

[54] CLAMP FOR THIN WALLED TUBING

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R, 73 LF, 259 A; 132/48 A, 48 R; 128/346;
251/4, 10

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[57]

ABSTRACT

A process is disclosed which is useful for sealing a thin walled, flexible, plastic tube such as dialysis membrane tubing. The process utilizes a clamp which has an elongated base member having at least two spaced longitudinal ridges positioned thereon. A second mating member is hinged to the base member and has at least two grooves which are positioned to mate with the ridges of the base member when the clamp is closed. The clamp is held in a closed position by the longitudinal movement of the second mating member whereby its terminus is held in a notch which is located in a lug which is integral with the base member.

5 Claims, 6 Drawing Figures

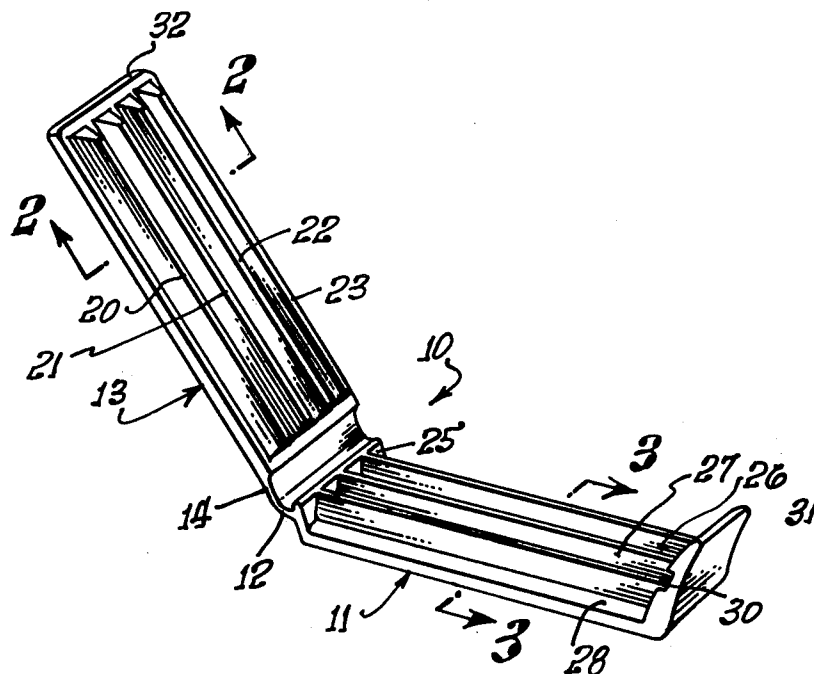


Fig. 1.

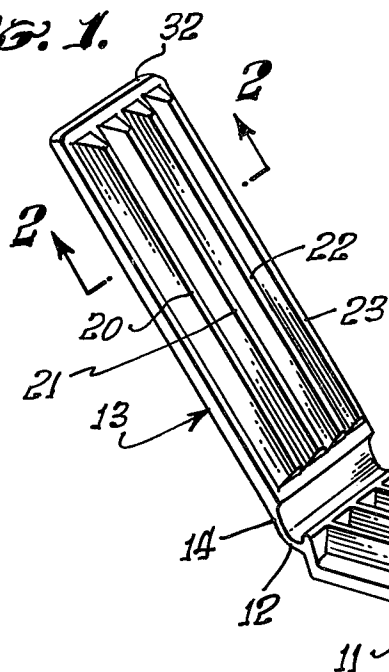


Fig. 2.

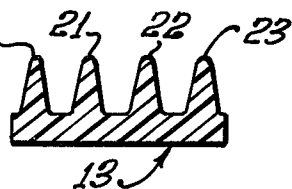


Fig. 3.

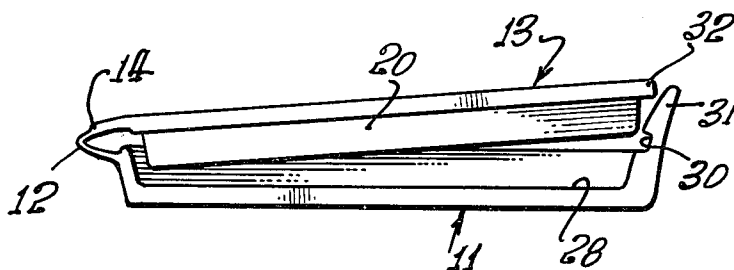
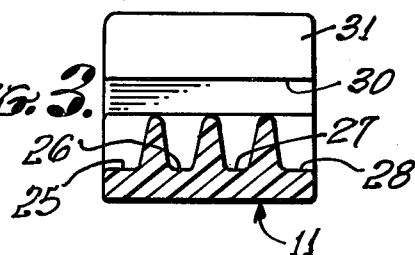


Fig. 4.

