Jan. 16, 1968 E. C. WOOD 3,363,628

HEMOSTATIC CLIP

Filed Sept. 28, 1964

FIG. 1

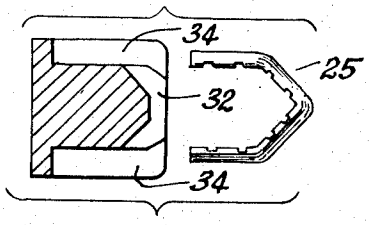



FIG. 2

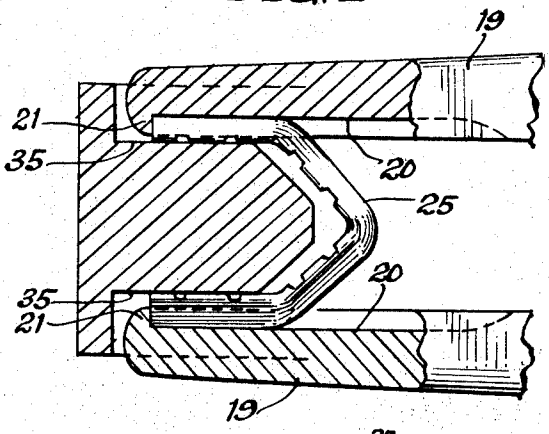



FIG. 3

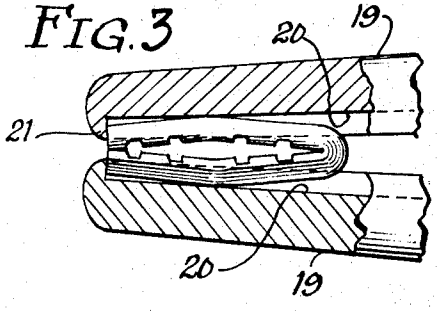



FIG. 6

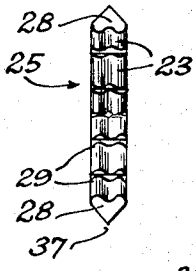
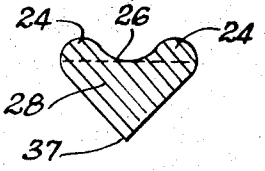



FIG. 7



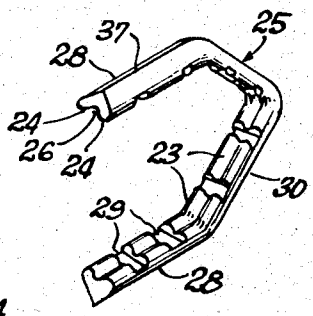
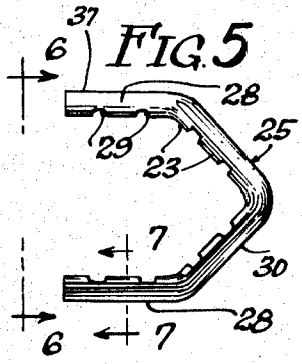




FIG. 4



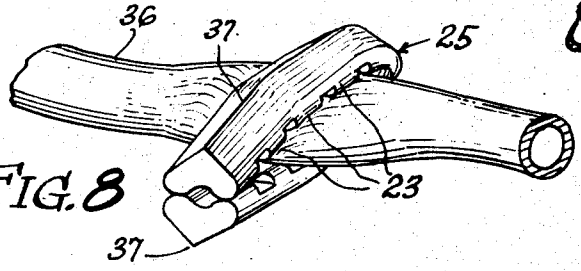




FIG. 8

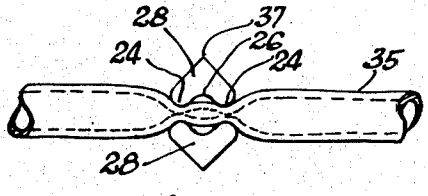



FIG. 9

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3,363,628

# HEMOSTATIC CLIP

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7 Claims. (Cl. 128—325)

This invention relates to mechanisms useful in the strangulation of tubular members. Specifically, it is directed toward devices including hemostatic clips and applicator structures useful in the strangulation of blood vessels and other fluids ducts in the human body.

