

[54] HEMOSTATIC CLIP AND APPLICATOR THEREFOR

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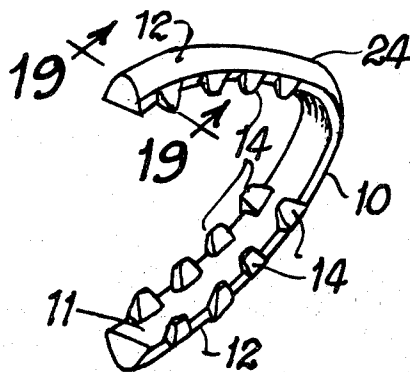
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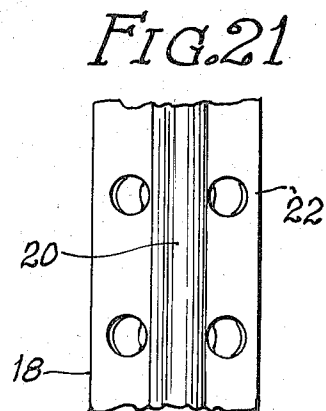
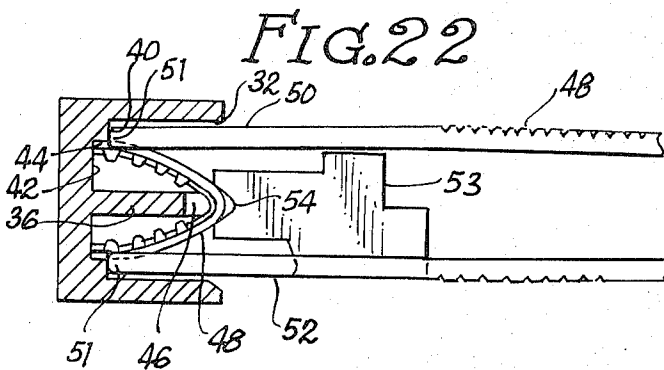
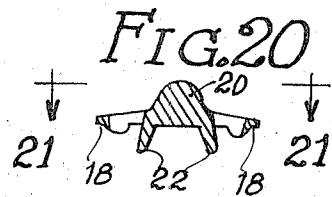
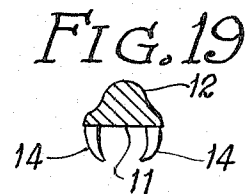
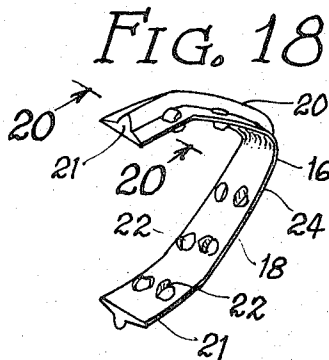
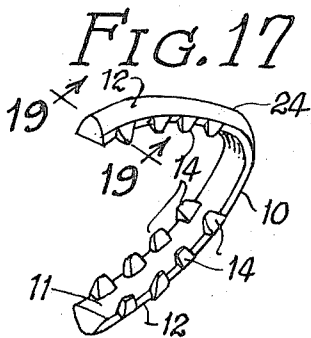
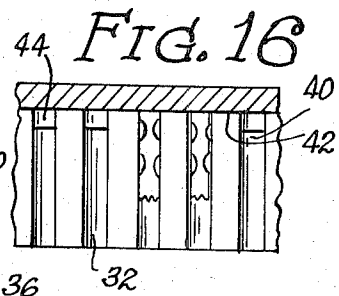
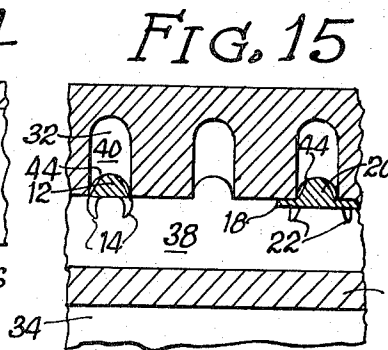
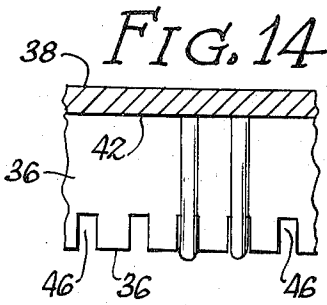
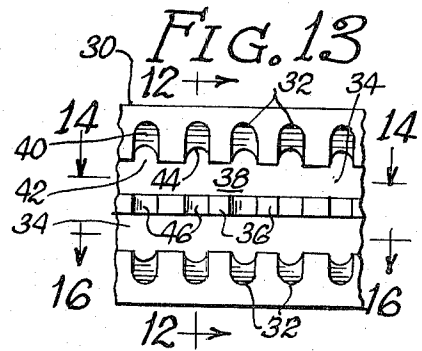
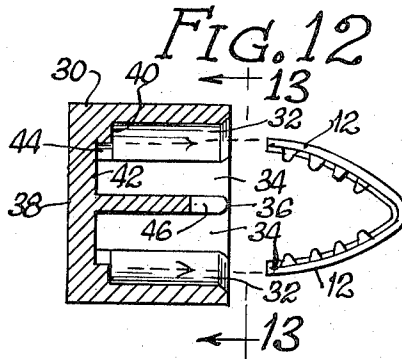
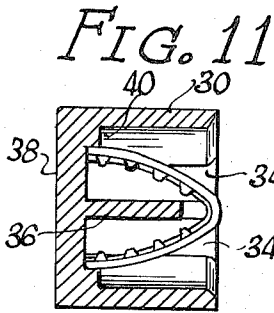
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ABSTRACT

