discharge end of the siphon tube 40. The outlet end portion 43 of siphon tube 40 in this example of the invention has passage section 53 of passage 50 extending therethrough and over a substantial part of its length passage section 53 has a gradually increasing or diverging flow area, i.e., increasing cross-sectional area in the direction of fluid flow. Passage section 53 in this example of the invention is defined by three axially aligned end-to-end passage portions. In particular, passage section 53 is comprised of a first passage portion 53A having a first gradually diverging flow area of substantially frustoconical configuration adjoining the central section 52, a transition portion 53B of cylindrical configuration adjoining the downstream end of portion 53A, and a second portion 53C adjoining the downstream end of transition portion 53B and having a gradually diverging flow area also of substantially frustoconical configuration. The angle of divergence of section 53A in this example of the invention is equal in magnitude to the angle of convergence of inlet section 51 and preferably has an included angle of 8 degrees.

Although the central portion 53B of passage section 53 has a cylindrical configuration, it will be appreciated that portion 53B need not necessarily have such a configuration and may be provided with a diverging configuration to blend smoothly between passage portions 53A and 53C. Also, the passage portion 53C may have a total included angle of divergence which may be equal to or substantially greater than the angle of divergence of passage portion 53A to thereby further substantially reduce the flow velocity of the beverage flowing through siphon tube 40 and assure that the beverage may be dispensed through siphon tube 40 without foaming.

The tapered central section 52 of passage 50 is provided with a gradual taper in which the total included angle of taper is substantially less than the angle of convergence of inlet section 51 and hence is also substantially less than the angle of divergence of portion 53A of outlet section 53 of passage 50. Although the amount of taper that is provided may vary depending upon the types of liquids dispensed through the siphon tube, for carbonated beverages such as beer and soft drinks the siphon tube 40 of this example of the invention has a central elliptical passage section 52 which is 3.156 inches long. In exemplary siphon tube 40 the dimension across the minor axis 57 adjacent the entrance at 61 of the elliptical passage section 52 may range between 0.18-.021 inch while the corresponding dimension across such minor axis adjacent the discharge end of central section 52 at 62 may range between .032-.036 inch. Thus, in considering the smaller dimension at each end of central passage section 52 it is seen that the amount of the taper provided in such central section toward the inlet of siphon tube 40 is .014 inch over the length of 3.156 inches.

Previously, it was indicated that one exemplary siphon tube 40 has an overall length of 6.383 inches and that the central passage section 52 of passage 50 and hence the corresponding central portion 42 of siphon tube 40 has a length of 3.156 inches. Additional dimensions will now be given for such exemplary siphon tube 40.

The inlet portion 41 of siphon tube 40 of this example has a dimension of .468 inch which extends from the entrance end of siphon tube 40 to position 61. The outlet end portion 43 of siphon tube 40 extends from position 62 to the terminal end of the siphon tube 40 and has a length of 2.759 inches. In a similar manner as described in connection with central portion 42 and its associated passage section 52, the above dimensions given as being applicable to the various portions 41 and 43 of siphon tube 40 are also applicable to their associated passage sections 51 and 53 respectively.

Although the length of inlet portion 41 and hence associated passage section 51 is given in this example of the invention as being .468 inch long, siphon tubes having an overall length of roughly 6-7 inches have been made essentially to the configuration illustrated wherein the length of inlet portion 41 has been approximately one inch in some applications and in other applications has been roughly three quarters of an inch. Thus, it will be appreciated that the small tapered end of the tapered central section 52 will generally start at a location ranging from roughly one-half inch to one inch from the inlet end of siphon tube 40.

The above dimensions are to be considered as typical exemplary dimensions for siphon tube 40 which is substantially straight in configuration and such dimensions may vary depending upon the liquid being dispensed through such siphon tube, the type of pressurizing means, and the size of the dispensing container and desired quantity to be dispensed at a time. However, in each instance each siphon tube similar to siphon tube 40 is provided so as to have a continuous passage comprised of a gradually converging inlet passage section, the unique configuration central section (of elliptical cross-sectional outline in this example) which is tapered toward the inlet of the siphon tube and extends over a substantial length of the overall siphon tube, and the diverging outlet section, whereby in dispensing a liquid such as a carbonated beverage through such siphon tube such dispensing is achieved rapidly and with substantially little or no foaming.

