

[54] **BODY MEMBER TOURNIQUET**
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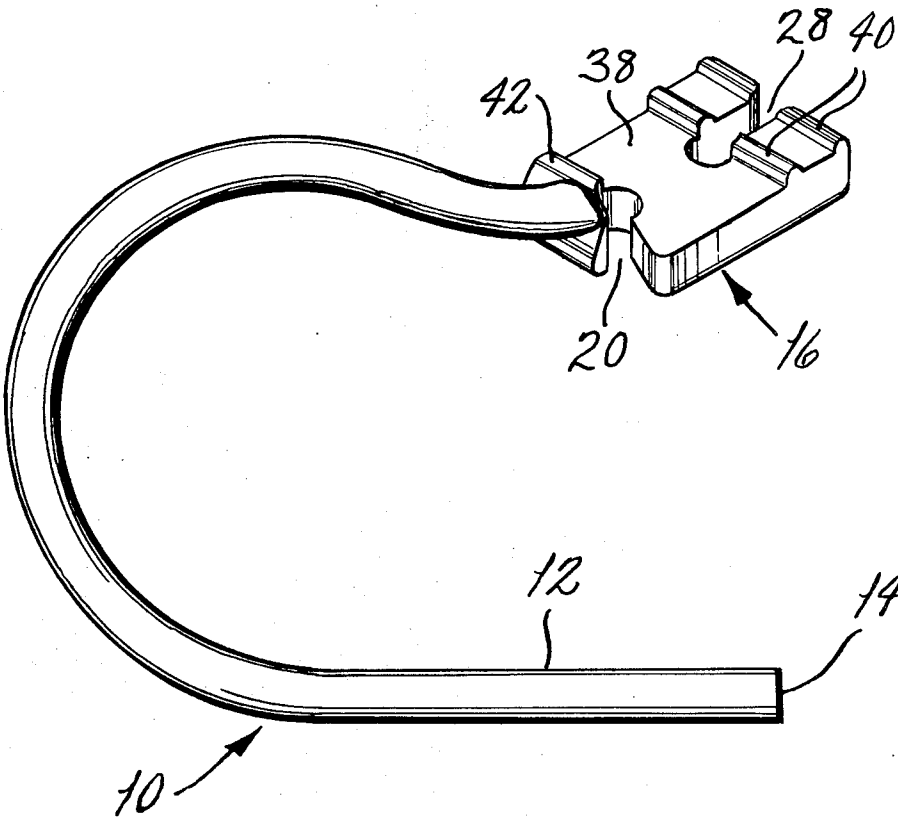
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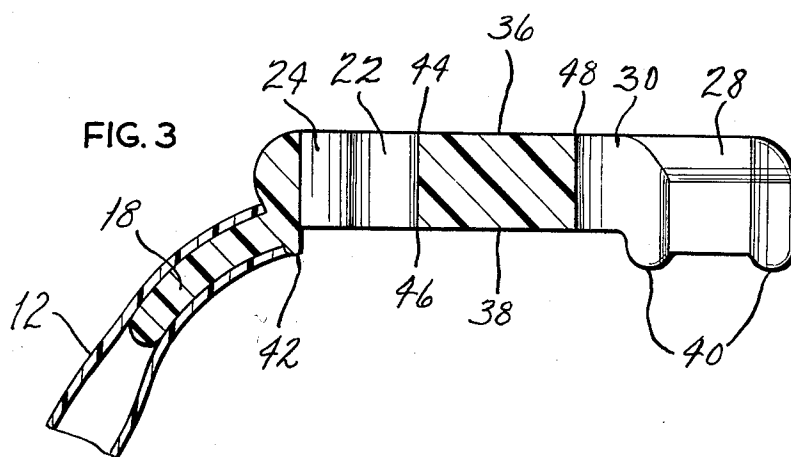
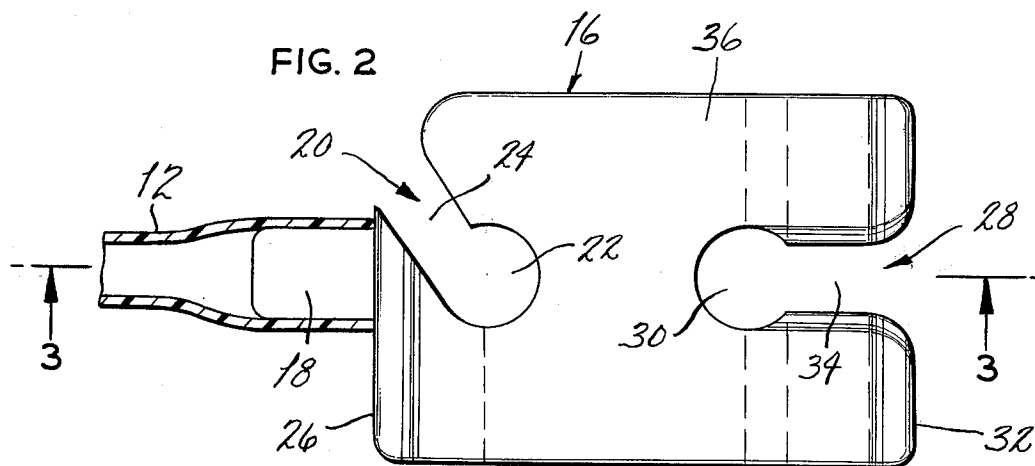
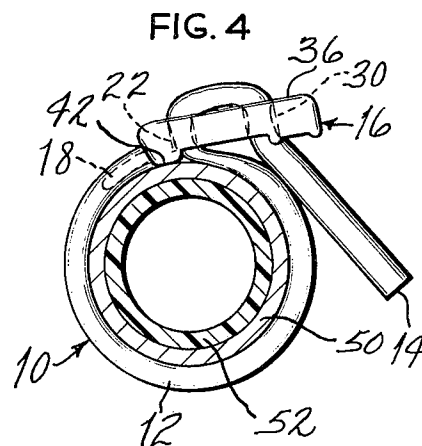
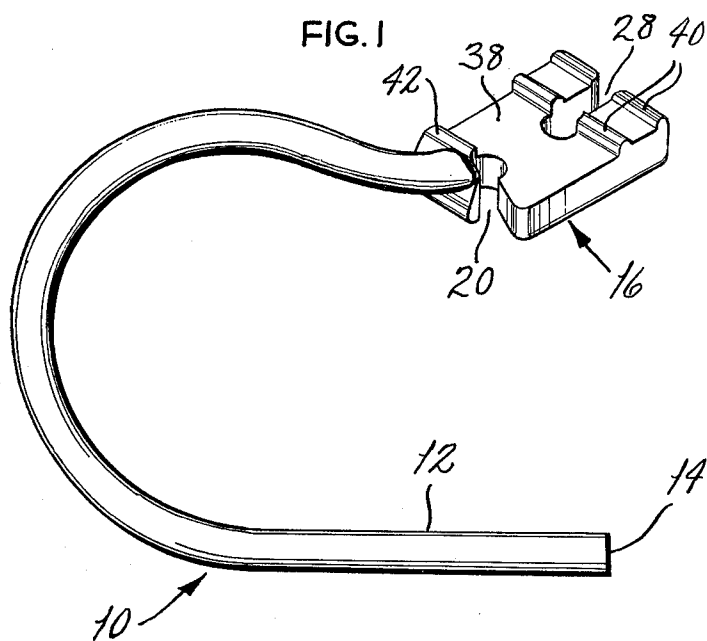
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[57] **ABSTRACT**
A body member tourniquet for use in surgical proce-
dures where it is desired to limit or restrict flow
through a body vessel or to secure a tube within such
vessel. The tourniquet consists of an elongate flexible
tube having a rigid head at one end. The tube is
looped about a vessel and the free end positioned in a
passage in the head and drawn about the vessel, the
head holding the tube about the vessel. A second pas-
sage is provided for additional security in locking the
tube against movement relative to the head.