A hemostatic clip and an applicator therefor in which the clip is formed of a pair of elongate strips defining spaced opposing arms interconnected at one end and open at the other end, with each of the arms having a plurality of teeth members on opposing faces, with the teeth members being spaced along the lateral edges of the faces. The invention further includes a forceps-type applicator comprising a pair of elongate members defining jaw portions at one end and gripping members at the other end, with one of the elongate members having an intermediate portion defining a cam member and a lip and the other of the elongate members having a slot intermediate thereof and having two raised members at the lateral edges of the slot, with the raised surfaces having profiles corresponding to the profiles of the cam member and the lip when the jaws of the applicator are in gripping relationship with a hemostatic clip. The applicator also includes a cantilever spring overlying the raised surfaces, the lip and the cam member to thereby resiliently maintain the applicator in an intermediate open position to grip a hemostatic clip.

4 Claims, 22 Drawing Figures





HEMOSTATIC CLIP AND APPLICATOR THEREFOR

This invention relates to mechanisms useful in the strangulation of tubular members, and more particularly to devices including hemostatic clips and applicators therefor useful in the strangulation of blood vessels and other fluid ducts in the human body.

The invention will be described herein in reference to the strangulation of blood vessels, although it will be understood by those skilled in the art that devices embodying the concepts of the invention are likewise adapted for closing tubular structures in general, not only near their open ends but also on intermediate points.

In nearly any surgical operation, one or more blood vessels must be severed. It is generally desirable to provide means for closing the ends of the severed vessels, at least until the end of the operation, to stop bleeding which would otherwise interfere with the operation and result in the loss of large amounts of blood or other fluids. Until recently, it was the practice to employ ligatures or the like which were tied about the vessel at the desired point of strangulation. The customary procedure calls for the separate clamping of each vessel after the incision has been made; after the clamping of the vessels, a ligature is secured about each vessel providing closure and permitting removal of the clamps. In some instances, a great number of vessels must be severed, requiring hours of operating time, before the operation can proceed.

Substantial improvements in operating techniques have been provided by improved hemostatic clip constructions and applications therefor as are described in U.S. Pats. Nos. 3,270,745, 3,326,216, 3,363,628, 3,439,522. In the foregoing patents, the hemostatic clips are formed of a deformable, non-toxic material and include a pair of spaced arms adapted to be clamped about blood vessels and the like to strangle the vessel. The foregoing patents also describe applications for such clips in which the applicators are of the forceps type or the pliers type and are used in the application of the hemostatic clips to secure the clips to the vessels.

This invention relates to further improved applicator means and improved hemostatic clips and magazines therefor.

It is accordingly an object of this invention to provide a further improved applicator for hemostatic clips in which the applicator is adapted to engage a hemostatic clip to remove the clip from a magazine therefor, in which the applicator is adapted to engage the clip to secure the clip in the applicator and in which the applicator includes means to provide resistance to closure of the applicator loaded with a hemostatic clip to prevent the clip from being inadvertently deformed prematurely through finger pressure.

It is another object of this invention to provide a further improved hemostatic clip and magazine therefor in which the hemostatic clip is provided with improved means to secure the clip onto a tubular vessel or the like without slippage, and in which the magazine is adapted to contain the hemostatic clips to prevent damage to or contamination thereof and to facilitate removal of the improved hemostatic clips for rapid and simple application.

