

[54] **LOCKING ARRANGEMENT FOR PLASTIC
TELESCOPING TUBES USED TO INSERT
TAMPONS AND THE LIKE**

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[58] Field of Search 128/260-265, 270, 269,
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Primary Examiner—Richard A. Gaudet

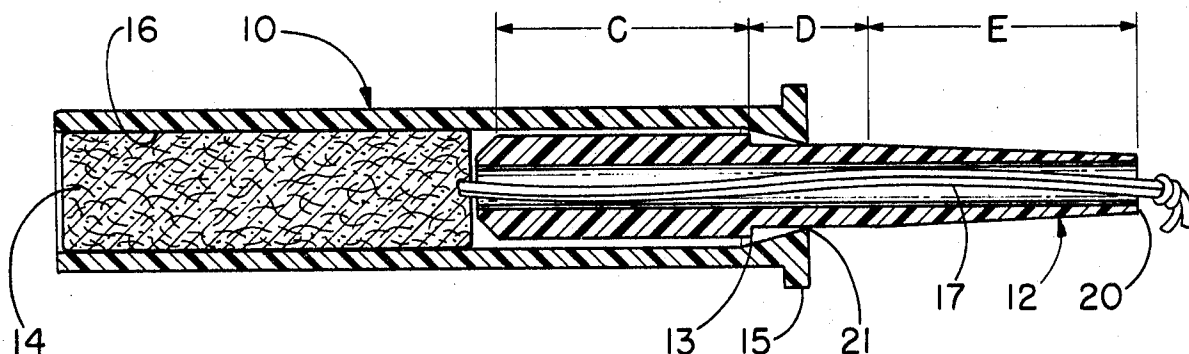
Assistant Examiner—J. C. McGowan

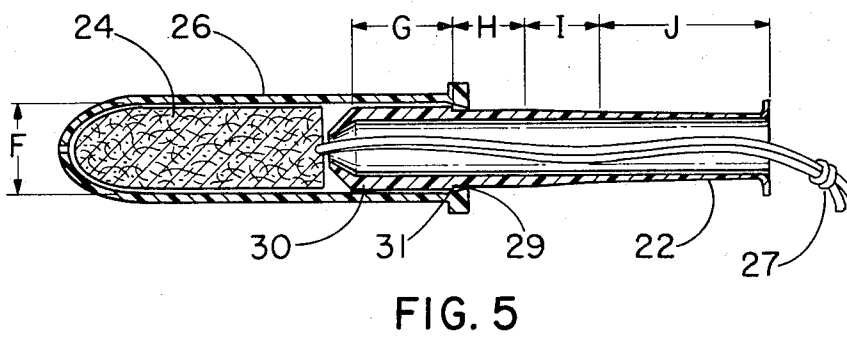
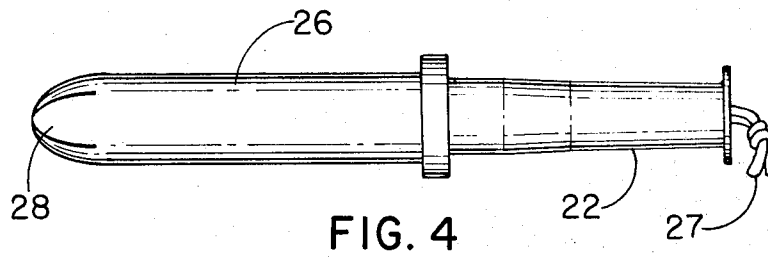
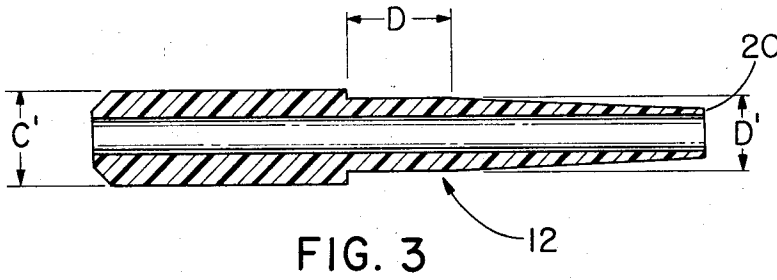
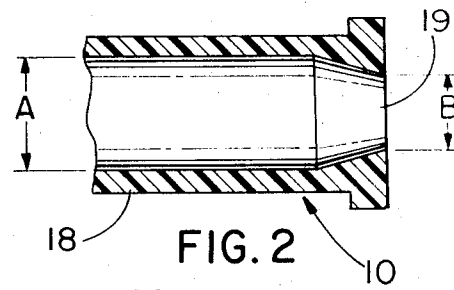
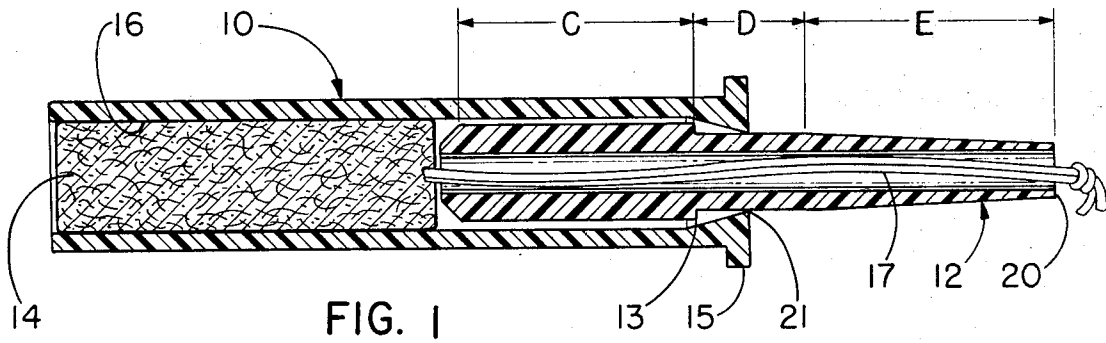
Attorney—Daniel J. Hanlon, Jr. et al.

