

[54] **TROCAR-CANNULA**
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[52] U.S. Cl. 222/81
 [51] Int. Cl. G07f 11/00
 [58] Field of Search 222/81-90,
 222/159; 128/214 C, 347-351, 221

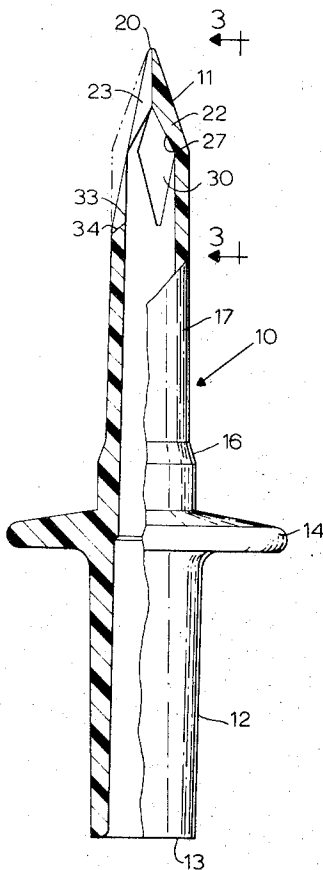
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[57] **ABSTRACT**
 A trocar-cannula for piercing a venoclysis diaphragm. A piercing point is provided on the end of a trocar, providing three large openings for passage of fluid into the interior of the cannula tube, as defined by three ribs shaped to provide maximum size of openings, to minimize cutting or tearing action on the diaphragm, to maximize stretching action thereon, and to prevent possible collapse of part of the container from closing off the opening area. Also, a combination trocar-cannula-drip barrel unit is shown.