The siphon tube 40 of this invention may be made from any suitable material which may be either metallic or a non-metallic material. One presently preferred technique utilized to make siphon tube 40 is to provide a suitable material in the form of an elongated tubing section which is made of a substantially flexible and heat-curable plastic material. The section of plastic tubing material is initially partially formed to provide a frusto-conical inlet passage section or bore which will define inlet of the siphon tube and extends over a substantial 40, a right circular cylindrical passage section or bore which is to be precisely flattened and formed in a manner to be described hereinafter, and a frustconical outlet passage section or bore which is essentially to the configuration of the final outlet section 53 of passage 50 of the completed siphon tube 40. The tubing material is also preferably provided with an integral connector in its outlet end portion and such connector is of the character previously described and defines the outlet connector for siphon tube 40. The manner of forming the central portion of the section of tubing described above will be described subsequently.

It has been previously proposed to form a siphon tube using a section of tubing similar to the above described section of tubing and having a right circular cylindrical bore through the central portion of the tubing section which is flattened so that it has a substantially uniform cross-sectional configuration throughout its length. However, such technique while providing a siphon tube giving good performance does not provide the optimum performance provided by the siphon tube 40 of this invention which has the tapered configuration central passage section.

The tapered central section 52 of passage 50 is formed in a unique manner which is rapid, economical, and particularly adapted for high volume production. In particular, it has been found through testing that accurately controlled surfaces in the form of a tapered blade may be effectively used to define the tapered passage.

The tapered pin is inserted within the central bore of the above described section of partially preformed tubing and oppositely arranged surfaces of the central portion of the section of tubing are flattened against the tapered pin. The flattened central portion is held firmly against the accurately dimensioned tapered pin and subjected to a heated atmosphere for a comparatively short period of time ranging from three-fourths of a minute to one and a half minutes. The heat-curable plastic section of tubing, with its central portion clamped against the tapered pin as described above, is subjected to the heated atmosphere without prior preheating or heat soaking.

The resulting siphon tube 40 formed in the manner described above utilizing a tapered pin has a precisely and accurately controlled central section 52 of passage 50 and the inlet and outlet sections 51 and 53 are preferably partially preformed in the section of plastic tubing, as previously mentioned and are unaffected by the later precise forming of tapered section 52 because such passage sections are not compressed or deformed in any way.

The heating of the above described section of tubing material to form tapered passage section 52 is preferably achieved in a substantially inert atmosphere such as partial vacuum, or an atmosphere utilizing an inert gas such as nitrogen, for example. Also, the temperature of the heated atmosphere will vary depending upon the particular physical characteristics of the material employed in forming the siphon tube 40. For the flexible plastic material used to make siphon tube 40 of this example of the invention a temperature of 325 degrees F. was used.

Upon removing the siphon tubes formed in accordance with the above described technique from the heated atmosphere and with forming, i.e., heating, times of less than two minutes it has been found that each siphon tube 40 permanently retains a tapered configuration for central passage section 52 which is accurate and corresponds to the precise configuration of its associated tapered pin.

As seen particularly in FIGURE 8 of the drawings, the peripheral outline of central section 52 of passage 50 at each position therealong is comparatively large, as viewed in cross section, compared to the flow area bounded thereby. This configuration assures that minimum foaming is provided upon flowing liquid through the siphon tube 40. It will be appreciated that a substantially larger flow area would be provided for a given periphery if such outline were to be expanded to its maximum, i.e., to define a circular configuration or outline for central section 52.

As previously indicated, siphon tube 40 is preferably formed as an integral single piece unit using any suitable material. However, it will be appreciated that such siphon tube may be formed using several sections of similar or dissimilar materials which are suitably fixed together end-to-end.

For ease of presentation, terms such as "roughly elliptical," "substantially elliptical," and the like have been used throughout this specification and claims to describe the cross-sectional outline of certain passages provided in the siphon tubes described herein. However, it is to be understood that the actual cross-sectional outline of each passage thus described is more accurately defined by stating that it is comprised of a substantially rectangular central area adjoined at a pair of opposite ends thereof by an associated pair of roughly D-shaped areas each having an area which approaches a semicircular area. Therefore, it is to be understood that the use herein of a term similar to any of those presented in quotes above defines any non-circular configuration which has arcuate portions and a

dimension along one axis, referred to as a major axis, which is greater than a dimension along another axis, referred to as a minor axis, arranged perpendicular to the one axis.