[57] **ABSTRACT**

A smoothly releasable temporary locking arrangement for a pair of telescoping plastic tubes such as are employed for inserting tampons or the like into body orifices. The locking arrangement assures against premature bidirectional longitudinal movement between the tubes. Backward movement of the inner tube is prevented by a circumferential raised shoulder portion near the front end of the inner tube which cooperates with a portion of reduced internal diameter at the trailing end of the outer tube. Forward movement of the interior tube is inhibited by the frictional relationship between the tubes provided by a particularly defined degree of interference between a circumferential portion of the inner tube adjacent the raised shoulder portion and the reduced diameter terminal portion of the outer tube.

6 Claims, 7 Drawing Figures





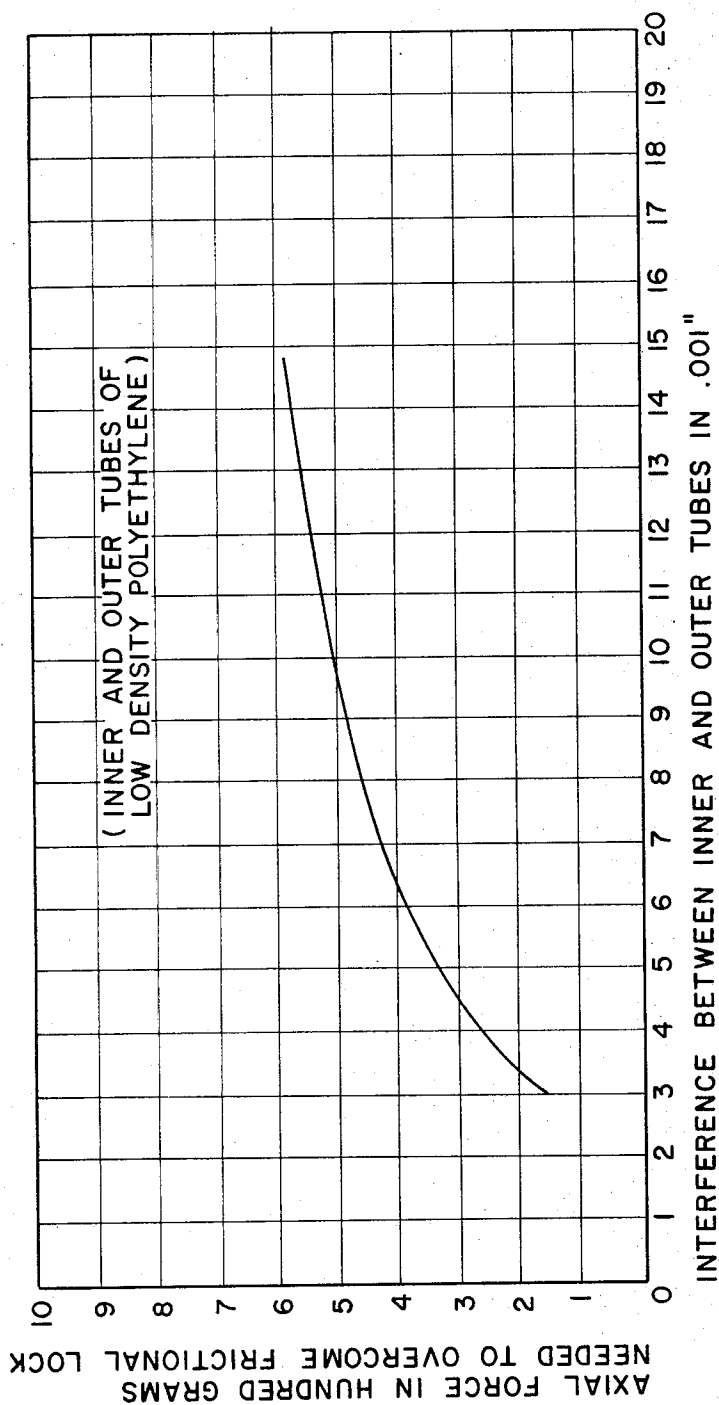


FIG. 6

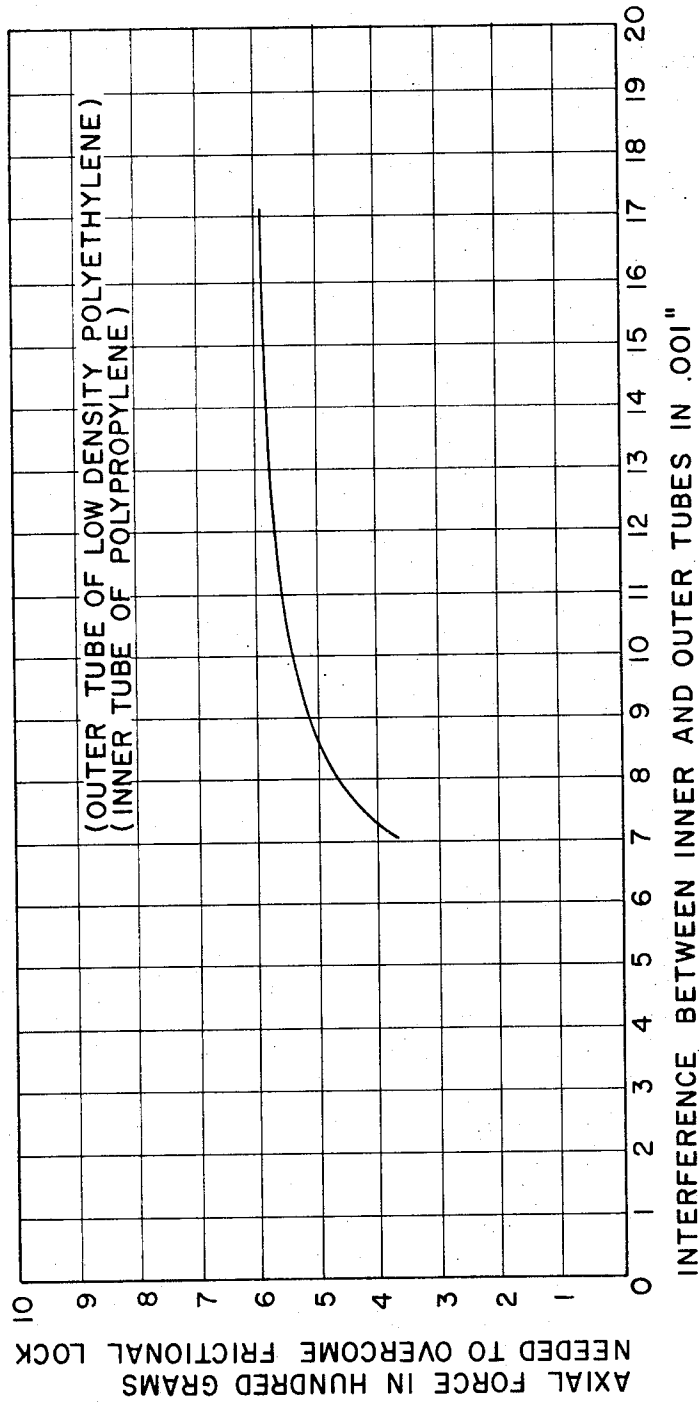


FIG. 7

LOCKING ARRANGEMENT FOR PLASTIC TELESCOPING TUBES USED TO INSERT TAMPONS AND THE LIKE

BACKGROUND OF THE INVENTION

Telescoping tube inserters for tampons and the like have been a part of the patented art for many years. The most common type comprises a pair of spirally wound paper tubes slidably engaged with each other in telescopic association. As is well known, tube inserts of this type require a temporary interlocking means to prevent premature axial movement between the tubes prior to use. The interlock for paper