9 Claims, 11 Drawing Figures



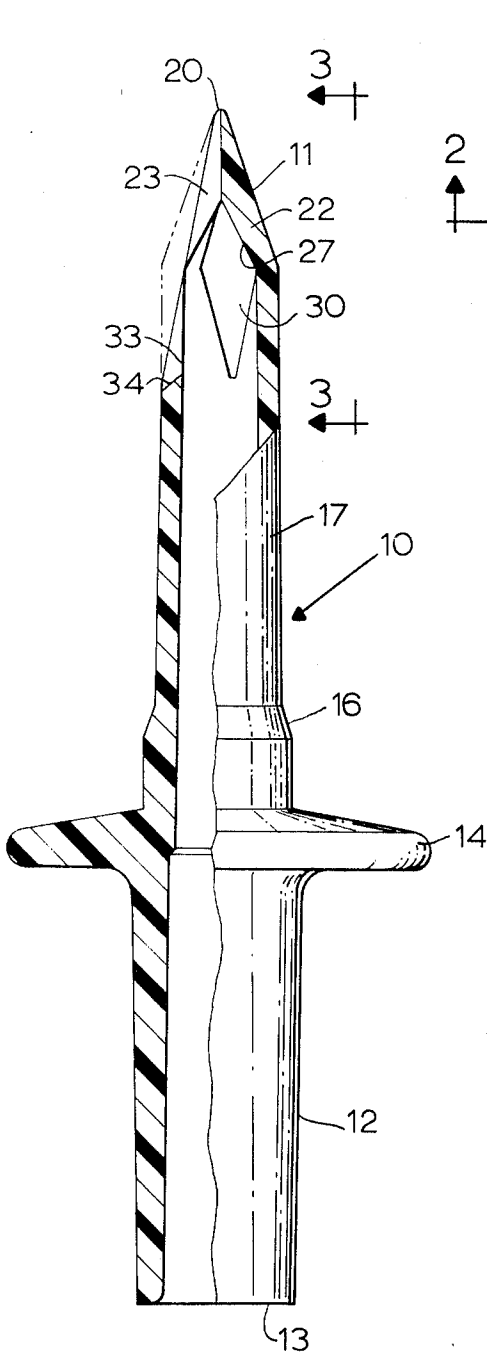


FIG. 2

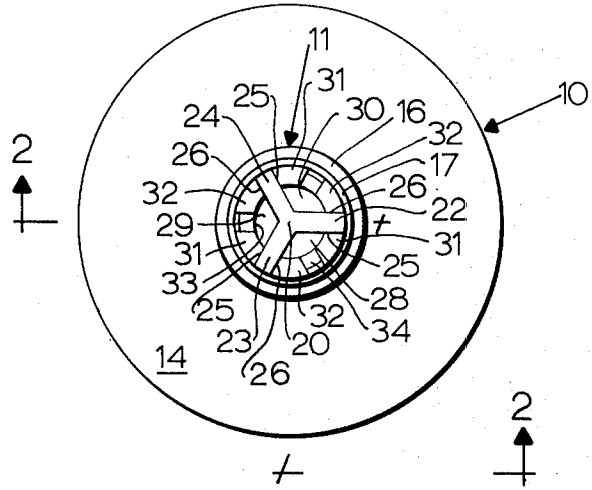


FIG. 1

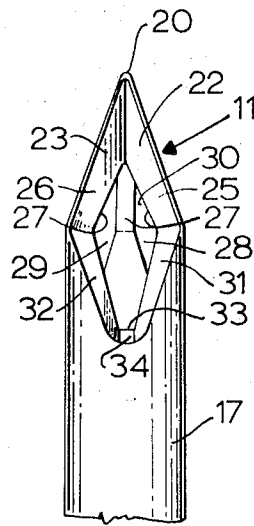


FIG. 3

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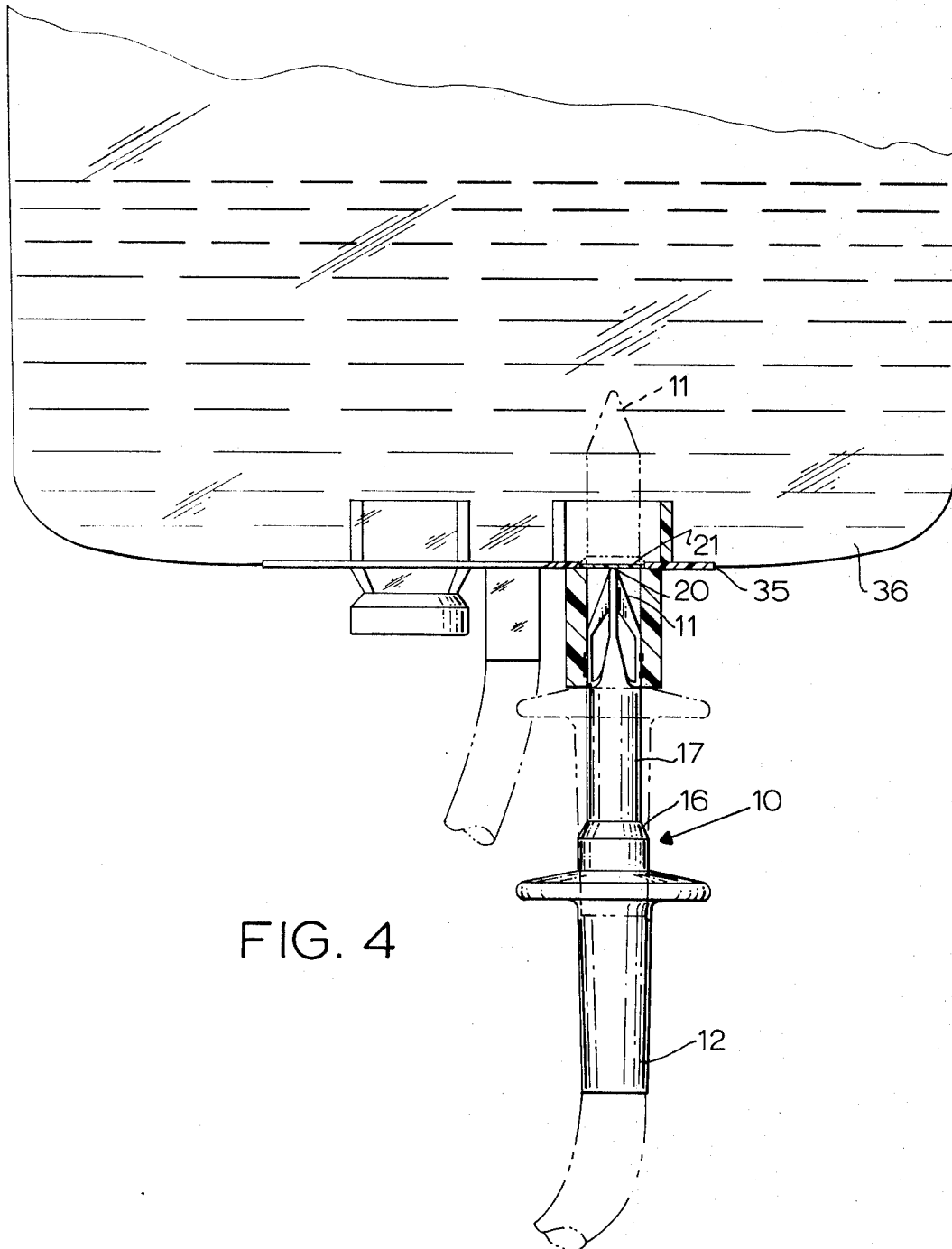


