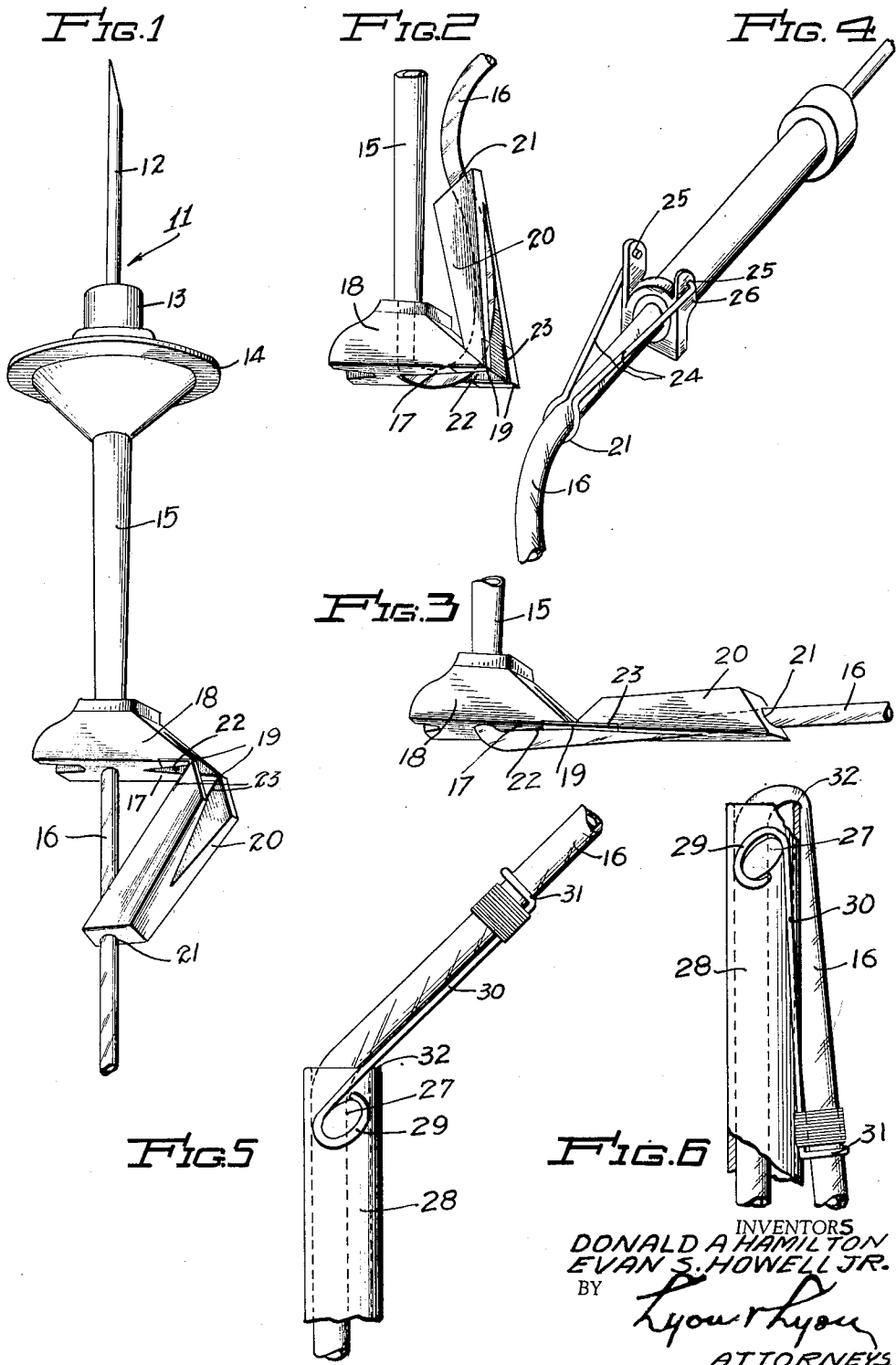


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TUBING CLAMP

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TUBING CLAMP

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This invention relates to a device for clamping off fluid flow through a flexible tube, and particularly to a device which operates by collapsing the tube across a rigid member.

In drawing blood, the donor is connected to an evacuated blood bottle by a donor set. The set usually has a bottle-entry needle, a venipuncture needle, a flexible plastic or rubber tube connecting the needles, and a clamping member for shutting off fluid flow through the tube. The clamping member is a particularly important part of the equipment. If the clamp leaks, or is not completely closed when the bottle is entered with a needle, vacuum in the bottle is dissipated. During the blood-drawing procedure, the operator must often hold or agitate the blood bottle. The clamping member must therefore be capable of quick and effective one-hand operation. In case of an accident, such as the needle pulling out of the vein or a reversal of flow through the tube, the clamp must have a fast, reliable clamping action.

The clamps now available are often difficult to operate quickly with one hand. Moreover, they often cut or break the tubing during the repetitive use necessary to draw blood. Blood bank operators, who often spend long hours drawing blood from many donors, are often troubled with sore hands. The recent popularity of disposable sets has made many of the better clamps impractical because of their cost.