The particular application of this invention to the strangulation of blood vessels will serve as an illustration of the inventive concepts enclosed herein. It will be appreciated, however, that the mechanisms embodying the concepts of this invention can be adapted for the closing of other tubular structures at intermediate points as well as near their open ends.

In the course of a surgical operation, a surgeon must often sever one or more blood vessels. It is desirable to provide means for closing the ends of the severed vessels, at least until the end of the operation, to stop bleeding that could interfere with the performance of the operation as well as present unnecessary risks to the patient.

Conventional means for closure consist of ligatures or the like tied about the individual vessels at the desired point of strangulation. The customary technique provides for the separate clamping of each vessel after the incision has been made. After clamping the vessels, a ligature is secured about each vessel providing closure and permitting the removal of the clamps. In some instances a great number of vessels must be severed after requiring one or more hours for proper closure at which point the operation may proceed. Also, the accurate placement of conventional hemostats and ligatures, particularly in confined areas or in close proximity to other hemostats and the like, often takes the ability of even the most skilled surgeon. It will be apparent that an improved technique for closure will not only obviate the excessive expenditures of time by the surgeon and his assistants under conventional practice but also the dangers to the patient inherent in any delay.

It is an object of this invention to provide mechanisms for use in the strangulation of blood vessels whereby the time required for closure is materially reduced and whereby bleeding can be terminated without the use of the excessive combination of clamping and tying operations.

It is a more particular object of this invention to provide improved mechanisms for the strangulation of blood vessels and the like whereby the blood vessels may be sealed off in a highly efficient manner to prevent bleeding during an operation and whereby the operation can proceed with a minimum loss of time as well as blood thereby to maintain conditions most favorable to the patient.

It is a specific object of this invention to provide an improved design for a hemostatic clip, which is adapted to meet the foregoing objects and an applicator structure for the insertion with a high degree of accuracy of placement of the aforementioned clip both to be used in conjunction with a holding means that will facilitate their rapid use to accomplish the aforementioned objects.

These and other objects of this invention will hereinafter appear and for purposes of illustration, but not of limitation, specific embodiments of the invention are shown in the accompanying drawings, in which:



FIG. 1 is a sectional elevational view showing the spatial relation of the clip and magazine;

FIG. 2 comprises an enlarged cross-sectional view illustrating the relative positions of clip, applicator and magazine during loading of the applicator with a clip from the magazine;

FIG. 3 is an enlarged sectional view illustrating the manner in which the jaw portions of the applicator provide for closing the clip;

FIG. 4 is a perspective view of a hemostatic clip construction designed in accordance with the concepts of this invention.

FIG. 5 is an elevational view of the clip shown in FIG. 4;

FIG. 6 is a view of the clip taken about line 6—6 of FIG. 5.

FIG. 7 is a cross-sectional view of the clip taken about line 7—7 of FIG. 5.

FIG. 8 is a perspective view of a blood vessel with a clip clamped thereon; and

FIG. 9 illustrates the strangulation of a blood vessel effected by having a clip clamped thereon.

The hemostatic clip of this invention is adapted to be formed from a triangular strip of deformable nontoxic material whereby it can be safely used in an operation. The clip to be fully described hereinafter defines a pair of arm portions with interfaces in opposed relationship. These interfaces, when clamped by means to be described, engage the outer surface of a blood vessel to effect the strangulation desired.

The applicator of this invention includes jaw portions with defining means for receiving the outer faces of the arm portion the clip. When so received the clip will be firmly held and there will be little tendency for the clip to be dislodged therefrom before being clamped to a blood vessel.