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

FIG. 1 is a side view in elevation showing a clip applicator embodying the concepts of this invention;

FIG. 2 is a top view in elevation showing the applicator of FIG. 1;

FIG. 3 is a top view of the applicator shown in FIG. 2, with spring means displaced to expose the biasing mechanism;

FIG. 4 is a detailed view of the applicator shown in FIGS. 1 to 3, with the clip engaged therewith;

FIG. 5 is a detailed view of the biasing mechanism illustrated in FIG. 3, with the applicator in the closed position;

FIG. 6 is a detailed view of the applicator of this invention in the maximum open position;

FIG. 7 is a sectional view taken along the lines 7—7 in FIG. 1;

FIG. 8 is a sectional view taken along the lines 8—8 in FIG. 1;

FIG. 9 is a detailed view of the biasing cam of the applicator of the invention;

FIG. 10 is a detailed view of the spring assembly of the applicator of the invention;

FIG. 11 is an end view of the hemostatic clip magazine of the invention, having a hemostatic clip positioned therein;

FIG. 12 is an end view of the magazine shown in FIG. 11, illustrating removal of a clip therefrom;

FIG. 13 is a sectional view taken along the lines 13—13 in FIG. 12;

FIG. 14 is a sectional view taken along the lines 14—14 in FIG. 13;

FIG. 15 illustrates the engagement of hemostatic clips in the magazine illustrated in FIGS. 11 to 15;

FIG. 16 is a sectional view taken along the lines 16—16 in FIG. 13;

FIG. 17 is a perspective view of one embodiment of an improved hemostatic clip of the present invention;

FIG. 18 is a perspective view of another embodiment of an improved clip of the invention;

FIG. 19 is a sectional view taken along the lines 19—19 in FIG. 17;

FIG. 20 is a sectional view taken along the lines 20—20 in FIG. 18;

FIG. 21 is a sectional view taken along the lines 21—21 in FIG. 20; and

FIG. 22 is a view of the magazine shown in FIGS. 11 to 16, illustrating the removal of clips therefrom with an applicator.

The hemostatic clip of the invention is adapted to be formed of a deformable non-toxic material whereby it can safely be used in a surgical operation. The clip, which is more fully described hereinafter, includes a pair of arm portions with interfaces in opposed relationship. These interfaces, when clamped, engage the outer surface of a blood vessel or other fluid duct to effect strangulation of the vessel or duct.

The applicator of this invention includes jaw portions with means for receiving the outer faces of arm portions of hemostatic clips and means to provide resistance to opening and closing the jaw portion to securely hold the clip in the jaws of the applicator to pre-

vent premature, inadvertent closing of the clip and to prevent loss of the clip from the jaw portions.

To further increase the efficiency of the invention, a suitable magazine or holding means is provided for mounting a plurality of clips in position to be loaded between the jaws of an applicator for use. The magazine and associate clips can be sterilized and packaged whereby the package can be stored indefinitely and will be ready of use.

The accompanying drawings, in FIGS. 11 through 22, illustrate the improved hemostatic clip of this invention. In one embodiment, as shown in FIG. 17 of the drawing, the hemostatic clip includes an elongate strip 10 of a deformable material having its end portions arranged in arms 12 in spaced apart parallel relation, with the facing or opposing inner faces 11 of the arms being formed with a series of teeth-like projections 14 extending inwardly toward the opposite arm along the lateral edges of the arms 12. In the embodiment shown in FIG. 17 of the drawing, the clip is formed with a parabolic cross-section. The teeth 14 extend along the lateral edges of each of the opposing faces 11 and thereby prevent slippage of the clip once it has been engaged in a clamping relationship with the blood vessel or the like. As is shown in FIG. 17, the teeth 14 are preferably aligned on either lateral edge of each face 11 of the arms 12; however, as will be appreciated by those skilled in the art, the teeth 14 can be staggered along the opposite lateral edges of each arm 12.

The clip 10 is formed of a non-toxic material, such as stainless steel, plastics, and the like, which are capable of being deformed and which retain the amount of deformation for clamping the blood vessels or the like fluid ducts between the arms 12.

In accordance with another embodiment as shown in FIGS. 18, 20 and 21 of the drawing, the clip 16 can be formed of a substantially flat strip 18 having an integral rib 20 which extends longitudinally over substantially the entire length of the strip 18. In this embodiment, a plurality of teeth 22 can be provided on each arm 21 of the clip 16. In the preferred practice of this embodiment of the invention, the teeth 22 are formed from the strip 18 by punching out a portion of the metal forming the strip 18 to thereby define the teeth 22 which extend toward the opposing arm.