It is the general object of this invention to provide an inexpensive, reliable clamp for a flexible tube.

Another object of the invention is to provide a flexible-tubing clamp which can be used many times without breaking or cutting the tube.

Another object is to provide a tubing clamp which can be operated by one hand with a minimum of manipulation.

Another object is to provide a clamping device in which the operator can see at a glance whether the device is on or off.

A further object of the invention is to provide a positive-action, on-off clamp, which operates by stretching and collapsing a tube across a rigid member.

A further object of the invention is to provide a positive-action, on-off clamp operating on a toggle or snap-action principle.

The tubing clamp of the present invention will be more fully understood from the description of the preferred form of the invention given with the accompanying drawings, in which:

FIGURE 1 is a perspective view of the tubing clamp in open position;

FIGURE 2 is a perspective view of the clamp in closed position;

FIGURE 3 is a perspective view of the clamp in an intermediate position;

FIGURE 4 is a perspective view of a modified form of the invention;

FIGURE 5 is an elevation showing another modified form of the invention in open position;

FIGURE 6 is an elevation showing the modification of FIGURE 5 in closed position.

Referring now to FIGURES 1 to 3, the bottle needle generally indicated as 11, has a metal cannula 12, a protector hub 13, a flange 14, and a hub 15. A flexible tube 16 is preferably attached to the inside of the hub

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15. The tube 16 may be conveniently made of extruded polyvinyl chloride, rubber, or other flexible material. At the end opposite the cannula 12, the hub 15 has a clamping edge 17 and a hub extension or side arm 18, projecting laterally from the hub. The end of the hub extension 18 has a pivot 19 to which a pivot arm 20 is attached. The distal end 21 of the pivot arm 20 is secured to the tube 16. The hub extension 18 has a groove 22 through which the tube 16 passes when the clamp is in closed position.

The clamp unit, consisting of the extension 18, the pivot 19 and the pivot arm 20, is conveniently made in a single piece. For example, the extension 18 and arm 20 are molded of rigid plastic and attached together by a flexible film 23, which acts as a pivot. Alternatively, the unit may be stamped out of sheet metal. In this case, the surfaces of the metal forming the extension 18 and the arm 20 are parallel to the axis of the hub 15, while the pivot 19 is at right angles to the hub 15. Pivot action occurs by bending the flat metal sheet at the pivot 19. A laminate of plastic and metal can be used to facilitate attachment of the clamp unit to the hub 15.

In the modification shown in FIGURE 4 a wire, or plastic-covered wire, arm 24 acts as the pivot arm. The ends of the wire are inserted in the pivot holes 25 of the extension 26 and the distal end 21 of the arm 24 is secured to the flexible tube 16.

In the modification shown in FIGURES 5 and 6, an elliptical boss 27 projects from each side of the hub 28. The boss 27 is located below the clamping edge 32 and is positioned so that the minor ellipse axis, on the clamping edge side, extends at an angle of about 45° to the axis of hub 28. A spring wire ring 29 tightly encircles the boss 27. An arm 30 extends from the ring 29 and is attached at its distal end 31 to the flexible tube 16.

In use, the clamp is closed (see FIGURE 2), a protector (not shown) removed from the protector hub 13, and the cannula 12, pushed by the flange 14, through the stopper of an evacuated blood bottle. A donor needle (not shown) on the other end of the tube 16 is inserted in a vein of the donor and the clamp opened (see FIGURE 1). This opening may be accomplished by lifting the pivot arm 20 or by merely raising the tube 16 so as to flip the pivot arm up. When the clamp is to be closed again, the pivot arm 20 may be pushed down, or the tube 16 may be pulled down to change the pivot arm position.

As the pivot arm 20 moves from the open position (FIGURE 1) to the closed position (FIGURE 2) the tube 16 is collapsed across the clamping edge 17. Maximum stretch occurs at a point midway between the positions shown in FIGURES 2 and 3. As the pivot arm 20 passes beyond the position of maximum stretch, the clamp snaps to a closed position (FIGURE 2). Likewise, on opening, the clamp has a snap or toggle action forcing the pivot arm from the position of maximum stretch to an open position. The maximum stretch position is at substantially the center of swing of the pivot arm and the action in either direction is an over center or toggle action.

The modification shown in FIGURE 4 works in the same manner as the previous example, except that the pivot action is provided by the ends of the wire arm 24 fitting in the holes 25.

In the modification shown in FIGURE 5 the toggle action is provided by the wire ring 29 and an elliptical boss 27. As the arm 30 is pulled down to close the clamp, the ring 29 is expanded by the major axis of the ellipse. Tension on the ring 29 reaches a maximum when the arm 30 is parallel with the minor axis, i.e., at an angle of about 45° with the hub axis. When the arm 30 is pulled past this position, the tension on the ring 29

causes the arm 30 to snap down against the hub 28. Since the boss 27 is located below the clamping edge 32, the tube 16 is collapsed under tension across the clamping edge 32.