6 Claims, 4 Drawing Figures





BODY MEMBER TOURNIQUET

BACKGROUND OF THE INVENTION

This invention relates to a tourniquet for a body member, and more particularly to a disposable device of this nature which substantially reduces the clutter normally occurring, for example, in the surgical field during certain operative procedures, while permitting rapid, non-traumatic application.

During certain surgical procedures, it is necessary to either constrict a body vessel or insert a catheter or other medical tube into the lumen of a body vessel. For example, in open-heart surgery it is necessary to provide an artificial means whereby the breathing functions of the lungs and pumping functions of the heart can be assured during the period that the heart is open. Thus, the heart and lungs must be bypassed by diverting the venous blood returning from the body to the right atrium into a heart-lung machine and pumping the blood oxygenated by the machine back into the aorta, either through one of its branches or through the aorta itself. For this purpose, vena caval catheters are inserted into the superior and inferior vena cavae. In the past, it has been common practice to prevent leakage of blood past the catheter opening by encircling the vessel with a snare or tourniquet to tighten the vessel around the inserted catheter. For example, a cord "shod" may be used, the latter consisting of a rubber tube through which a length of umbilical tape is passed after encircling the vessel. Once the tape is passed through the tube, an external clamp such as a hemostat is applied to the tube to secure the tape in position therein.

The use of such prior art clamping devices provide considerable clutter in the operative field mainly due to the clamp used to secure the umbilical tape within the rubber tube. In certain operative procedures, a relatively large number of such devices must be used, thereby unduly limiting the surgeon's access to the operative site.

Examples of vascular tourniquets which have been designed to overcome these and other problems in the use of conventional devices are illustrated in U.S. Pat. Nos. 3,043,308 and 3,507,270. As will be readily observed, however, the devices illustrated by these patents are relatively expensive to manufacture, and lack the simplicity and ease of use which characterize the present invention. An improved tourniquet of the type including a rubber tube through which a length of umbilical tape is passed is shown and described in application Ser. No. 441,702, filed Feb. 11, 1974, now U.S. Pat. No. 3,877,434, for Vascular Tourniquet and assigned to the same assignee as the present application.

SUMMARY OF THE INVENTION

Accordingly, among the several objects of the present invention may be noted the provision of a body member tourniquet which substantially reduces clutter in the operative field; the provision of such a device which easily and quickly applied about a body member or vessel to either restrict the same or secure a tube or catheter therein; the provision of such a device which causes little or no trauma to the body member; and the provision of such a device which is characterized by low cost for disposal after use with a single patient.

In general, a body member tourniquet constructed in accordance with the present invention comprises an

elongate member having a smooth, rounded outer surface formed of a soft, flexible material. A rigid head is secured to one end of the elongate member, the head providing a passage for receiving the other end of the elongate member after it is disposed about the body member, the passage restricting movement of the elongate member relative to the head to secure the elongate member about the body member.

These and other objects and features will be apparent hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a preferred embodiment of the tourniquet of this invention;

FIG. 2 is an enlarged plan view of a portion of the device in FIG. 1;

FIG. 3 is a sectional view taken on line 3—3 of FIG. 2; and

FIG. 4 is a sectional view illustrating use of the tourniquet of FIG. 1 with a body vessel having a medical catheter within its lumen.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, and particularly to FIG. 1, the present body vessel tourniquet is indicated generally at 10. While the tourniquet will be illustrated and described for use in securing a catheter within a body vessel, such as a vein or artery, it should be understood that the invention also can be used for restricting a vessel, such as a blood vessel, urinary tract duct, or other body member.

The tourniquet 10 comprises an elongate flexible member shown as a tube 12 formed of a soft plastic material such as, for example, polyvinyl chloride. The tubing may, for example, be approximately 8 inches in length and may be provided in various diameters depending upon the particular application. A preferred tube outer diameter for use in general surgery has been found to be within a range between about one-eighth to one-fourth of an inch, for example, approximately 0.144 inch. As illustrated, the free end 14 of tube 12 is blunt, although a beveled or pointed end may be provided as described more fully hereinafter.

A relatively rigid head member 16 is secured to the opposite end of tube 12 by means of an integral projection 18 extending angularly from the head, as seen in FIGS. 2 and 3. The tube 12 is telescoped over projection 18 and is solvent or adhesively bonded thereon.

The head is of generally rectangular, flat configuration and may be formed, for example, by injection molding a suitable plastic material, such as, for example, relatively hard polyvinyl chloride, polycarbonate, or polyethylene. As will be noted in FIGS. 2 and 3, a passage, indicated generally at 20, extends through the head 16 near its distal end. The passage 20 consists of a circular hole or aperture 22 and an entrance slot 24 extending from the hole 22 and opening at the distal edge 26 of the head. Hole 22 is slightly smaller in diameter than the outer diameter of tube 12 so that the tube 12 is constricted when it is inserted into the hole. Similarly, the width of slot 24 is smaller than the outer diameter of tube 12.

