United States Patent [19]

Morman et al.

[11] **3,807,399**

[45] **Apr. 30, 1974**

[54] **TAMPON APPLICATOR**

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[73] Assignee: **Kimberly-Clark Corporation**, Neenah, Wis.

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[21] Appl. No.: **284,773**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 206,479, Dec. 9, 1971, abandoned.

[52] **U.S. Cl.** **128/263**

[51] **Int. Cl.** **A61f 15/00**

[58] **Field of Search** ..... 128/285, 263, 261, 270, 128/218 D, 264; 221/279; 222/225, 386

[56] **References Cited**

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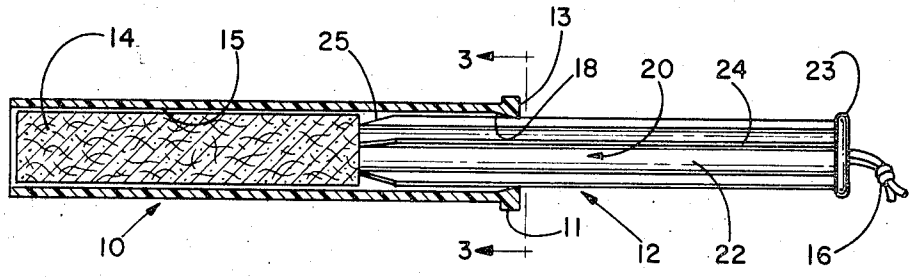
[57] **ABSTRACT**

An arrangement for maintaining in slidable engagement a pair of telescoping flexible plastic tubular elements such as are employed for inserting tampons or the like. In the tube comprising the outer element a short interior portion at the trailing end is tapered down in diameter to provide the rear opening of the tube with an internal diameter slightly less than the internal diameter of the remaining major portion of the outer tube. The inner ejector element is a tube of small diameter with a plurality of exterior parallel fins uniformly spaced around the tube circumference and extending longitudinally thereof. A line circumscribing the external edges of these exterior fins is of a diameter significantly larger than the internal diameter of the opening at the trailing end of the outer tube but no larger than the internal diameter of the remaining portion of the outer tube so that when the two elements are fitted together the fin edges are in firm but slidable engagement with the rear opening of the outer tube.