FIG. 4

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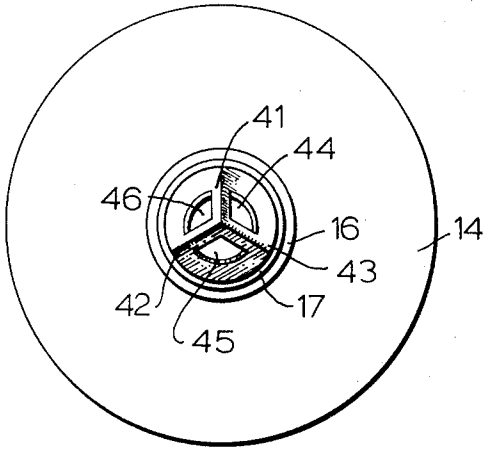


FIG. 5

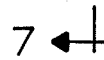
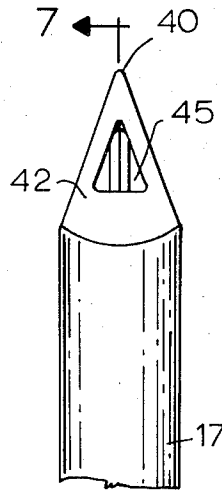


FIG. 6

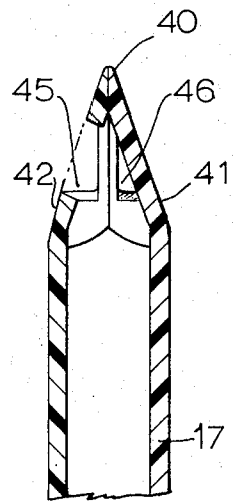


FIG. 7

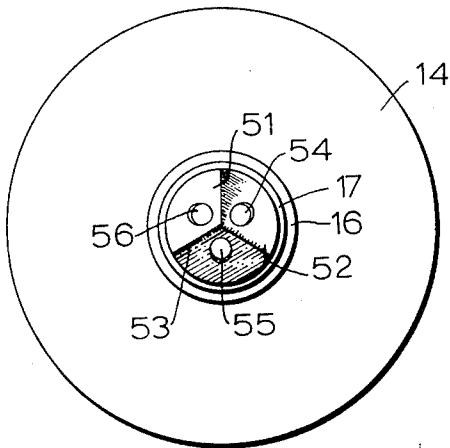


FIG. 8

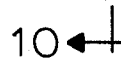
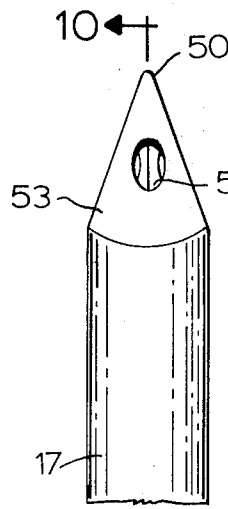