The opposite or proximal end of head 16 is similarly provided with a passage 28 extending therethrough and consisting of a hole or aperture 30 opening to the proximal edge 32 of the head via a slot 34. The diameter of

hole 30 and width of slot 34 are also slightly less than the diameter of tube 12. As best illustrated in FIG. 3, the passages 20 and 28 extend completely through head 16 from its upper surface 36 to its lower surface 38. As also shown in FIG. 1, the lower face 38 of the head is provided with a pair of ribs 40 at its proximal end and a rib 42 at its distal end. The rib 42 extends only over a portion of the lower surface of the head due to the interruption caused by passage 20, while the ribs 40 extend across the head but are interrupted in the middle by passage 28.

As set forth above, the diameter of holes or apertures 22 and 30 are slightly smaller than the outer diameter of the tube 12. Preferably, the relative size of the hole and tube are such that the tube is only slightly larger than the hole so that frictional resistance to passage of the tube through the hole is not so great as to prevent the tube from being readily manually pulled through the hole or excessively compressed by the hole. For example, for a tube having an outer diameter of 0.144 or 0.145 inch, the apertures or holes 22 and 30 may have a diameter of approximately 0.140 inch. The width of each of the slots 24 and 34, as viewed in FIG. 2, is substantially less than the diameter of the holes 22 and 30 and the tube 12 and especially where the slot joins the hole. For example, each of the slots 24 and 34 may have a width that allows the tube to be moved through it but in a compressed or deformed condition. As seen in FIG. 3, hole 22 is provided with relatively sharp upper and lower proximal edges 44 and 46, and hole 30 has an upper distal edge 48 which is relatively sharp to secure the tube against movement, as will be described more fully hereinafter.

The use of the tourniquet 10 will now be described in connection with securing a body vessel 50 about a medical tube or catheter 52, as illustrated in FIG. 4. In use, after catheter 52 is inserted into the vessel 50, the tube 12 is looped about the vessel and the distal end of the tube is pressed into hole 22 through slot 24. For example, with the end 14 about or proximally of the head 16, the side wall of the tube is readily pushed first into the slot 24 and then into hole 22. The longitudinal axis of the tube can be parallel to the axis of hole 22 during this insertion. The tube 12 is then tightened about the vessel 50 for holding the catheter 52 therein and preventing blood flow around it by sliding the head 16 downwardly over the tube 12 to urge the vessel against the catheter with a desired force. In this position, it will be noted that the rib 42 extends radially downwardly at the distal end of head 16 and presses against the vessel 50 thereby tending to fill the space between the vessel and the tourniquet where the tube passes through passage 20 and this tends to apply pressure all around the vessel and avoid any pinching of tissue. The tube is held against movement relative to the head primarily by edge 46 of aperture 22 which frictionally binds against the outer surface of the tube, although retention is also obtained or aided by frictional engagement with the walls of the aperture.

To insure against slippage of the tube in aperture 22, a second locking means is provided by passage 28 so that the tube can be extended proximally over the upper face 36 of the head from hole 22 and passed through slot 34 into aperture 30, thereby eliminating any chance of slippage. As seen in FIG. 4, the tube 12 extends around the vessel 50 upwardly through hole 22, across the upper surface 36, and downwardly

through hole 30. The tube 12 may be slightly stretched when it is inserted into slot 34 and hole 30. Since the hole 30 and slot 34 are somewhat narrower than tube 12, the tube cannot pop out of hole 30 and straighten out. The edge 48 and side walls of hole 30 frictionally engage the tube to retain it against movement in hole 30.

The elongate member 12 is preferably circular in cross-section in its normal or untensioned condition and compressible in a radial direction so that when applied under tension to a body member, such as in FIG. 4, it becomes slightly flattened or oval. This has the effects of increasing the area of contact and more evenly distributing the pressure on the body member. Also, the elongate member 12 may roll or be applied with an axial twist without any edges causing concentrated pressures against the vessel. When the elongate member 12 is tubular or hollow, the radial compression and the above desirable effects are enhanced because of the ease with which it tends to flatten or become compressed. It should be noted that the projection 18 is arcuate so that it conforms generally to the average size vessel or body member with which it is to be used. The projection 18 is also flat or of general oval configuration in cross-section so that the portion of the tube 12 which receives the projection will generally conform to the major portion of the tube when applied to a body member.