13 Claims, 8 Drawing Figures



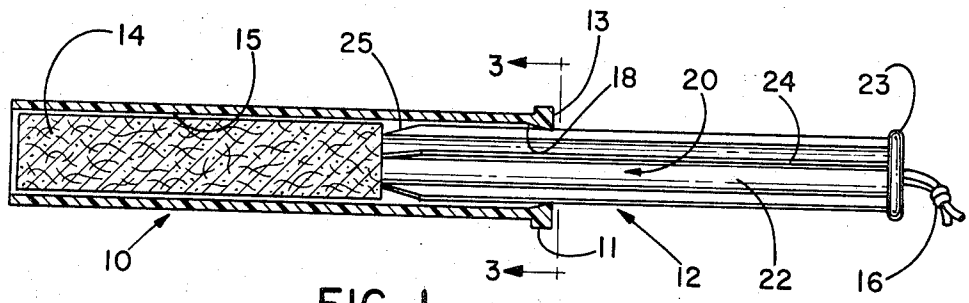


FIG. 1

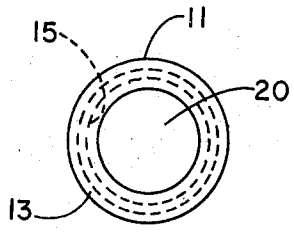


FIG. 2

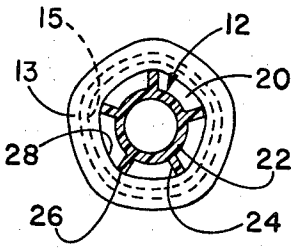


FIG. 3

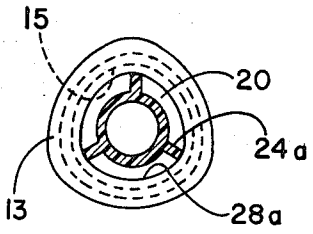


FIG. 4

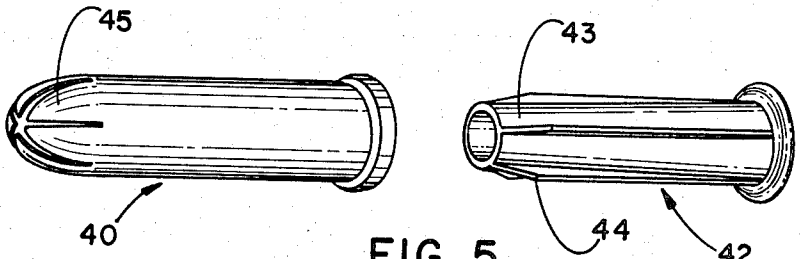


FIG. 5

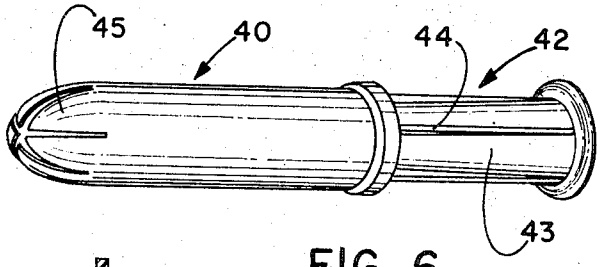


FIG. 6

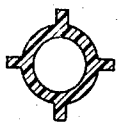


FIG. 7

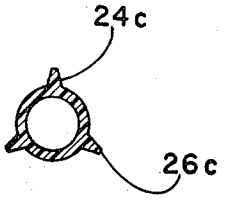


FIG. 8

TAMPON APPLICATOR

This application is a continuation-in-part of copending application Ser. No. 206,479 filed Dec. 9, 1971 and now abandoned.

RELATED APPLICATIONS

U. S. Ser. No. 168,851, Werner et al., filed Aug. 4, 1971 and entitled "Locking Arrangement for Plastic Telescoping Tubes Used to Insert Tampons and the Like."

BACKGROUND OF THE INVENTION

Inserter devices for catamenial tampons and the like comprising a pair of telescopically associated tube-like elements of flexible plastic such as polyethylene, polypropylene or the like are known. However, because of the inherent flexibility and resilient memory of plastic, the use of conventional locking devices between telescoping tubes such as matched indentations or punched out portions as used with prior art paper tubes is not practical. Accordingly other interlocking means have been found necessary when plastic tubes are used. Most of these means are incorporated into the tube structure when first molded. A number of these interlocking means rely on mated male and female portions, while others depend on close frictional association of the adjoining surfaces. Since the outer and inner elements are usually molded separately, and have parts designed to cooperate with one another, it is difficult to dimension the molding dies so that the molded plastic parts fit precisely, simply because the molded plastics do not retain their exact dimensions because of shrinkage or expansion. It is desirable therefore to design a plastic structure for applicator tubes which permits a wide range of tolerance in dimensional specifications to allow for normal variations encountered in mass production of plastics, and yet to insure that the parts will cooperate as intended. Another reason for having a wide tolerance range is that even if plastic could be precision molded it is material of such a nature that it often expands or contracts considerably when subjected to the extremes in heat or cold normally encountered during warehousing and shipping, and any real precision which may exist originally in mated parts is lost. When this happens the effectiveness of ordinary frictional interlocks are often destroyed.

In application Ser. No. 168,851 assigned to the same assignee as the present application, there is disclosed one attempt at solving the problem when frictional association is used as the interlocking means. In that application there is described an outer tube in which the internal diameter near the opening at the trailing end tapers down to a diameter smaller than the internal diameter of the major portion of the outer tube as in this application. The inner tube acting as the ejector element has a small truncated conical portion at its leading end followed by a large diameter portion and then a smaller right cylinder barrel portion with an external diameter slightly larger than the internal diameter of the rear opening in the outer tube. The remaining portion of the inner tube then tapers down slightly to an external diameter smaller than the outer tube's rear opening. The difference between the internal diameter of the rear opening in the inwardly tapered portion of the outer tube and the external diameter of the barrel portion of the inner tube provides an interference fit

which retains the two tubes in firm frictional engagement, yet because of the flexibility of the plastic permits the tubes to be easily telescoped together when longitudinal force is applied against the rear of the inner tube. While this arrangement serves to accommodate to some degree the ordinary variations in dimensions which occur in the molding operation of the two tubes, a still wider tolerance is considered desirable both to facilitate fabrication and to cut down on the number of rejection of parts which may occur due to failure to meet minimal dimensional variations.