In order to further increase the efficiency of this invention, a suitable magazine or holding means is provided for mounting a plurality of clips in position to be loaded between the jaws of the applicator for use. The holding means and associated clips can be sterilized and packaged whereby they can be stored indefinitely and will be ready for use at any time. The slots defined in the holding means are dimensioned to receive therein the end portion of the jaws of the applicator means, to permit the jaws to grasp the clip contained therein and extract it from the holding means thereby eliminating the necessity of handling the clip at any time between sterilization and use in the strangulation of a blood vessel.

The accompanying drawings illustrate the structures that embody the concepts of this invention. As illustrated in FIGS. 4 through 7, the hemostatic clip of this invention comprises a triangular elongate strip 25 of deformable material having its end portions arranged in arms 28 in spaced apart parallel relation with the facing inner surfaces of the arms, corresponding to the base of the triangular cross-section, being formed intermediate their lateral edges with a valley or recessed portion 26 extending lengthwise through at least the end portion of the arms and preferably through the entire length thereof.

In the preferred practice, as illustrated, the clip is formed with but a single recessed portion which extends continuously through the central portion of the strip but

it will be understood that the inner face of the strip may be formed with more than one such recessed portion in side by side parallel relation. The ridges 24 formed alongside the recessed portion are preferably formed to curvilinear shape and the inner surfaces are preferably, but not necessarily, formed with longitudinally spaced part, crosswise extending serrations 29 which extend continuously crosswise of the strip from edge to edge.

The strip is formed of non-toxic material, such as stainless steel, plastics and like materials, which are capable of being deformed and which retain the amount of deformation for fixedly clamping blood vessels therebetween.

In the illustrated modification, the bail portion 30 of the strip intermediate the spaced arms 28 is bent to substantially V-shape but it will be apparent that the portion intermediate the arms may be formed to other contours, such U-shape, rounded shape, or other polygonal shape.

The depth and width of the recess 26 is not sufficient to noticeably weaken the clip, yet adeqaute to leave ridges 24 that will impress a circumferential band of compression about the blood vessel whereon the clip is attached.

The crosswise extending serrations are dimensioned to have a depth and width substantially equal to the depth and width of the recess 26, and spaced to permit at least one and preferably more than one such serration to be in contact with the surface of the blood vessel upon which the clip is attached, yet not so close as to permit the distance between the center lines of the serrations to be less than twice the width of recess 26.

As illustrated in the drawings, the clip holder 31 comprises a rigid body in the form of a substantially rectangular block 40 having a recessed portion across the top and down the sides with the recessed portion 32 across the top being formed of V-shape or other shape corresponding to the bail of the clip and dimensioned to have a length corresponding to the length of the clip and a width slightly greater than the width of the clip. The recessed portion 34, which extends downwardly along the sides of the body from the opposite end of the top recess, is dimensioned to have a width slightly greater than the width of the jaw portions of the applicator or the clip, whichever is greater. With the bail of the clip seated firmly on the saddle portion 32 of the recess and with the arms extending downwardly in the recessed portion 34, the depth of the recess 34 is dimensioned to permit the ends of the clip to terminate short of the ends of the recessed portions by an amount which corresponds to the spaced relation between the end of the V-groove 20 and the end of the jaw portion, or slightly greater.

The open ends of a clip can be placed on opposite sides of the severed end of a blood vessel and, when pressure is applied to urge the jaw members 19 and 20 of the application in the direction towards each other, the clip held by the jaws will be clamped as shown in FIG. 3. The interfaces on the ends of the clip arms being the first portions to come in contact, the remainder of the interfaces encircling the blood vessel and pressing together, strangulating the vessel as shown in FIG. 8.

