MODULAR BENDABLE STRAW WITH SECURE CONNECTION

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ABSTRACT
An extendible flexible drinking straw segment (10) fabricated so as to be collapsible after having been extended and capable of being bent into many different configurations. The drinking straw segment (10) has male and female tubular end sections (14) and (12) respectively, capable of being joined together in liquid-tight junction (20) or to other like drinking straw segments to form a longer structure. The segment (10) provides a flexible, accordion-like, tubular zone (18) intermediate the end sections (14) and (12). In a further embodiment the male end 34 would be externally threaded and the female end 32 would be internally threaded. Like drinking straw segments are connected using a threaded connection. In another embodiment, each straw section is made of a rigid plastic, e.g., a food grade high density plastic. In this embodiment, when the straw sections are connected together, the straw looks continuous. There is a series of ridges on a male end element which mate with a series of innermost portions of the female end section.
FIG. 9

200

20

20

20

12

14

FIG. 9
MODULAR BENDABLE STRAW WITH SECURE CONNECTION

CROSS REFERENCE TO RELATED APPLICATION(S)


BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention
[0003] This invention relates to extendable, collapsible, flexible drinking straws. The invention is, however, more particularly directed to the further extensibility of flexible drinking straw structures as realized by connecting the end elements of successive flexible drinking straw segments. Various forms and configurations may be realized through the applications of the flexibilities and extensibilities of the drinking straw segments as provided by the invention.
[0004] 2. Description of the Related Art
[0005] Much effort has been directed to the provision of intermediate flexible portions in otherwise rigid tubular drinking straws. These efforts have been pursued from the earliest paper-wound drinking straws through the modern thermal setting plastic or thermoplastic drinking straws and preferably food grade plastic. The early straight, rigid tubular drinking straws exhibited the unwanted difficulty of kinking when an attempt was made to bend one into a more convenient configuration and position for the benefit of a user. Much of the early innovative activity was, therefore, directed to the alleviation of this unwanted kinking and the provision of bendability of drinking straws.
[0006] The relevant prior art related to drinking straws includes U.S. Patent No. 2,557,411, to A. G. Butsch for Child’s Drinking Tube issued Jun. 19, 1951. In a specific embodiment, rigid portions of tubular material are formed into a desired configuration and a swivel joint provided so as to bring the mouthpiece into convenient access for a user. No flexible or extendable portions have been provided by the inventor.
[0007] A flexible portion in a drinking straw has been provided in the invention by H. L. Levi in Flexible Drinking Straw which U.S. Patent No. 3,025,004 was issued on Mar. 13, 1962. The drinking straw so provided is made up of three tubular segments, connected end to end. The drinking end is described as being of a smooth, relatively stiff tube which is then connected to the intermediate portion which is flexible, accordion-like and which in turn is connected to the segment that is dipped into the material to be drunk by the user.
[0008] U.S. Patent No. 3,168,982 was issued Feb. 9, 1965 to H. E. Davis for Drinking Straw and described a tubular straw made of a helically wound strip having reinforcing wrinkles that provide flexibility to the body of the straw without kinking.
[0009] U.S. Pat. Nos. 2,094,268 and 2,550,797 were issued Sep. 28, 1937 and May 1, 1951 for Drinking Tube and Flexible Drinking Straw respectively to J. B. Friedman. The ’268 patent describes a method and apparatus for fabricating a flexible section in a tubular drinking straw positioned so that the tube may be bent without substantially reducing the diameter of the straw.
[0010] The ’797 patent describes a solution to a problem encountered when the drinking straws were attempted to be withdrawn from a package in which they were contained.
[0014] These prior art innovations and their methods are commendable and show a creative spirit for their times. The quest to optimize ease of use for users of drinking straws including children, invalids and all others has been long and varied and many creative ideas have been contrived. The originators and their methods have contributed remarkably to the technology involved. These prior art innovations and systems, however, do not include those elements of the instant invention that provide a long felt but unmet need in the art. None of the prior art discovered has included highly longitudinally extensible drinking straw segments with the added capability of being serially connected end-to-end to form a much longer construction. None connect together reasonably securely, seal reasonably well against leakage, and look like a one-piece construction.