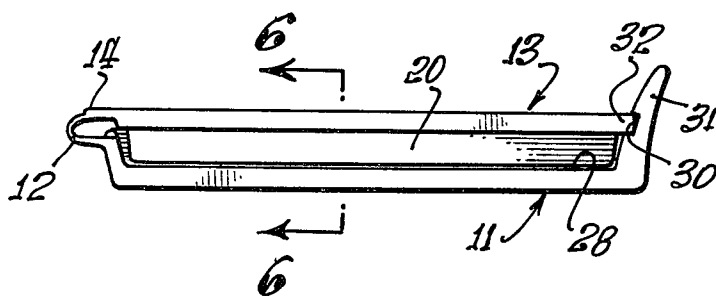


Fig. 5.

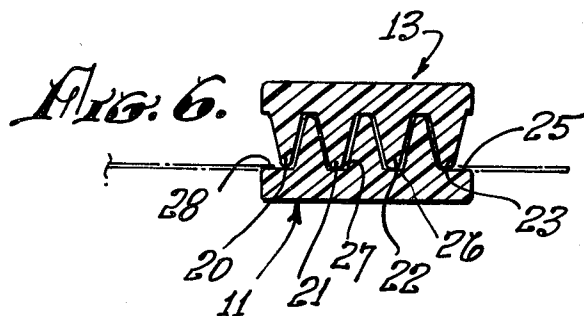


Fig. 6.

CLAMP FOR THIN WALLED TUBING

BACKGROUND OF THE INVENTION

Dialysis membrane fabricated from microporous sheeting has found wide application for the separation of various solutes from water and the separation of larger molecules in solution from smaller ones. The dialysis membrane may be a natural or synthetic material and viscous-process regenerated cellulose having a wall thickness between about 0.0008 inches and 0.0035 inches is commonly used. Such membranes are frequently formed into tubes in which shape they are particularly useful for carrying out dialysis or ultra filtration. The tubing may be supplied in a continuous roll and the dialysis is carried out by closing one end of the tubing while introducing a solution to be purified or otherwise altered into the open end. The open end may then be closed and the solution immersed in an eluting liquid.

Various methods have been used to close such dialysis tubing with the usual technique being to wet the end of the tubing to be closed and to tie a knot therein. Another suggested approach is to tie the open end around a rubber or plastic stopper. Such methods, however, are not entirely satisfactory for several reasons. First, leakage is common if the tied end has not been first wetted and, if first wetted, further leakage becomes difficult to detect because the membrane is already wet. Furthermore, the knotting step is time consuming, and does not permit the easy opening of the tubing after the dialysis has been carried out. Secondly, it is frequent that the user will not tighten the knot sufficiently for fear of tearing the membrane. Thirdly, the tying method is time consuming which is particularly inconvenient when a large number of separations need to be made. Other methods such as applying an adhesive to the inner surface of an end to be closed has not proved entirely successful because of potential contamination and/or leakage.

SUMMARY OF THE INVENTION

The present invention provides a simple, inexpensive, easy to use method utilizing a closure device or clamp which may be snapped over thin walled dialysis tubing and is capable of forming a leak-proof seal. The member has an elongated base with at least two spaced longitudinal ridges positioned thereon. The base is hinged to an elongated mating member with the hinge being located at one end of each elongated member. The mating member has at least two grooves and the grooves and the member are positioned so that when the closure member is in a closed position, the grooves and ridges are intermeshed. Means are provided for holding the closure member in a closed position. In a preferred embodiment, the hinge and the means for holding the member in a closed position are integrally formed with the closure member from a single molded piece of plastic. In this preferred embodiment the hinged portion moves longitudinally so that a tongue on the movable member is pushed into a notch in the base member.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the closure useful with the method of the present invention.

FIG. 2 is a cross-sectional view taken along line 2—2 of FIG. 1.