tubes has commonly been provided by simultaneously puncturing the walls of both tubes in a manner to permit a tab or flap portion of the outer tube to extend through the wall of the inner tube (U.S. Pat. No. 2,587,717). This tab portion serves as a temporary lock which is easily displaced and allows the tubes to be telescoped by merely applying longitudinal pressure on the free end of the inner tube.

While this type of interlock is satisfactory for paper tubes, it was found impractical for use with the telescoping plastic tubes which are beginning to appear in the market place. For such tubes, puncture-type locks do not function well because of the inherent flexibility and memory of the plastic which tends to return to its original shape if deformed. Accordingly it has been necessary to design interlocking arrangements which are molded into the tubes as they are fabricated. One such arrangement comprises at least one circumferential groove or raised ring in the interior wall of the outer tube and a mating raised ring or groove in the exterior wall of the inner tube. This arrangement provides a good temporary interlock, but in order to disengage the cooperating ring and groove structure, it was found necessary to apply a comparatively large amount of initial longitudinal force to the back end inner tube. Because of this, disengagement of the two tubes results in a rather precipitous release, and an abrupt and sudden initial movement. Such precipitous release is undesirable for the insertion purposes intended. The user is unable to reliably predict how much force is required to break the interlock so there is an absence of positive control in the ejection operation.

In another interlocking arrangement for plastic tubes, the front edge of the inner tube has a built up circumferential flange while the outer tube has near its trailing end at least one interior ring portion of a diameter less than the flange to block rearward movement of the inner tube (U.S. Pat. No. 3,148,680). However in this arrangement no provision is made to prevent forward movement of the inner tube other than that provided by the presence of a tampon or other body in the forward end of the outer tube. In addition, with this arrangement difficulties are encountered in keeping the tubes together during assembly operations, especially before the tampon or other body is put into place and frictionally held in the outer tube.

In still another arrangement for plastic tubes, the outer tube has a number of longitudinal ribs around its internal periphery with the bearing surfaces defining an internal opening of a diameter substantially the same as the external diameter of an inner tube with an enlarged flange on the leading end. The inner tube is designed to have a snug slidable association with the internal ribs of the outer tube (U.S. Pat. No. 3,015,332). However,

in such construction extremely close tolerances are required in order to retain a suitably snug fit.