The clips are designed to tightly seal the blood vessel when clamped thereon and, therefore, the use of ligatures in an operation can be greatly diminished. As illustrated in FIG. 9, the ridges of the opposed interfaces of the clip engage the surface of the blood vessel at multiple locations 24 whereby more than one tight seal is formed. The advantage of several separate sealing rings in a given length of blood vessel over one single seal is that the clamping force exerted by the clip is concentrated in the circumferential compression band impressed by the ridges on the clip's interfaces rather than distributed over the enclosed length of the vessel clamped. To adequately seal the vessel less clamping pressure need be applied than is necessary with the clip with small interfaces. Such reduces the danger of crushing the vessel walls. The multiple crosswise serrations on the clip interfaces insure a firm hold on the blood vessel even with the light clamping pressure necessary to effect strangulation thereby preventing bleeding and providing an additional safety feature insuring that if the clamping pressure used to close the clip is excessive, part of the vessel upon which the clamp is fixed will remain uncrushed.



The design of the clip construction 25, which represents the preferred design, is particularly important. The provisions of the parallel portions 28 and the angled ridges 37 serve to insure a firm gripping action by the applicator. These straight sections of the clip are readily seated in the grooves 20 in the lips 19, the ridges 21 preventing the clip from sliding from the groove. The minimum thickness of the applicator is not dictated by the thickness of the clip. Rather, the applicator need only be thick enough to firmly hold the clip which, it will be appreciated, may be of a dimension greater than the lip of the applicator. Therefore, the limits on the application of the hemostatic clips of this invention in confined areas will be set by the size of the clip itself as well as the dimensions of the applicator. Also, a single applicator may be used in the application of clips of various sizes.

When it is desired to place two or more clips on one vessel, side by side, this may be readily accomplished by clamping the clips one at a time or all at once through the use of an applicator on each lip of which are defined parallel V-grooves dimensioned to securely hold more than one clip in side by side relation. Closing the jaws of the applicator will simultaneously clamp the clips held therein.

The clip of this invention is preferably formed of surgical metals which are non-toxic and which therefore can be tolerated within the body for indefinite periods of time. Representative of such metals are stainless steel, platinum and tantalum. It is also contemplated that the clips be formed of less expensive non-toxic, non-metallic materials such as plastic, or materials which are slowly absorbable in body fluids, such as collagen, gelatin, albumin, dried blood, synthetic materials, and the like.

It will be understood that various other changes can be made in the above described hemostatic clip and applicator constructions which provide the characteristics of this invention without departing from the spirit thereof, particularly as defined in the following claims.

I claim:

1. A hemostatic clip formed of an elongate deformable strip of non-toxic material comprising a pair of arms interconnected at one end and open at the other with the arms arranged in laterally spaced apart substantilly parallel relation, each of said arm portions being triangular in cross-section with a flat side facing inwardly and with the apex facing outwardly, at least one longitudinal valley and at least one crosswise serration in the flat interior surfaces of the arms facing one another.

2. A clip construction in accordance with claim 1 wherein said strip defines a V-shaped configuration and comprises an equilaterally triangular cross-section, one side of the triangle indented to conform to the longitudinal valley on the clip's interface, the depth and width of the valley sufficient to allow the ridges alongside to define multiple circumferential lines of contact upon the tubular member to which it is to be clamped without materially weakening the clip.

3. A clip construction in accordance with claim 1 wherein said strip defines a V-shaped configuration and comprises a triangular cross-section that is essentially isosceles, the base of said triangle indented to conform to the longitudinal valley on the clip's interface, the depth and width of the valley sufficient to allow the ridges alongside to define multiple circumferential lines of contact upon the tubular member to which it is to be clamped without materially weakening the clip.

4. A hemostatic clip as described in claim 1 having multiple longitudinal valleys.

5. A clip construction in accordance with claim 1

in which said strip is formed of a deformable surgical metal.

6. A clip construction in accordance with claim 1 in which said strip is formed of a material slowly absorbable in body fluids.

7. A clip construction in accordance with claim 1 in which said strip is formed from a non-metallic, deformable, sterile material.


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