FIG. 9

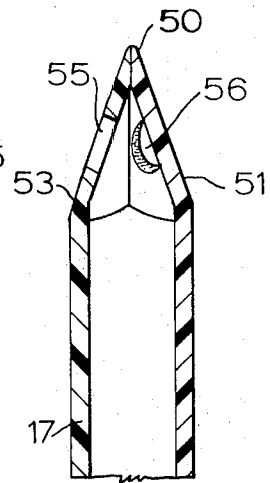


FIG. 10

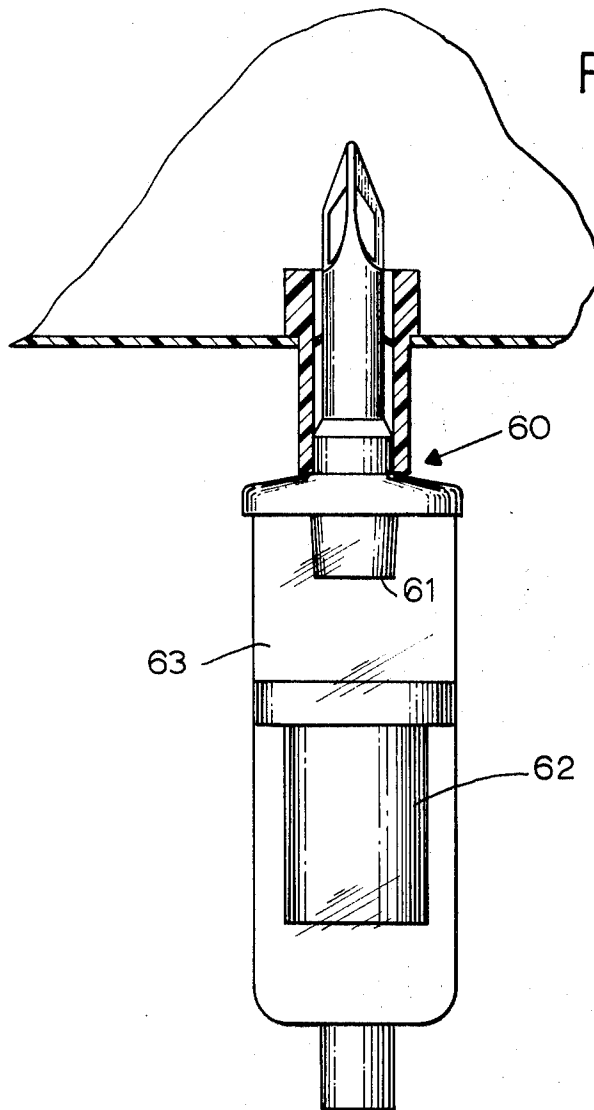
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FIG. 11



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TROCAR-CANNULA

This invention relates to a novel trocar-cannula for piercing a venoclysis diaphragm.

Now that venoclysis diaphragms are made from plastic, it has become important to prevent the point which cuts through them from tearing or cutting the diaphragm to a point where there is leakage around the cannula. It has also become important to prevent closure of the area of the openings into the cannula, by collapse of the wall of the container. Furthermore, it is important to obtain maximum delivery for any given diameter of cannula.

All these objectives are simply stated, but are not so easily achieved. However, these problems are solved by the apparatus of this invention, which employs a trocar with a generally rounded extremity serving as the "point" for piercing and with three openings defined by three ribs and recessed end portions of the tube, with the rib walls rounded and shaped to provide narrow areas of contact while at the same time avoiding any cutting edges. These features that solve the problem are all absent from the prior art devices, where reliance was made on sharp edges with cutting functions and where insufficient attention was given to the dangers that might be produced by collapse of the wall of the container or by insufficient feed of fluid.

Other objects and advantages of the invention will appear from the following description of a preferred form thereof.

In the drawings:

FIG. 1 is an enlarged head-on view of a trocar-cannula embodying the principles of the invention.

FIG. 2 is a view in section taken along the line 2—2 in FIG. 1.

FIG. 3 is a fragmentary view in elevation of the end portion of the trocar-cannula as viewed along the arrows 3—3 in FIG. 2.

FIG. 4 is a fragmentary view in elevation and partly in section on a somewhat reduced scale showing how the trocar-cannula of FIGS. 1—3 is used to pierce a venoclysis diaphragm, broken lines showing the position after piercing.

FIG. 5 is a view similar to FIG. 1 of a modified form of trocar-cannula also embodying the principles of the invention.

FIG. 6 is a view similar to FIG. 3 of the trocar-cannula of FIG. 5.

FIG. 7 is a view in section taken along the line 7—7 in FIG. 6.

FIG. 8 is a view similar to FIGS. 1 and 5 of another modified form of trocar-cannula, also embodying the principles of the invention.