In yet another construction, small hinged flaps on either the inner or outer tube are bent back to provide a spring-like frictional impedance in a circumferential gap between the tubes (U.S. Pat. No. 3,534,737). This, of course, necessitates punching out the flaps and holding them in bent, folded back configuration until the tubes are assembled.

The present invention provides a positive locking arrangement which depends primarily on friction between cooperating portions of the tubes to provide a positive forward lock. No fabricating operations are necessary other than the forming of the tubes to dimensions having tolerances within a predetermined range. Easier handling of the tube combination prior to adding the tampon to complete the assembly is thereby achieved. In addition, the disengagement of this interlock by the user may be done with a smooth rather than abrupt motion as is true in some prior constructions.

SUMMARY OF THE INVENTION

As indicated above, the applicator of this invention comprises a pair of telescoping plastic tubes. The outer tube is of right cylinder construction with a substantially uniform internal diameter except for a small portion of the interior adjacent the trailing end. At the trailing end the internal diameter is gradually decreased to provide a rear opening of a predetermined smaller diameter. The inner tube is of a stepped design. At the front end there is a portion with an external diameter slightly less than the internal diameter of the major portion of the outer tube to provide a snug sliding fit. A small portion near the front end may also have a slight conical taper for non-binding association with the tube contents. Adjoining and to the rear of this large diameter front end of the inner tube there is a stepped down intermediate barrel portion with an external diameter less than the diameter of the front end portion but slightly larger by a predetermined amount than the internal diameter of the rear opening in the outer tube. The remaining back portion of inner tube tapers slightly to a still smaller external diameter at its back end. The small difference in diameter between the internal dimension of rear opening in the outer tube and the external dimension of barrel portion of the inner tube provides an interference fit which retains the two tubes in firm frictional association. Nevertheless, the two tubes may be easily telescoped by applying a small amount of force to the back end of the inner tube, i.e., in the range of from about 200 to about 650 grams. The degree of force required is readily adjusted by varying the amount of interference between the tube diameters at the friction point and by the selection of plastic used.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal section of a tampon and tube applicator assembly in accordance with the invention;

FIG. 2 is a partial longitudinal section of the outer tube of FIG. 1;

FIG. 3 is a partial longitudinal section of the inner tube of FIG. 1;

FIG. 4 is a side view of another form of applicator in accordance with the invention;

FIG. 5 is a longitudinal section of FIG. 4;

FIG. 6 is a graph indicating axial force required to telescope the tubes in one embodiment of the invention where both tubes are made of low density polyethylene, and

FIG. 7 is a graph indicating axial force required to telescope the tubes in another embodiment of the invention where the outer tube is low density polyethylene and the inner tube is polypropylene.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

In the FIG. 1 longitudinal section there is shown a tube tampon structure comprising an outer plastic tube 10 and an inner plastic tube 12. Disposed in the forward end of outer tube 10 is a tampon body 14 in light frictional contact with the interior wall 16 of outer tube 10. Attached to the rear end of the tampon body 14 is the usual withdrawal string 17 which extends completely through the inside of inner tube 12. Outer tube 10 also has a ring-like projection 15 at its rear end to provide finger gripping means.

As will be seen later, the dimensions of the inner diameter B at the rear end of outer tube 10 and the dimensions of the outer diameter D' of a mid-portion D of inner tube 12 with respect to each other are critical to this invention. The partial sectional views of these tubes in FIGS. 2 and 3 have these particular dimensions separately identified to more clearly illustrate these relationships.

In one particular embodiment, the inner diameter A of outer tube 10 throughout a major part of its length is about 0.579 inch, and the thickness of outer wall 18 is about 0.020 inch. The rear opening 19 of outer tube 10 has an inner diameter B of about 0.556 inch.

For inner tube 12, the outer diameter C' of shoulder section C is about 0.565 inch, the outer diameter D' of barrel section D is about 0.563 inch, and the trailing section E tapers to an outer diameter of about 0.525 inch at trailing end 20.