SUMMARY OF THE INVENTION

[0015] In accordance with one embodiment of the invention, there is provided a modular, collapsible, flexible drinking straw segment which is capable of retaining its form whether collapsed or extended and when subjected to a tortuous shaping force. That is, when retracted or collapsed, the drinking straw segment may be stretched, the drinking straw segment may be collapsed. In either the stretched or collapsed state, the drinking straw segment will be responsive to bending forces and will retain a configuration caused thereby. The drinking straw segment so provided has the additional capability of being joined end-to-end, by a friction fit to other like segments so as to form a structure of any desired length.
[0016] In a further embodiment, the straws are joined together using a threaded connection with one end of each straw being internally threaded and one end being externally threaded for fitting inside the internally threaded end of another straw.
[0017] In yet another embodiment, straw sections are of a rigid plastic or at least rigid at a connection, are blow molded in identical or substantially identical pieces, each having a male and a female end. The female end is substantially the same as a body of the straw section, and the male end has a tubular portion with multiple longitudinally spaced ridges that engage portions of the female end of another straw section. The tubular portion is fully inserted into the female end, such that when the straw sections are connected in this way, the straw sections appear to be one continuous straw, and the ridges of the male end engage the insides of the female end to
longitudinal secure the straw sections together and to seal them against leakage of liquid.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] FIG. 1 is a schematic illustration of a drinking straw segment as contemplated by a first embodiment of the invention in its fully retracted or collapsed form.

[0019] FIG. 2 is a schematic illustration showing the drinking straw segment slightly extended.

[0020] FIG. 3 shows a much more extended illustration of the extendible drinking straw segment.

[0021] FIG. 4 is an illustration intended to show the extendible drinking straw segment in a fully extended condition.

[0022] FIG. 5 is an enlarged perspective illustration intended to show details of the flexible zone and the accordion-like structure of the convolutions providing drinking straw segments which are flexible and bendable.

[0023] FIG. 6 is an enlarged perspective illustration showing how the accordion-like convolutions expand at an outer bend and contract on the inner bend as the drinking straw segment is bent.

[0024] FIG. 7 is a schematic illustration showing how one segment may be attached to another for purposes of creating longer composite structures.

[0025] FIG. 8 is a schematic illustration showing the capability of the drinking straw segment to be bent back upon itself.

[0026] FIG. 9 is a fanciful illustration showing a possible orientation of joined segments to make a desired configuration.

[0027] FIG. 10 is a perspective view of a straw in accordance with a further embodiment of the invention wherein each straw section has threaded ends.

[0028] FIG. 11 is a perspective view showing two straw sections of the type of FIG. 10 connected together.

[0029] FIG. 12 is an enlarged sectional view of FIG. 11 showing details of a threaded connection of the straw sections.

[0030] FIG. 13 is a sectional view of a male end and portion of a main body of a straw section fully inserted into a female end and portion of a main body of another straw section, such that the straw sections appear to be one straw in accordance with a further embodiment of the invention where each straw section has a male end with ridges and a female end.

[0031] FIG. 14 is a perspective view showing two straw sections of the type similar to that of FIG. 13 but in a variation of the embodiment of FIG. 13.

[0032] FIG. 15 is a perspective view showing two straw sections of the type similar to that of FIG. 13 but in another variation of the embodiment of FIG. 13.

[0033] FIG. 16 is a perspective view showing two straw sections of the type similar to that of FIG. 13 but in a further variation of the embodiment of FIG. 13.

[0034] FIG. 17 is an illustration showing a possible configuration of four joined straw sections to make a desired configuration in accordance with any of the embodiments of FIGS. 13 to 16.

DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

[0035] Referring to the drawing and to FIGS. 1 through 4 with greater particularity, an extendible, collapsible, flexible drinking straw segment is denoted generally by the numeral 10 and is shown in various stages of extension. A straight, tubular, cylindrical female end element or section has been identified by the numeral 12 while the numeral 14 denotes a straight, tubular, cylindrical male end section or element. A flexible, accordion-like, tubular zone, 18 is shown intermediate the two end sections or elements. Either end section, 12 or 14, is capable of being used by a drinker as a mouthpiece. Additionally, a male end section 14 of one drinking straw segment can be inserted into an ammendable female end section 12 of another drinking straw segment in liquid-tight connection so as to create longer overall drinking straw structures. As many drinking straw segments as desired may be so connected in tandem thus to form longer structures. Alternatively, a drinking straw segment may be connected to itself to form an O structure, if desired.

[0036] FIG. 5 shows enlarged detail of the convolutions 16 forming the accordion-like structure of the flexible, tubular zone 18 and illustrating how these convolutions may be collapsed upon one another to shrink the segment into its collapsed or retracted form.

[0037] In FIG. 6 indication of the action of the convolutions 16 in response to a bending force is illustrated showing contraction of the convolutions on the inner bend and expansion on the outer bend.

[0038] Referring now to FIG. 7, one drinking straw segment is shown above with its male element 14 about to be inserted into the female element 12 of a lower shown companion drinking straw segment. The resulting drinking straw structure will be longer than either of the component segments alone. It is, of course, to be understood that the conjoining of successive drinking straw segments may be repeated in accordance with the desires of a user so as to make as long a structure as is wanted. The lower shown companion drinking straw segment is shown as bent into a substantially right angled configuration.

[0039] FIG. 8 shows a drinking straw segment as bent and constrained to form a loop. Both male 14 and female 12 ends are free so that they might be each attached to companion segments to form other desired shapes. The male and female ends of the segment shown could just as easily be joined together to form a closed O shape.

[0040] FIG. 9 illustrates a possible application showing serially connected drinking straw segments, connected at connection junctions 20 and forming a numeral.

[0041] In another embodiment, shown by FIGS. 10, 11 and 12, an extendible, collapsible, flexible drinking straw segment is denoted generally by numeral 30. Straw 30 has a straight, tubular, cylindrical female end element or section 32 and a straight, tubular, cylindrical male end element or section 34. A flexible, accordion-like, tubular zone 38 is shown intermediate the two end sections. Female end section 32 is capable of being used by a drinker as a mouthpiece as it preferably has a smooth outer surface. Male end section 34 of one drinking straw segment can be inserted into a female end section 32 of the same or of another drinking straw segment in a threaded connection to create a longer overall drinking straw. Female end section 32 has internal threads 40, while male end 34 has external threads 42. As many drinking straw segments as desired may be so connected to form longer structures, such as in FIG. 7 or 9.

[0042] Preferably, especially in this embodiment, the straw is made out of plastic, such as thermo-set or thermo-resin plastic, so that threading can be readily molded. The plastic is
preferably food grade plastic and preferably a high density plastic. Examples may include polypropylene or polystyrene.

In another embodiment as shown in FIG. 13, each straw section is made of a rigid plastic, again preferably a food grade high density plastic. In this embodiment, when the straw sections are connected together, the straw looks continuous. Each straw section 50, 52 has a male end 54 and a female end 56. Each straw section 50, 52 has a main body 55, 57, respectively. The straw sections are identical or substantially identical. The main bodies 55, 57 are identical or substantially identical. The female end of straw section 50 looks like the female end 56 of straw section 52, and the male end of straw section 52 looks like the male end 54 of straw section 50. The male end 54 has multiple bumps or outwardly extending projections or ridges 54a, 54b, 54c, preferably three such ridges, and a free end 54d. The female end 56 has innermost projections 56a, 56b, 56c, and 56d. Preferably, these innermost regions are the same as in the main body 57.