Although this tubing clamp is particularly useful in drawing blood into an evacuated blood bottle, it also has other uses. For example, it can be used as a shut-off device on any flexible tube by merely providing an extension, similar to the extension 17, attached to the tube and a pivot arm attached to this extension.

We claim:

1. A clamp comprising: a plastic hub having a flat clamping surface; a flexible tube extending from said hub and attached thereto; an extension projecting outwardly from said hub; a pivot point on the end of said extension; a channel between said pivot point and said flat clamping surface; an arm having one end attached to said pivot point and the other end secured to the tube, the distance from said secured end to said clamping surface being less in the open and closed positions of the clamp than in an intermediate position.

2. A clamp comprising: a plastic hub having a clamping edge; a flexible tube extending from said hub and attached thereto; an extension projecting outwardly from said hub; a pivot point on said extension; a channel between said pivot point and said clamping edge; an arm having one end pivotally attached to said pivot point and the other end secured to the tube; the distance from said secured end to said pivot point being constant; the distance from said secured end to the clamping edge being variable, so as to apply tension to the flexible tube in the closed position and greater tension in the nearly closed position.

3. A clamp comprising: a rigid member; a flexible tube adapted to be bent over said said member and attached thereto; an extension on said member; a pivot point on the end of said extension; an arm attached to said extension at the pivot point, the other end of said arm being secured to the flexible tube at a point spaced longitudinally from the rigid member; and a channel formed by the walls of said extension adapted to allow the flexible tube to lie between the rigid member and the pivot point when the clamp is in closed position, one side of the channel being open so that the flexible tube can move out of the channel when the clamp is opened.

4. A clamp comprising: a rigid member; a flexible tube extending from and attached to said member; an extension projecting laterally from said member; and an arm pivotally attached at one end to said extension, the other end of said arm being secured to the flexible tube at a location spaced from the rigid member; said arm extending longitudinally beyond the rigid member and being pivotable to a position lying along side the rigid member whereby the flexible tube is collapsed by bending and stretching it across the rigid member.

5. A clamping member comprising: a rigid member; a unitary, one piece clamping unit attached to said rigid member; said clamping unit having an extension projecting laterally from said rigid member; a pivot point at the distal end of said extension; a flexible tube attached to said rigid member, extending axially therefrom, and adapted to be bent over the end thereof; a pivot arm rotating about the pivot point from a first position extending longitudinally beyond the rigid member, to a second position contacting the rigid member; the distal end of the pivot arm being secured to the flexible tube, the tube being adapted to be open in said first position of the pivot arm and to be bent and stretched over the end of the rigid member in the second position whereby the pivot arm may be easily shifted from said first position to said second position by pulling on the flexible tube.

6. A clamp comprising: a rigid tubular member; a flexible, elastic tube attached to the tubular member and extending axially therefrom; a lateral extension on said

member; an arm pivotally attached at one end to the lateral extension and attached at the other end to the flexible tube; said arm having two normal positions, in one of said positions the arm extending longitudinally beyond the end of the tubular member, the flexible tube being uncollapsed, the other of said positions being back along the tubular member whereby the section of the flexible tube between the tubular member and the arm is bent and stretched over the tubular member, the arm being urged into one of said normal positions from any position intermediate thereto by the elasticity of the stretched section of tube.

7. A clamp comprising: a rigid member having a clamping surface; a flexible tube extending from said member and attached thereto; an extension projecting laterally from the rigid member; a pivot means on the extension spaced laterally from the rigid member; and an arm having one end attached to the pivot means and the other end secured to the flexible tube, the distance from the secured end of the arm to the clamping surface being less in the open and in the closed positions of the clamp than in an intermediate position.

8. A clamp as set forth in claim 6 wherein the rigid member is attached to a supporting means whereby the arm may be easily shifted from either of the normal positions to the other of said positions by pulling on the flexible tube.

9. A clamp comprising: a rigid member; a flexible tube attached to and extending from said member; a rigid, U-shaped extension, the arms of which project laterally in a generally transverse plane from the rigid member; pivot means on each of the arms of the U-shaped extension, said pivot means being spaced laterally from the rigid member; and a movable arm, one end of which is attached to the pivot means and the other end of which is secured in a slip-proof manner to a portion of the flexible tube spaced from the rigid member.

10. A clamp comprising: a rigid member; a flexible tube adapted to be bent over said member and attached thereto; an extension projecting from the side of the rigid member in a direction generally parallel thereto; a pivot means on said extension, spaced laterally from the rigid member; an arm attached at one end to the pivot means; means restricting the movement of said arm to rotation substantially in a plane around the pivot means and generally parallel to the extension; means on the other end of the arm projecting laterally from the plane of rotation of the arm, said lateral projection means being secured in a slip-proof manner to the flexible tube at a location spaced longitudinally along said tube from the rigid member, whereby rotation of the arm about the pivot means causes movement of the flexible tube in a plane spaced laterally from the plane of rotation of the arm.

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