What is claimed is:

1. A siphon tube for use with a spigot construction having a smooth uninterrupted passage provided substantially axially therethrough said siphon tube comprising, an outlet portion having an outlet section of said passage extending therethrough, an inlet portion having an inlet section of said passage extending therethrough, and a central portion comprising a substantial part of said siphon tube and arranged between said inlet and outlet portions, said central portion having a central section of said passage extending therethrough which is tapered toward said inlet section, said central section of said passage providing a gradual reduction in flow velocity of a liquid flowing through said siphon tube while cooperating with said inlet and outlet sections to convey said liquid through said siphon tube without foaming said central section having a substantially fixed non-circular cross-sectional outline at each position therealong which retains its configuration independently of external means and said outline is large compared to the flow area bounded thereby.

2. A siphon tube as set forth in claim 1 in which at each of said positions said non-circular fixed cross-sectional outline of said central section is roughly elliptical and the distance across its major axis is substantially greater than the distance across its minor axis.

3. A siphon tube as set forth in claim 2 in which said inlet section has a gradually converging flow area of substantially frustoconical configuration.

4. A siphon tube as set forth in claim 2 in which said outlet section comprises a gradually diverging flow area of substantially frustoconical configuration adjoining said central section.

5. A siphon tube as set forth in claim 1 in which said inlet section comprises a gradually converging flow area of substantially frustoconical configuration and with a given angle of convergence, said outlet section comprises a gradually diverging flow area of substantially frustoconical configuration adjoining said central section having an angle of divergence equal in magnitude to said angle of convergence, and at each of said positions said non-circular cross-sectional outline of said central section is roughly elliptical and the distance across its major axis is several times greater than the distance across its minor axis.

6. A siphon tube as set forth in claim 5 in which said tapered central section has a total included angle of taper which is substantially less in magnitude than said angle of convergence.

7. A siphon tube as set forth in claim 2 made from a single piece of flexible plastic material.

8. In combination: a container containing a liquid under gaseous pressure; a spigot fastened in fluid-tight relation to a wall of said container and having an inlet end portion extending within said container, said inlet end portion having a connector; and a siphon tube comprising, a smooth uninterrupted passage provided substantially axially therethrough, an outlet portion having an outlet section of said passage extending therethrough and having a cooperating connector provided on its terminal end and connected to said connector on said spigot to place said siphon tube in flow communication with said spigot, an inlet portion having an inlet section of said passage extending therethrough and its entrance end submerged in said liquid, and a central portion comprising a substantial part of said siphon tube and arranged between said inlet and outlet portions, said central portion having a central section of said passage extending therethrough which is tapered to-

ward said inlet section and has a substantially fixed non-circular cross-sectional outline at each position therealong which retains its configuration independently of external means and said outline is large compared to the flow area bounded thereby and said central section of said passage providing a gradual reduction in flow velocity of a liquid flowing through said siphon tube while cooperating with said inlet and outlet sections to convey said liquid through said siphon tube without foaming upon opening said spigot to draw liquid from within said container.

9. The combination as set forth in claim 8 in which at each of said positions said non-circular fixed cross-sectional outline of said central section is roughly elliptical and the distance across its major axis is substantially greater than the distance across its minor axis.

10. The combination as set forth in claim 9 in which said inlet section has a gradually converging flow area of substantially frustoconical configuration.

11. The combination as set forth in claim 9 in which said outlet section comprises a gradually diverging flow area of substantially frustoconical configuration adjoining said central section.

12. The combination as set forth in claim 8 in which said inlet section comprises a gradually converging flow area of substantially frustoconical configuration and with a given angle of convergence, said outlet section comprises a gradually diverging flow area of substantially frustoconical configuration adjoining said central section and having an angle of divergence equal in magnitude to said angle of convergence, and at each of said positions said non-circular fixed cross-sectional outline of said central section is roughly elliptical and the distance across its major axis is several times greater than the distance across its minor axis.

13. The combination as set forth in claim 12 in which said tapered central section has a total included angle of taper which is substantially less in magnitude than said angle of convergence.

14. The combination as set forth in claim 13 in which said siphon tube is made from a single piece of flexible plastic material.

15. The combination as set forth in claim 8 in which: said inlet section has a gradually converging flow area of substantially frustoconical configuration and with a given angle of convergence; said non-circular cross-sectional outline at each of said positions is roughly elliptical and the distance across its major axis is several times greater than the distance across its minor axis; and said outlet section comprises, a first portion having a first gradually diverging flow area of substantially frustoconical configuration adjoining said central section and having a first angle of divergence equal in magnitude to said angle of convergence, a transition portion of cylindrical configuration adjoining the downstream end of said first portion, and a second portion having a second gradually diverging flow area having a second angle of divergence substantially greater in magnitude than said angle of convergence.

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ROBERT B. REEVES, Primary Examiner

N. L. STACK, JR., Assistant Examiner

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