Each of the ridges 54a, 54b and 54c are preferably solid all the way around, and longitudinally spaced (in the axial or lengthwise direction of the male section, so as to correspond to the axial or longitudinal spacing of the innermost projections 56a, 56b and 56c. The tubular portion of the male end has an outer radius which is the same or substantially the same as the inner radius of the female end at the innermost projections 56a, 56b and 56c. The ridges have a slightly larger external radius than the inner radius of the female end at the innermost projections 56a, 56b and 56c, e.g., on the order of one, two or three mills different, but it could be larger, e.g., up to one, two or three hundreds or more, depending upon the plastic used for the straw sections, the dimensions of the straw sections, and other factors that would be evident to one of ordinary skill in the art. The mating of the ridges and the innermost projections should be sufficiently tight to seal the straw sections against leaking at this joint, and to enable the straw sections to stay together under bending stresses and normal usage to create shapes as in the other embodiments herein, such as the shape of FIG. 9.

To keep the straw sections together even more securely, there may be a ridge or bump 54e located just before the tubular male end begins. This will further help the seal as well. In addition, the straw section 52 preferably terminates at an end 56c where the straw section extends radially outwardly just past first innermost projection 56a. Accordingly, this end 56c would abut the ridge 54e. The free end 54d of the male section may also have a ridge or flare slightly and be located at a distance from ridge 54a which is less than the distance between ridges 54a and 54b or 54a and 54c, so that it abuts the innermost projection 56d of the female end to help act as a stopper, and to help seal the connection against leakage.

In another embodiment as shown in FIG. 14, each straw section is the same or essentially the same as in the embodiment of FIG. 13, except that the male end 54A of straw section 50A has additional ridges 54f, 54g, 54h right before the ridges 54b, 54c and the end 54d, respectively. Ridge 54b acts, like ridge 54c, as a stopper and seal point, and ridges 54f and 54g also function this way. In a further embodiment as shown in FIG. 15, each straw section is the same or essentially the same as in the embodiment of FIG. 13, except that the male end 54B of straw section 50B has ridges 54f, 54g right before the innermost projections 56d, 56c, respectively. In a still further embodiment as shown in FIG. 16, each straw section is the same or essentially the same as in the embodiment of FIG. 13, except that the male end 54C of straw section 50C has ridges 54a, 54b and 54g.

The aspect of the embodiments of FIGS. 13 to 16 that the connected straw sections will look like one continuous straw is best shown in FIG. 17. Four straws 50, 52, 50, 52 are connected together at three junctions 60. Yet, the four straw sections look like one continuous straw. At least in the embodiments of FIGS. 13 to 16 the straw sections are preferably blow molded, and rigid at least in the female and male ends, and the male end has at least two radially outwardly projecting ridges, preferably three, and in some embodiments greater than three. The straw sections are preferably unitary made. Although made of a rigid plastic, the accordion-like body provides a series of living hinges, allowing the straw section to bend.

In the embodiments above like reference numerals represent like elements.

The straw sections may have any reasonable length, thickness and radius, and there are many variations in the art. By way of example only, one set of suitable dimensions might be that the male end is about ½” long or just over ½”, from the free end 54d to just at or just at the far end of ridge 54a (FIG. 13). Peak to peak distance on the profile, innermost projection to innermost projection (e.g., 56a to 56b), and outermost ridge to ridge (54a to 54b, e.g.) distances are all roughly, e.g., 170 to 200 mils, in one embodiment, and, e.g., the ridge radius may be, e.g., about 7 to 10 mils, so that the peak height of each bump is about 7 to 10 mils. In a 12” straw, e.g., the male end would be at least about or about 1/8 of the length of the straw, and the female end would be a substantially corresponding amount. A typical straw thickness would be a few mils, and here, e.g., for some rigidity, when using polypropylene or polyethylene, the straw may be about ten mils thick. The inner radius of the straw section may be, e.g., about 5/16” (for the male and female sections and the outer radius may be about 5/16” to about 5/16”, also by way of example. The thickness and material are chosen, in relation to the straw length, the peaks and valleys of the straw’s profile, and the ridge size, so that the straw sections securely connect under typical bending stresses in connecting and positioning the sections, and still the sections can bend a substantial amount.

While blow molding is preferred, extrusion molding and other types of molding may work as well.