FIG. 3 is a cross-sectional view taken along 3—3 of FIG. 1.

FIG. 4 is a side elevation of the closure of FIG. 1 in a partially closed position.

FIG. 5 is a side elevation of the closure of FIG. 1 in a closed position.

FIG. 6 is a view taken along 6—6 of FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The closure, indicated in FIG. 1 generally by the reference character 10, is shown fabricated from a single and integral molded piece of plastic. Injection molded polypropylene is one satisfactory plastic which has the advantage, in addition to its strength, of being thermally stable so that it is autoclavable. Polypropylene also may be readily injection molded thereby permitting low cost fabrication. The device has a lower half 11 which is connected through hinge 12 to its upper half 13.

As shown more clearly in FIG. 2, upper half 13 has a series of longitudinally positioned ribs 20 through 23. Similarly, as shown best in FIG. 3, lower half 11 has a matching set of valleys or grooves 25—28.

Means for holding the closure 10 in a shut position are provided by notch 30 located in lug 31 which cooperates with tongue 32 in a manner shown in FIG. 5.

Preferably, lug 31 is made sufficiently thick so that it is not significantly deformed or bent back by the closing of the clamp. The clamp is held in a closed position by the longitudinal movement of the upper or hinged portion of the clamp. The force for this longitudinal movement is provided by a hinge having a thin and a thick flexible part. The thin part of the hinge is identified by reference character 12 and the thick part by reference character 14. The thin part of the hinge pulls the thick part downwardly and tends to urge the tongue 32 into notch 30.

Unlike most snap closing devices, the device of the present invention does not tend to open with increasing force exerted perpendicularly to the longitudinal axis of the device. Instead, the upper half of the unit must be moved longitudinally or the base must be flexed downwardly to cause the device to open. Since increasing internal pressure in a length of clamped dialysis tubing tends to cause an outward bowing, its effect is to tighten the closing strength. In other words, to open the device, one bends the end of the base downwardly whereas increased pressure tends to bend the base in the opposite direction.

The number of ribs is another important feature of the present invention and in order to obtain a leak proof seal, there should be at least 2 ribs with 3 or 4 being preferable and as many as 6 being permissible. When more than 6 ribs are used, a stretching action can take place which becomes so severe that tubing failure is possible.

The material of construction of the closure and its thickness should provide sufficient resistance to bowing so that the spacing between the ribs and valleys along the mid point of the closure does not increase with increased internal pressure. Polymers such as polypropylene, rigid polyvinylchloride, high impact polystyrene are examples of plastics having sufficient strength for this purpose.

While the present invention has been discussed with an emphasis on dialysis tubing, the teachings are appli-

cable to closures for other thin-walled tubing as long as the tubing is formed from a material with sufficient flexibility and strength to withstand the stretching action of the closure. As used herein, the term "flexible" is intended to mean plastic film which can be stretched 10% without tearing.

The present embodiments of this invention are thus to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims therefore are intended to be embraced therein.

I claim:

1. A method for sealing a thin walled, flexible tube, said method comprising closing said tube between intermeshed grooves and ridges located between an elongated base member having at least two spaced, longitudinal ridges positioned thereon, said base member being connected to an elongated mating member by hinge means attached to one end of said mating member and one end of said base member thereby interconnecting said mating member and said base member, said hinge means being integrally formed from the same material of construction used to form said base member and said mating member and having a non uniform thickness which is positioned so that upon closing,

the thinner portion of said hinge means deflects the thicker portion of said hinge means; the mating member further having at least two spaced, longitudinal grooves having about the same shape as the ridges on said base member and positioned so that when said mating member and said base member are moved to a closed position said ridges and said grooves are brought into close and intermeshed proximity, said base member and said mating member having closing means for holding said members in a closed position, said closing means comprising an integral tongue with a notch formed therein attached to one of said mating members, said tongue being located at an end opposite from said hinge means and said notch being shaped to hold the end of the other of said mating members.

2. The method of claim 1 wherein said base has three ridges.

3. The method of claim 1 wherein said closure member is fabricated from polypropylene.

4. The method of claim 1 wherein said hinge means has a thin portion of a generally uniform thickness and a thick portion of generally uniform thickness.

5. The method of claim 1 wherein said tongue is substantially rigid whereby said elongated mating member moves longitudinally upon closing.

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