Thus, at numeral 21, where rear opening 19 of outer tube 10 has an inner diameter of 0.556 inch, the outer tube is in circumferential frictional engagement with barrel portion D of inner tube 12 which has an outer diameter of 0.563 inch and there is an interference between the tubes of about 0.007 inch, i.e., the inner tube in this area is 0.007 inch greater in outer diameter than the inner diameter of the outer tube with which it is in contact. Throughout this specification the word "interference" will mean the difference in dimensions between the smaller interior diameter of the rear opening 19 of the outer tube and the larger exterior diameter of the barrel portion D of the inner tube.

Now referring to the graph of FIG. 6 it will be noted that at 0.007 inch interference, and when both tubes are made of low density polyethylene, about 425 grams of axial force are required to overcome the frictional resistance between the two tubes, in order to telescope the tubes for ejection of the tampon.

Referring to the graph of FIG. 7 it will be noted that when the outer tube is low density polyethylene and the inner tube is polypropylene the axial force required to overcome frictional resistance between the tubes at 0.007 inch interference is about 370 grams.

It should also be noted from these graphs that as the amount of interference between tubes is increased the degree of frictional resistance to movement between the tubes does not increase linearly as might be ex-

pected, but forms a hyperbolic curve. That is, for each increment of interference there is not a proportionate increase in the amount of force required to break the frictional interlock. This indicates that the increased force required to break the interlock is asymptotic, almost approaching zero as the higher levels of interference shown are reached.

It is well known in the molding of plastics that the degree of shrinkage varies from time to time even though the base material is supposedly of a standard molecular weight, so that where close tolerances between fitted pieces are called for, difficulties in fittings are often encountered. The discovery that the frictional resistance between the tubes in this instance is asymptotic as the degree of interference increases indicates that a wider range in tolerance for diameter dimensions can be used and still assure that in the finished product there is sufficient interference between tubes to provide a satisfactory frictional fit.

It will thus be seen that a range of inner and outer dimensions for the tubes can be established within normal fabricating tolerances for plastics to provide a suitable interference between the tubes and to assure frictional resistance sufficient to give a good lock without increasing the required breaking force of the interlock to undesirable levels.

In assembling the embodiment of the applicator shown in FIG. 1 the small trailing end of inner tube 12 can be inserted into the front end of outer tube 10 until shoulder portion 13 abuts the inner tapered rear portion of the outer tube. Frictional resistance between the tubes at circumferential area of interference provided at 21 then holds this assembly together while tampon 14 can be inserted and string 17 drawn through the inner tube. In this structure, the outside diameter of compressed tampon 14 is slightly greater than the internal diameter of outer tube 10 so that a small frictional force is generated to hold tampon 14 within outer tube 10. In a modified embodiment of the invention as shown in FIGS. 4 and 5 a compressed, bullet-shaped tampon 24 is loosely encased in a plastic tube 26 having flexible triangular segments 28 forming a tapered tip. In this example tampon 24 is designed with a smaller outside diameter than the inner diameter of tube 26 so that it is not frictionally engaged with the walls of tube 26 and therefore requires a closed or semi-closed front end for inner tube 22 as provided by flexible triangular segments 28. When the inner diameters of the portions of outer tube 26 from the base of the tapered tip rearward are dimensioned similarly to those of outer tube 10 as shown in FIGS. 1-2 and described above, and when dimensions G and H of inner tube 22 are similar to dimensions C and D of inner tube 12, the tubes comprising the applicator of FIGS. 4 and 5 are flexible enough to permit the complete device to be assembled by first pushing tampon through the reduced diameter rear opening 29 of outer tube 26, drawing string 27 through inner tube 22 and then forcing leading end 30 of tube 22 through opening 29 until its shoulder 31 is within the edge of opening 29. After such assembly, the amount of breaking force required will be substantially the same as for the FIG. 1 embodiment described above.

By referring to the graphical representations of axial force needed to overcome the frictional lock at various amounts of interference between tubes as shown in FIGS. 6 and 7, it will be seen that a comparatively wide

range of diameter dimensions for the two tubes may be used as long as the interference between the rear opening of the outer tube and the central barrel portion of the inner tube is maintained within predetermined limits.