Although the invention has been described using specific terms, devices, and/or methods, such description is for illustrative purposes of the preferred embodiment(s) only. Changes may be made to the preferred embodiment(s) by those of ordinary skill in the art without departing from the scope of the present invention, which is set forth in the following claims.

What is claimed is:
1. A flexible drinking straw segment comprising:
   a male end element;
   a flexible accordion-like main body joined to said male end element at one end thereof; and
   a female end element amenable to the insertion of said male end element so as to form a liquid-tight junction.

2. The flexible drinking straw segment of claim 1, wherein the main body is formed in one piece of plastic.
to the distance apart of the two innermost projections and having an outer radius of at least one mil more than an inner radius of the two innermost projections, a distance along the tubular shape of the male end such that when the male end element is inserted into the female end element, the two innermost projections of the female end element are abutting the at least two radially outwardly extending ridges.

2. The flexible drinking straw segment of claim 1 wherein said male end element may be used as a mouthpiece.

3. The flexible drinking straw segment of claim 1 wherein said female end element may be used as a mouthpiece.

4. The flexible drinking straw segment of claim 1, wherein a free end of the female end element has a radius less than a maximum radius of the main body of the straw segment.

5. A flexible drinking straw system, wherein there are a plurality of identical straw sections, each straw section comprising:

   a male end element;

   a flexible accordion-like main body joined to said male end element at one end thereof; and

   a female end element having the same accordion-like structure as the main body and amenable to the insertion of said male end element so as to form a liquid-tight junction and joined to the other end of said flexible main body, wherein the straw is unitarily formed in one piece of plastic, and wherein the female end element is constructed the same as the flexible main body and having at least two innermost projections, and wherein the male end has a tubular shape with at least two radially outwardly extending ridges located at a distance apart equal to the distance apart of the two innermost projections and having an outer radius of at least one mil more than an inner radius of the two innermost projections, a distance along the tubular shape of the male end such that when the male end element is inserted into the female end element, the two innermost projections of the female end element are abutting the at least two radially outwardly extending ridges, and wherein a free end of the female element has a radius less than a maximum radius of the main body of the straw segment.

6. The flexible drinking straw system of claim 5, wherein the male end element of a first straw section is disposed in the female end element of a second straw section, and wherein the outer portion of the main body of the first straw section and the outer portion of the female element of the second straw section mate such that the accordion-like structures of each look like one continuous straw.

7. The flexible drinking straw system of claim 5, wherein each of the male end elements have at least three ridges spaced apart the same distance as three innermost projections of the female end elements.

8. The flexible drinking straw system of claim 5, wherein each of the male end elements have at least three ridges, and at least two of the ridges are spaced apart the same distance as two innermost projections of the female end elements, and one of the ridges is spaced less than the distance of the two innermost projections of the female end elements.

9. The flexible drinking straw system of claim 5, wherein each of the male end elements have three ridges spaced apart the same distance as three innermost projections of the female end elements, such that the ridges abut the three innermost projections when the male end element is inserted into the female end element.

10. The flexible drinking straw system of claim 5, wherein there are at least four straw sections.

11. The flexible drinking straw system of claim 5, wherein there are at least four straw sections connected together.

12. The flexible drinking straw system of claim 7, wherein when the first and second straw sections are connected together only one male end element is visible.

13. The flexible drinking straw system of claim 5, wherein when the first and second straw sections are connected together only one male end element is visible.

14. The flexible drinking straw system of claim 7, wherein there are at least four straw sections.

15. The flexible drinking straw system of claim 6, wherein there are at least four straw sections connected together.

16. The flexible drinking straw system of claim 14, wherein when the first and second straw sections are connected together only one male end element is visible.

17. A flexible drinking straw structure comprising: at least one flexible drinking straw segment comprising: a male end element; a flexible zone joined to said male end element at one end thereof; and a female end element amenable to the insertion of said male end element so as to form a liquid-tight junction and joined to the other end of said flexible zone, wherein the male end element has external threads and the female end element has internal threads such that the male and female end elements may thread together.

18. The flexible drinking straw structure of claim 17 wherein said drinking straw segments are joined together in liquid-tight junction.

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