The present invention is directed to cooperating tubular structures which assure that a firm frictional engagement between the tubular elements is provided even though a wider tolerance in dimensioning is permitted, while still providing a smooth and easy telescoping action between the tubes.

SUMMARY OF THE INVENTION

As indicated above, the applicator of this invention comprises a pair of telescoping tube-like structures of flexible plastic. The outer tube is preferably of right cylinder construction, but may have a slight barely discernible forward taper or draw for ease in molding. A short interior portion at the trailing end of the outer tube is tapered down in diameter to provide the rear opening of the tube with an internal diameter slightly less than the internal diameter of the remaining major portion of the tube. The inner ejector element comprises a central cylinder of significantly smaller external diameter than the internal diameter of the outer tube rear opening. Spaced around and protruding from the periphery of this smaller diameter tube are a plurality of external substantially parallel fins extending longitudinally of the element. A line circumscribing the external edges of these fins has a diameter substantially greater than the diameter of the rear opening in the outer tube, but of less diameter than the internal diameter of the remaining portion of the outer tube. The circumscribed diameter is substantially constant for the length of the element. A forward portion of each fin is preferably tapered to give the finned tube a somewhat truncated conical forward end which for assembly purposes permits easy insertion of the inner element into the rear opening of the outer tube as well as serving to avoid binding when a tampon of the like contained in the outer tube is being ejected. When the inner element is inserted into the outer tube, the rear opening in the outer tube flexes and is radially distorted slightly out of round by the larger diameter dimensions of the fins. The distortion or deformation of the rear opening is readily permitted because of the spaces between fins. The slight deformation of the rear opening in the outer tube serves to hold the inner element firmly where contact is made with the fin edges yet permits easy telescoping of the two tubular elements when longitudinal forces are applied. By designing the fins with a tapered cross section, wide at the bottom and narrow at the top, the amount of static frictional engagement force is substantially retained but the frictional resistance to dynamic force is somewhat reduced.

The above features and other advantages of the present invention will become apparent by reference to the following specification and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a side view partly in longitudinal section of an applicator assembly in accordance with the invention.

FIG. 2 is an enlarged rear view of an outer tube of the type shown of FIG. 1.

FIG. 3 is an enlarged and somewhat idealized section taken through line 3—3 of FIG. 1.

FIG. 4 shows a modification of the FIG. 3 structure in which three fins are shown in the inner element instead of five.

FIG. 5 is a perspective view of another modification of the applicator in accordance with this invention, showing outer and inner elements before assembly.

FIG. 6 is a perspective view of the outer and inner elements of FIG. 5 in assembled condition.

FIG. 7 is a section of another embodiment of the inner tube showing four fins.

FIG. 8 is a section similar to FIG. 4 except that the fins are tapered in cross section.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIG. 1 there is shown an applicator structure comprising an outer plastic element **10** with an inner plastic element **12** partially telescoped therein. The outer element **10** which comprises a thin-walled tube is shown in section to reveal a tampon body **14** in light frictional contact with the interior wall **15** of the tube. The usual withdrawal string **16** is attached to the rear of tampon **14** and extends through a tubular central portion of inner element **12** to protrude from the trailing end as shown. The tube of outer element **10** has a substantially uniform diameter throughout its length but purposefully tapers down at **18** near its trailing end to provide an opening **20** at the rear end of the tube which opening is of smaller internal diameter than the internal diameter of the major portion of the tube. Outer element **10** may also be provided with a conventional reinforcing ring **11** at its trailing end to help in grasping the tube during use.