FIG. 9 is a view similar to FIGS. 3 and 6 of the trocar-cannula of FIG. 8.

FIG. 10 is a view in section taken along the line 10—10 in FIG. 9.

FIG. 11 is a view in elevation and in section of a combination trocar-cannula-drip barrel unit, also embodying the principles of the invention.

FIGS. 1—3 show a trocar-cannula 10 that embodies the principles of the invention, having a trocar 11 at one end and a cylindrical cannula tube 12 at the other end. Spaced from the end 13 of the cannula 12 is a disc-like flange 14, against which a flexible tube or conduit shown in broken lines in FIG. 4 may be pushed, encircling the cannula 12 and conveying liquid therefrom. On the other side of the disc flange 14, the exterior di-

ameter of the cannula tube 12 is narrowed at an exteriorly sloping portion 16, while the interior diameter remains the same, thereby providing a thinner and narrower wall portion 17 where less strength is needed. This thinner wall portion 17 is integrally joined to the trocar or three-segmented portion 11.

At the end of the trocar 11 is a rounded point-like extremity 20 which serves to pierce the venoclysis diaphragm 21 (FIG. 4), but, due to its rounded shape, does this with a minimum of cutting or tearing action, though there is, of course, some cutting. Three narrow radial ribs 22, 23, 24 join this extremity 20 smoothly to the tube portion 17. The ribs 22, 23, 24 are made as narrow as is feasible, but their outer surfaces and edges are rounded so as to prevent any cutting action, as would occur from a sharp edge; as a result movement of the trocar 11 into the diaphragm 21, after piercing by the extremity 20, results mostly in spreading and stretching the diaphragm wall rather than tearing or cutting it, so that when the trocar 11 is fully inserted (FIG. 4) the diaphragm wall ends up encircling the tubular portion 17, going, of course, no further than the flange.

The sidewalls 25, 26 of the ribs 22, 23, 24 are generally radial and are perhaps better described as parallel to the radial plane which bisects their ribs 22, 23, 24 so that each rib 22, 23, 24 is generally rectangular in cross-section, except for the interior wall 27 which may be slightly concave. Again, the edges are rounded and not sharp.

Moreover, the end of the tubular portion 17 is itself cut back by three recesses 28, 29, 30 with converging walls 31, 32, and again the side walls 31, 32 of these recesses 28, 29, 30 lie generally radially, so that they are perpendicular to all planes perpendicular to the radial plane through the ribs 22, 23, 24. The walls 31, 32, in each recess converge but do not meet at a sharp point, but rather meet at a short cylindrical arc 33, on the interior surface, which is joined to the exterior surface by a smooth bevel or sloping face 34.

As a result, three large openings (shown in FIGS. 1—4 as generally lozenge-shaped) are provided with approximately the maximum size of opening that can be obtained while still getting the strength necessary for entry of the trocar 11 into the diaphragm.

Due to the three-fold nature of the structure, collapse of the walls 35 of the venoclysis bag 36 (FIG. 4) against the device 10 is not able to block off the full area of the openings as they might, for example, if there were only two such openings diametrically opposite each other. At the most, one of these openings could be blocked off, and the blocking off of one would insure that the other two would be rather wide-open.

In using the trocar-cannula 10, the extremity 20 is forced through the diaphragm 21. Instead of the extremity 20 beginning a cutting action that is carried out by sharp ribs, along with tearing, the cutting action stops just beyond the rounded extremity 20 itself, and the remaining action of the rounded ribs 22, 23, 24 is a stretching action, which minimizes tear, and therefore minimizes leakage around the cannula.

FIGS. 5, 6, and 7 show a modified form of the invention differing principally in the shape of the openings through the trocar. Most of the parts of the device are the same, but here a trocar 40 is provided with ribs 41, 42, and 43 and with openings 44, 45, and 46 which are generally in the form of a three-sided pyramid. Thus,

the shape of the trocar 40 is, in this instance, generally that of a pyramid, with the outer ribs 41, 42, and 43 providing smooth surfaces but with the openings 44, 45, 46 extending directly into the pyramid face instead of being formed in the manner shown in FIGS. 1 through 4.

FIGS. 8 through 10 show a trocar 50 that is generally similar to the trocar 40 of FIGS. 5 through 7, except that the openings are generally elliptical or circular, depending on the way in which they are viewed. Thus, there are ribs 51, 52, and 53 with elliptical openings 54, 55, and 56.