Thus, the embodiment shown in FIG. 18 provides a clip of somewhat increased width, but nevertheless includes a plurality of teeth 22 spaced over the width of the strip 18 and extending longitudinally along the strip to provide increased guiding means to thereby prevent slippage of the clip in clamping engagement with a blood vessel or the like.

The teeth 22 of the embodiment shown in FIG. 18 are somewhat different from those illustrated in FIG. 17 in that the teeth 22 are in the form of hollow circular teeth; these teeth can simply be formed by punching out the metal forming the strip 18 to thereby provide a cylindrical projection having a sharp edge adapted to engage a blood vessel or the like when the clip is closed around the vessel to effect strangulation thereof.

In the illustration of the clips of FIGS. 17 and 18, the bail portion of each of the clips intermediate the spaced arms 12 and 21, respectively, is bent to a substantially V-shaped configuration, but it will be apparent to those skilled in the art that the portions intermediate the arms may be formed to other configurations, such as a U-shape, rounded shape or other polygonal shape.

The magazine for use with the clips of the invention is shown in FIGS. 11 to 16 and 22 of the invention. The magazine 30 is in the form of a rectangular block having a pair of slots 34 extending longitudinally over the length of the magazine 30 on either side of a centrally disposed, longitudinally extending partition member 36. Positioned on either side of the partition member 36 are a plurality of opposing aligned slits 32 adapted to receive clips of the type illustrated in FIGS. 17 or 18 of the drawing and which extend upwardly from the base 38 of the magazine to the top opposite the base.

The bottom of slots 32 is defined in part by the inner face 42 of the base 38 and in part by a raised surface 40. The face 42 and the raised surface thus define a step at the bottom of the slots 34; the arms of the clips are adapted to abut the inner face 42 of the bottom of the slots 32 and an applicator, when inserted into the magazine for loading and removal of a clip, abuts the raised surface 40 as hereinafter described.

The inner face 42 of the base and the raised surface 40 define a curved surface 44 extending upwardly from the base to the raised surface in each slot 32. The opposing curved surfaces of opposing slots 32 on either side of the partition member 36 are spaced each from the other by a width slightly less than the width between the arms of the clip. Thus, as shown in FIGS. 11 and 12, the outer portions of the arms 12 are adapted to be engaged between the curved surfaces 44 to securely hold the clip in the slits 32.

The longitudinally extending slots 34 communicate with the upwardly extending slots 32, with the longitudinally extending slots having a depth corresponding to the length of the clip.

The partition member 36 serves to further support the clips in the magazine. In the preferred embodiment of the invention, the partition member is provided with slits 46 extending crosswise therein in alignment with the slots 32 whereby the bail of the clips is received in the slits 46 to maintain a separation between the clips in the adjacent slots 32 and thereby insure alignment of the clips for removal by a suitable applicator as hereinafter described.

In the use of the clips of the invention in the strangulation of blood vessels or the like, the clips are first loaded on an applicator as shown in FIGS. 12 and 22 of the drawing. The applicator employed can be one of those described in the foregoing U.S. patents or the improved applicator of this invention; the applicator illustrated in FIG. 22 of the drawings is a forceps type applicator as described in the above patents.

Referring to FIGS. 12 and 22, the applicator 48, which includes a pair of opposing jaws 50 and 52 adapted to engage the arms of the clip by means of grooves in the jaws, is inserted into the slots 32 containing a clip 49 which can be either the clip of FIG. 17 or the clip of FIG. 18. The tips 51 of the jaws 50 and 52 are advanced to the slot until the tips abut the raised surface 40 and the jaws are closed slightly to disengage the arms of the clip from the curved surfaces 44 of the magazine. After disengagement from the curved holding surfaces, the arms of the clip spring outwardly as shown in FIG. 12, and the clip is removed from the magazine, while secured between the jaws of the applicator, by sliding the clip through the slots 32 ready for use.

The clip, after removal from the magazine, can be applied to a blood vessel or vessels by closing the jaws of

the applicator with the clip positioned about the vessel or vessels whereby the clip is deformed about the vessel or vessels to effect strangulation thereof. The lateral spaced teeth, which extend intermittently over the length of the arms of the clip, serve to prevent slippage of the clips in the closed position.

The improved applicator of this invention is illustrated in FIGS. 1 to 10 of the drawings. The applicator comprises two pivotally joined elongate members 60 and 62, each of which includes a jaw portion 64 or 66, respectively, adapted to engage a hemostatic clip therebetween. For this purpose, the opposing faces of the jaw portions are formed with elongate grooves 70 and 68, respectively, which are adapted to engage the arms of a hemostatic clip, such as clips of the type described in the foregoing patents or the improved clips of this invention. Opposite the jaw portions, the elongate members are provided with gripping members 72 and 74.