Inner element **12** is shown in full side view in FIG. **1** and in transverse section in FIG. **3** as taken at **3—3** of FIG. **1.** Inner element **12** comprises a tubular central section **22** of significantly smaller diameter than opening **20** and a plurality of longitudinally extending and substantially parallel fins **24** spaced around the circumference thereof. The forward end of fins **24** of element **12** are preferably tapered as shown at **25** to permit easy entry into opening **20.** The rear end of element **12** may also be provided with a reinforcing ring **23.** A circular line circumscribing the top edges **26** of fins **24** has a diameter larger than the internal diameter of the rear opening **20** in the outer tubular element **10,** and preferably slightly less than the internal diameter of the remaining portion of the outer tube. This circumscribed diameter of the fins is substantially constant for the full length of the element except where the forward end is tapered at **25** as described above. With this construction when an inner element **12** with five ribs **24** as shown in the drawings is inserted into outer element **10** via rear opening **20,** the ring portion **13** of outer element **10** is radially distorted out of its substantially circular configuration as shown in FIG. **2** into a pentagon-like shape with arcuate sides **28.** The flexibility of the plastic permits this distortion, and the resiliency of the plastic serves to hold inner element **12** securely in place by seizing edges **26** of fins **24.** Yet because fins **24** have so little real area in actual gripping contact with opening **20,** inner element **12** is easily slidable within outer element **10.** Because the arcuate segments **28** which define opening **20** may be deformed until they are almost straight without causing binding between the elements, a large variance in the defined diameters between the outer and inner elements is possible. Accordingly, the die designer for these elements may allow for a wide range of tolerance in arriving at the die dimensions needed for good functionability.

In one specific embodiment, for example, in which the elements were made of low density polyethylene, a wall thickness of the outer tube was about 0.020 inch and the rear ring thickness was about 0.070 inch. The inner diameter of the major portion of the outer tube was about 0.560 inch and the inner diameter of rear opening **20** of the outer element **10** was about 0.550 inch. The circumscribed diameter of ribs **24** in element **12** was about 0.5572 inch making the circumscribed diameter of the inner element about 0.0072 inch or 7.2 mils larger than the inner diameter of rear opening **20** in the outer tube. With these dimensions the edges of fins **24** of inner element **10** were held firmly by the outwardly stressed rear opening of outer element **20** and was still freely slidable therein. Since the circumscribed diameter of element **10** was constant for the entire length thereof except tapered frontal area **25,** inner element **12** was held securely by opening **20** at all points of traverse as element **12** was slid into element **10.** This ability to maintain firm frictional contact throughout the length of ribs **24** permits tampon **14,** or any other material contained in tube **10** for ejection purposes, to be of any variable length consonant with the outer tube size, and still be in firm contact with the leading end of element **12.**

Differences in inner element and outer element diameters of from as little as 0.0015 inch to up to about 0.0180 inch are possible while still obtaining satisfactory holding and telescoping action between the elements. Again, as indicated earlier, it is understood that the circumscribed diameter of the fins should not exceed the internal diameter of the major portion of the outer tube. While the above variations are useful, a diameter difference or interference between the elements intermediate that range is preferred, and dies are dimensioned so as to meet that intermediate range as closely as possible.

In FIG. **4** there is shown an inner element with only 3 ribs **24***a*. In this structure, span **28***a* between points of distortion is considerably longer. There is a small reduction in static holding power between the two elements, and dynamic force required to telescope the tubes is reduced a bit more.

In FIG. **7** there is shown in cross section an inner element with four fins. It will be noted in this construction, and any construction with an even number of fins, the effective diameter is much greater because the fins are exactly opposite each other. Accordingly, an even-numbered fin construction would fit much tighter than an odd-numbered fin construction with the same circumscribed diameter, since the latter has a space diametrically opposite each fin. The odd-numbered construction, therefore, is preferred because it is possible to allow much greater tolerance in dimension variations between the circumscribed diameter and the diameter of the opening in the end of the outer tube.

In FIG. 8, ribs 24c are shown as being tapered in cross section with edges 26c being considerably narrower. This construction seems to grab the outer element better and insures against axial rotation between the two elements, while still permitting easy telescoping action as described earlier.

In FIGS. 5 and 6 there is shown a construction in which outer element 40 has a substantially closed forward tip made up of flexible petals of juxtaposed triangular segments 45; the rest of the structure being the same as the outer element of FIG. 1.

For inner element 42, tubular portion 43 is shown as being forwardly tapered instead of being a substantially cylindrical tube as in FIG. 1. Fins 44 are otherwise the same as in FIG. 1 being substantially parallel and having a substantially constant circumscribed diameter from the end of the frontal taper to the trailing ring section of the element.

Other than the above differences, the FIG. 5–6 embodiment varies from the FIG. 1 embodiment primarily in the closed end structure of the outer tube. This structure permits the manufacturer to include within the outer element a loosely fitting tampon rather than a tampon with the required frictional fit shown in FIG. 1. Medicaments may also be disposed in the closed end outer tube if desired since closed petals 45 will serve to contain the contents.