To release the tourniquet, the free end of the tube 12 is grasped and forced upwardly out of aperture 30 through slot 34. The head 16 is then grasped and moved upwardly away from the vessel 50, ribs 40 providing a non-slick surface for grasping by the user, and the tube is removed from the primary aperture 22 through its associated slot 24.

As previously indicated, the present tourniquet reduces trauma to the body vessel by providing a smooth tube which encircles the vessel. The tube 12 has no sharp edge to injure the vessel and is slightly elastic and stretchable, and is slidable over the vessel surface so that it exerts uniform pressure over the entire contacting surface of the vessel. The tourniquet is also formed of a unitary assembly and does not require any other components for its operation.

As described above, the tube is locked within the passage 20 primarily by friction of the tube against the sharp edge 46 of aperture 22, although friction of the tube against the wall of the aperture also tends to retain the tube against movement relative to the head. This locking effect is aided by the fact that when the tourniquet 10 is tensioned about the vessel as in FIG. 4, the vertical axis of hole 22 or proximal wall of the hole is generally radial or chordwise of the vessel 52 and causes the tube 12 to severely bend around edge 46 reducing the chance of slippage. The axis of hole 22 is maintained generally radially or chordwise of the vessel by forming the head 16 such that the projection 18 is generally arcuate or angularly related to the main body portion of the head or to the axis of hole 22. With the shown projection 18 arcuate, and the axis of the hole generally radial relative to the arc of the projection 18, the arcuate projection and edge 46 of hole 22 are urged toward the vessel as seen in FIG. 4 to bend the tube severely and lock it against slippage.

While the passage 20 may be adequate to retain the tube against movement, the second passage 28 provides additional assurance against movement of the

tube relative to the head. It should be understood that while the passages 20 and 28 are illustrated as comprising a hole and slot, the slot may be eliminated although this will require threading of the distal end of the tube 12 through the hole and is slightly less convenient than moving the tube through a slot and into a hole. When using the latter construction, the distal end 14 of the tube may be provided with a tapered or pointed end to facilitate threading through the hole. Also, a hook, loop, ring or labyrinth passage could be provided on the upper surface 36 of head 16 to provide a passage for locking the tube against movement rather than the apertures 22 and 30.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results obtained.

As various changes could be made in the above construction without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A body member tourniquet comprising an elongate member having a smooth, rounded outer surface formed of a soft, flexible material, and a relatively rigid head including a relatively flat main portion having opposed ends and opposed sides, and a projection connected to one of said ends and extending generally angularly relative to the upper and lower faces of said main portion, one end of said elongate member being secured to said projection, said main portion having a pair of holes extending therethrough between the upper and lower faces thereof with the holes spaced

from each other and each of said opposed ends and opposed sides and with one of said holes closer to said one end than the other of said holes, and entrance slot means extending through said main portion from the periphery thereof to each of said holes to allow insertion of the side walls of said elongate member through said entrance slot means and into one of said holes after said elongate member has been placed about a body member, the diameter of each of said holes being less than the width of said elongate member and greater than the width of said entrance slot means.

2. The body member tourniquet of claim 1 wherein said slot means comprises a first slot connecting said one hole to the periphery of said head, and a second slot connecting the other of said holes to the periphery of said head.

3. The body member tourniquet of claim 1 wherein said elongate member is a tube of soft, elastic plastic, said one end of said elongate member being bonded to said projection.

4. The body member tourniquet of claim 2 wherein said head includes a rib extending downwardly from the lower face of said head adjacent said one end thereof and is engageable with a body member when the body member is encircled by the body member tourniquet.

5. The body member tourniquet of claim 1 wherein said projection is an arcuate integral part of said head, said head is of relatively hard plastic, and said elongate member is a tube of relatively soft plastic.

6. The body member tourniquet of claim 5 wherein said tube is circular in cross-section and comprises soft, elastic polyvinyl chloride.

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