The pivoting action of the applicator of the invention is provided by means of a slot 76 formed in one of the elongate members 60 which is adapted to receive an intermediate portion of the other elongate member 62. As is most clearly illustrated in FIG. 8 of the drawing, the pivotal action is provided by way of a pin 80 or the like which extends through an opening 82 in the intermediate portion 78 into openings 84 in the elongate member 60. Thus, the elongate members 60 and 62 are pivotal relative to each other about the pin 80 as an axis.

The configuration of the intermediate portion 78 of the elongate member is shown in detail in FIG. 9 of the drawing. The intermediate portion 78 includes a cam member 86 integral therewith and a longitudinally spaced, raised surface or lip 88 adjacent to the jaw portion 66 of elongate member 62.

Elongate member 60 is provided with a corresponding profile along the lateral edges of the slot 76. As shown in FIGS. 3 and 10, the elongate member 60 is provided with raised portions 90 on opposite lateral edges of the central slot 76 corresponding to the cam member 86 and longitudinally spaced raised portions 92 on the lateral edges of the slot corresponding to the raised portion 88 on the intermediate portion 78.

As is shown in FIG. 1 of the drawing, when the jaw portions 64 and 66 are in an intermediate open position, the cam member 86 is in a position corresponding to that of the raised portions 90 adjacent to the cam member; in other words, the profile of the cam member 86 matches that of the raised portions 90. Similarly, the longitudinally spaced raised portion or lip 88 is in a position corresponding to that of raised portions 92.

However, when the jaw portions are displaced toward a closed position by displacing the gripping members 72 and 74 toward each other, the cam member 86 is thrust upwardly beyond the corresponding raised portions 90 adjacent the slot 76. Similarly, when the jaw portions are displaced toward an open position by displacing the gripping members 72 and 74 away from each other, the lip 88 is thrust upwardly beyond the corresponding raised surfaces 92 along the lateral edges of the slot 76.

The applicator of this invention is provided with a

substantially flat cantilever spring member 94 which is mounted adjacent one end to the elongate member 60 by suitable means such as a rivet or the like. As is shown in FIGS. 1 and 4, the spring member 44 presses downwardly on the cam member 86 and the corresponding raised portions 90 to maintain the jaw portions in an intermediate equilibrium position with matching profiles. This position is preferably such that the jaw portions securely grip a hemostatic clip 49 (FIG. 4) therebetween. Simultaneously, the spring member depresses lip 88 so as to maintain the profile of lip 88 the same as that of raised portion 92.

In this way, the applicator of this invention is maintained in an equilibrium clip-gripping position. As the jaw portions are closed by displacing the gripping members 72 and 74 toward each other, the cam member is thrust upwardly against the spring member 94 to thereby provide resistance to closure of the jaw portion. This resistance to closure prevents premature inadvertent closure of the hemostatic clip. Similarly, as the jaw portions are opened, the lip 88 is thrust against the action of the spring member 94 to prevent unintentional loss of the clip from the jaw portions.

Thus, the applicator of the invention is biased toward an intermediate gripping position in which a hemostatic clip is secured between the jaws thereof. Accidental loss of the clip from the applicator is prevented since the jaws can be opened only by displacing the gripping members away from each other, against the action of the spring member. Inadvertent closure of the jaws and consequently a hemostatic clip engaged between the jaws is prevented since the jaws can be closed only by displacing the gripping members toward each other against the action of the spring member.

The applicator of this invention can be used with the improved hemostatic clips of this invention. In addition, the applicator can also be used with the hemostatic clips described by the foregoing patents.

It will be understood that various changes and modifications can be made in the details of construction, operation and use without departing from the spirit of the invention, especially as defined in the following claims.

I claim:

1. A hemostatic clip formed of an elongate, substantially flat strip of a non-toxic material defining a generally V-shaped clip, said clip having spaced aims and being formed of a bail end and open opposite the bail end, said arms having opposing faces providing longitudinally continuous, smoothly curved surfaces a plurality of teeth members on said faces, said teeth members being spaced along the lateral edges of said faces, with a portion of said surfaces extending between the teeth on opposite lateral edges, and a rib extending longitudinally along the strip opposite the faces.

2. A clip as defined in claim 1 wherein the teeth members are in crosswise alignment on said faces.

3. A clip as defined in claim 1 wherein the teeth members are in the form of substantially circular projections extending toward the opposing faces.

4. A clip as defined in claim 1 wherein the teeth members are positioned at intervals longitudinally over the length of said arms.

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