It is also noted that while the outer element is shown as being substantially a right cylinder tube, in fabricating such tubes it is the practice to put in a slight, but hardly noticeable, taper or draw to permit ready removal from the forming dies.

In the embodiment of FIGS. 5 and 6 it is also noted that because the rear opening is only slightly reduced in diameter from the inner diameter of the main portion of the tube a full-size tampon or other body may be inserted from this end during fabrication without disturbing the closed end structure.

In the foregoing description it has been noted that a slight distortion or deformation of the rear opening of the outer element occurs when the inner element having fins of larger circumscribed diameter is inserted therein. Further observations indicate that the inner element itself may also be subject to some deformation depending upon the stiffness or flexibility of the plastic employed, as well as upon the stiffness or flexibility of the structure from which the fins extend. The amount of deformation of either or both elements also depends upon the relative flexibility of each of these structures to each other and upon the type of plastic used. In any event, in order to produce a suitable slidable fit between the elements, some deformation must take place in at least one of the elements at their mutual area of contact when both elements are telescopically associated.

For example, when the outer element is made of a firm and only slightly resilient plastic, and the inner element is made of a soft, highly flexible plastic, almost all of the deformation will take place in the inner element in the area where the inner element is in contact with the rear opening of the outer element. In this case there will be substantially no deformation in the outer element as in the preferred structures previously described. In this variation also, the desired firm but slidable frictional engagement of the two elements is obtained. In such an arrangement, for example, a firmer plastic such as polypropylene, high density polyethylene, rigid polyvinyl chloride or polystyrene may be used for the outer element, and a low density polyethylene may be used for the inner element. Of course when a tapered front end with flexible petals is employed, the outer element should be made from a plastic which is sufficiently flexible to permit the described petals to open easily when a tampon is ejected.

Numerous combinations of plastics characterized by varying density, hardness, and flexibility are comtemplated for use in the invention. For example, materials such as high and low density polyethylene, polypropylene, soft and firm polyvinyl chloride, nylon, polyester, polyacrylate, polyvinyl alcohol and the like may be used for either or for both elements.

What is claimed is:

1. An applicator consisting of a pair of telescopically associated flexible plastic tubular elements and comprising: an outer tubular element having a major longitudinal portion of substantially uniform internal diameter and a trailing end portion in which the internal diameter is reduced to define a rear opening having an internal diameter slightly smaller than the internal diameter of said major portion of said outer element; an inner element comprising a tubular structure of substantially smaller external diameter than the internal diameter of said rear opening; a plurality of substantially evenly spaced and parallelly disposed fins protruding from the surface of the tubular structure of said inner element and extending longitudinally for substantially the full length thereof; the diameter of a line circumscribing the top edges of said fins for the full length thereof except for a minor tapered frontal portion being larger than the internal diameter of said rear opening but no larger than the internal diameter of said major portion of said outer element, whereby at least one of said elements is caused to be radially distorted at the mutual area of contact when said inner element is telescopically associated with said outer element, said distortion being present as long as any portion of the defined full length of said fins is in contact with said outer element.

2. The applicator of claim 1 wherein said outer element is caused to be radially distorted at said rear opening.

3. The applicator of claim 1 wherein said inner element is caused to be radially distorted where it is in contact with said rear opening.

4. The applicator of claim 1 wherein the tubular structure of said inner element has an odd number of fins spaced therearound.

5. The applicator of claim 4 wherein said number is at least three.

6. The applicator of claim 1 wherein the tubular structure of said inner element has an even number of fins spaced therearound.

7. The applicator of claim 1 wherein the circumscribed diameter of said fins is substantially constant for the full length of said fins.

8. The applicator of claim 7 wherein said fins at the leading edge of said inner element are tapered to form a nose with a truncated conical-like structure.

9. The applicator of claim 1 wherein said fins are of rectangular cross section.

10. The applicator of claim 1 wherein said fins are of tapered cross section being wide at the base and narrow at the top edge.

11. The applicator of claim 1 wherein the tube comprising said outer element has an open front end and a compressed tampon is disposed therein in frictional engagement with the interior wall thereof.

12. The applicator of claim 1 wherein the tube comprising said outer element has a substantially closed tapered front end formed by flexible petals of juxtaposed substantially triangular segments.

13. The applicator of claim 12 wherein a loose fitting tampon is disposed within said outer element.

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