FIG. 11 shows how the principles of the invention can be used to make a combination trocar-cannula-drip barrel 60. The trocar itself is substantially identical to that shown in FIGS. 1-4 but instead of merely terminating in the end 13 of the tube 12, it terminates in a drip barrel 61. The drip barrel 61 empties into a filter unit 62. The unit 60 itself may be made of transparent plastic with a flexible housing 63. This complete combination unit 60 enables the user to dispense with the separate units and the connections heretofore that had to be used between them.

To those skilled in the art to which this invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope of the invention. The disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

I claim:

- 1. A trocar-cannula for piercing a venoclysis diaphragm of a fluid-containing container, comprising, a cylindrical tube portion with an integral trocar on one end, said trocar comprising
 - a rounded point-like extremity for piercing a venoclysis diaphragm with a minimum of cutting action,
 - three ribs joining said extremity smoothly to said tube, said ribs having smooth outer surfaces free from sharp edges,
 said trocar having three openings, one opening between each two adjacent ribs,
 - whereby after piercing a said diaphragm, said trocar stretches it and said fluid passes into said tube through the three openings, the threefold nature acting to prevent collapse of said container on more than one said opening and acting to provide the maximum size opening at all times consonant with the needed strength.
- 2. The trocar-cannula of claim 1 wherein said trocar tip is generally pyramidal.
- 3. The trocar-cannula of claim 2 wherein said openings are generally triangular.
- 4. The trocar-cannula of claim 2 wherein said openings are generally elliptical.
- 5. The trocar-cannula of claim 1 wherein said trocar ribs are generally radial with nearly radial sidewalls meeting their outer surfaces at rounded edges.
- 6. The trocar-cannula of claim 5 wherein said openings are generally lozenge-shaped.
- 7. The trocar-cannula of claim 5 wherein said openings are generally triangular.
- 8. A trocar-cannula for piercing a venoclysis dia-

phragm of a fluid-containing container, comprising, a cylindrical tube portion with an integral trocar on one end, said trocar comprising

a rounded point-like extremity for piercing a venoclysis diaphragm with a minimum of cutting action,

three narrow generally radial ribs joining said extremity smoothly to said tube, said ribs having nearly radial sidewalls and smooth outer surfaces inscribable in a three sided pyramid and with rounded edges,

said tube being recessed from where said ribs meet it to describe three generally triangular cylindrical shell segments with sidewalls generally perpendicular to the outer surface of said tube, the sidewalls of each said recesses being joined by a face sloping from the inner to the outer surface of the tube,

thereby providing three generally lozenge-shaped large openings,

whereby after piercing a said diaphragm, said trocar stretches it and fluid from said container passes into said tube through the three lozenge-shaped openings, the threefold nature acting to prevent collapse of said container on more than one said opening and acting to provide the maximum size openings at all times consonant with the needed strength, the walls of the opening being so shaped as to minimize cutting or tearing action.

9. A trocar-cannula for piercing a venoclysis diaphragm to enable passage of fluid therethrough, comprising,

a cylindrical tube having spaced from one end a disc-like flange, said tube on the opposite side from said end narrowing to a smaller exterior diameter while maintaining the same inner diameter, and,

a trocar integral with said tube on the end of the smaller diameter portion, said trocar comprising a rounded point-like extremity for piercing a venoclysis diaphragm with a minimum of cutting action,

three narrow radial ribs joining said extremity smoothly to said tube, each of said ribs having nearly radial sidewalls generally parallel to the radial plane through the center of the rib, and outer surfaces inscribable in a cone, meeting said sidewalls at rounded edges,

said tube being recessed on each side from where said ribs meet it to describe three triangular cylindrical-shell segments, each with two sidewalls each perpendicular to planes perpendicular to the radial plane through the rib which it joins, the two sidewalls being joined by a face with a sloping surface, sloping away from said extremity from the inner to the outer surface of the tube,

thereby providing between said ribs and said shell segments three large generally lozenge-shaped openings,

whereby after its extremity pierces a said diaphragm, said trocar ribs stretch it and said fluid passes into said tube through the three lozenge-shaped openings.

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