The preferred range of interference, as indicated in FIGS. 6 and 7, is between about 0.005 inch to about 0.016 inch. In such range the axial force required is from about 350 grams to about 600 grams when low density polyethylene is used for both tubes as shown in FIG. 6, or from about 200 grams to about 600 grams when low density polyethylene is used for the outer tube and low density polypropylene is used for the inner tube.

In setting up a typical engineering specification for injection molding dies needed to fabricate the applicator, the following range of dimensions were found useful in obtaining suitable tubes.

For the outer tube:	
Wall thickness	0.020"
Outer diameter	0.618" to 0.620"
Inner diameter	0.578" to 0.580"
Rear opening inner diameter	0.554" to 0.558"
For the inner tube:	
Wall thickness	0.020"
Outer diameter at C	0.563" to 0.566"
Outer diameter at D	0.562" to 0.564"
Outer diameter at end of E	0.525"

Thus it will be seen that when tubes are fabricated within the limits of such specifications the interference between barrel portion D of the inner tube and the rear opening diameter 19 of the outer tube can vary between 0.010 inch and 0.004 inch and the axial force needed to break the lock by overcoming friction still will not exceed about 600 grams. The axial force for such range of interference varying from between about 250 to about 600 grams.

While the above defined engineering specifications provide a preferred range of tolerances, it is evident that a much wider range is possible without exceeding a desirable breaking force. This is especially true with respect to the upper limits where as indicated on the graphs of FIGS. 6 and 7 an interference of as much as 0.0165 inch is within a reasonable release force. Accordingly, while the preferred range of interference is between about 0.005 inch and about 0.016 inch the device will still function satisfactorily with a range of interference between about 0.003 inch and 0.0165 inch. With such range, the amount of force required to overcome the frictional resistance between the two tubes at the point of contact is from about 200 to about 650 grams.

While reference has been made only to low density polyethylene and polypropylene in the specific examples, it is understood that the invention defined herein is applicable to other plastic materials such as nylon,

polyesters polystyrene and the like as long as they have sufficient flexibility and resilience to perform as indicated.

In addition to use with tampons, the applicator is also useful as well for inserting suppositories and medications into body cavities.

What is claimed is:

1. An applicator consisting of a pair of telescopically associated plastic tubes and comprising: an outer tube of right cylinder configuration with a substantially uniform internal diameter A throughout the major portion thereof and having a small area adjacent the trailing end gradually tapered down to a rear opening of predetermined smaller diameter B; and an inner tube with a stepped exterior cylindrical configuration comprising a front right cylinder shoulder portion C of substantial length with an exterior diameter C' slightly smaller than the uniform internal diameter A of said outer tube, an intermediate right cylinder barrel portion D of substantial length adjacent said shoulder portion C with an exterior diameter D' less than said shoulder portion C, and a back portion E of substantial length adjacent said barrel portion D, the outer diameter of said back portion E being gradually tapered rearwardly to a smaller exterior diameter than said barrel portion D and terminating at the back end of said inner tube; the exterior diameter of said barrel portion D being slightly larger by a predetermined amount than the internal diameter B of said rear opening in said outer tube; said inner tube being disposed within said outer tube with said barrel portion D in circumferential frictional engagement with the edges of said rear opening B in said outer tube.

2. The applicator of claim 1 wherein the axial force required to overcome the resistance of the frictional engagement between said barrel portion of said inner tube and said rear opening of said outer tube is from about 200 to about 650 grams.

3. The applicator of claim 2 wherein the exterior diameter of said barrel portion of said inner tube is from about 0.003 inch to about 0.0165 inch larger than the internal diameter of said rear opening of said outer tube.

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

5. The applicator of claim 1 wherein the outer tube has a tapered front end and in which said front end is comprised of flexible segments.

6. The applicator of claim 5 wherein a loose fitting bullet shaped tampon is disposed within said outer tube.

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