April 22, 1969 E. C. WOOD 3,439,522

HEMOSTATIC CLIP AND APPLICATOR

Filed May 17, 1967

FIG. 2

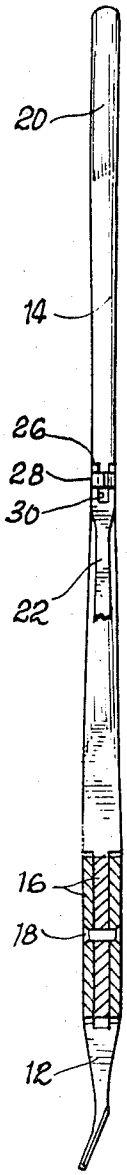


FIG. 1

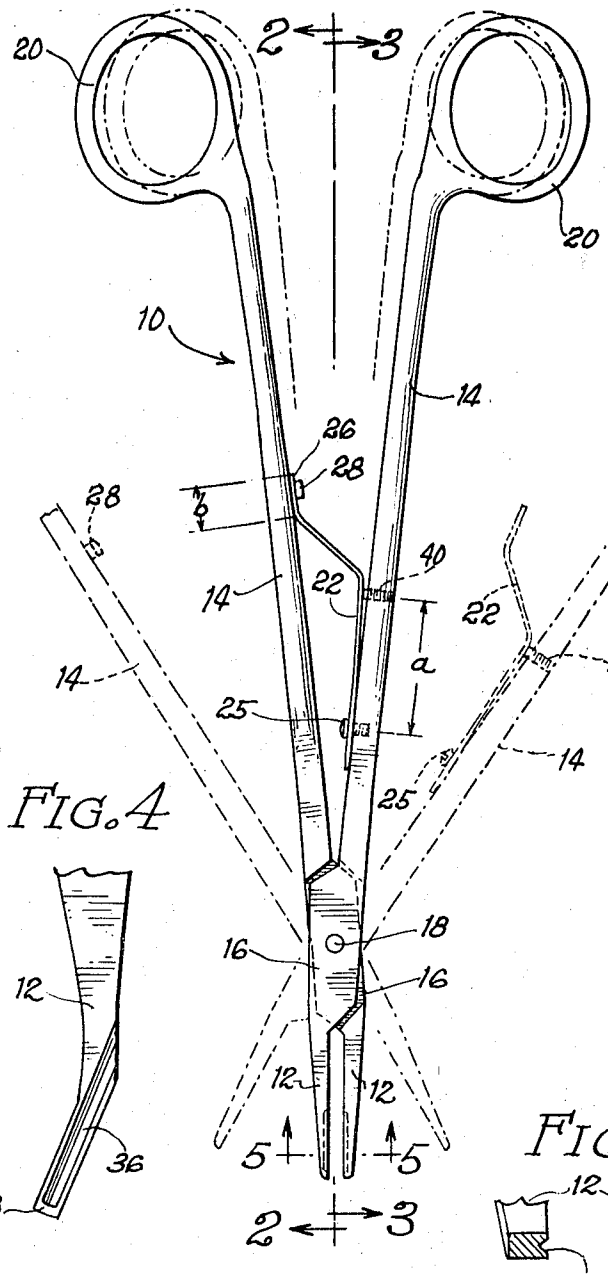


FIG. 3

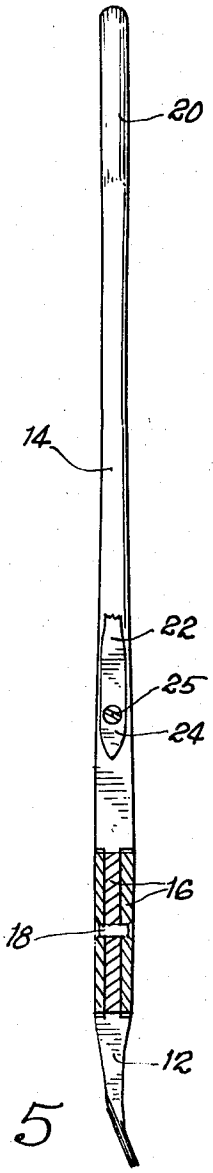


FIG. 4

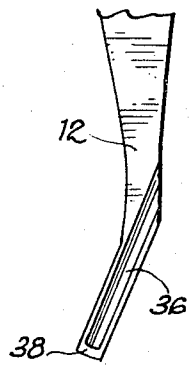


FIG. 5

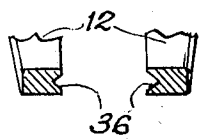
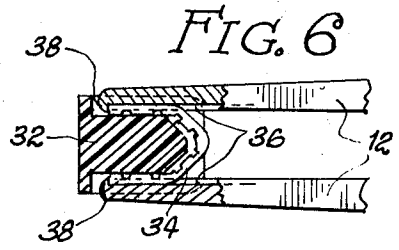


FIG. 6



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HEMOSTATIC CLIP AND APPLICATOR

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Int. Cl. B21d 9/08
U.S. Cl. 72—410 9 Claims

ABSTRACT OF THE DISCLOSURE

A hemostatic clip applicator comprising opposed jaw members and opposed handles formed as extensions of the jaw members with a spring normally retaining the jaw members and the handles in spaced apart relationship. The spring is releasibly connected at one end to one of the handles so that spreading of the handles beyond a normal open position will result in release of the connection of the spring with the handle. A spring tension adjusting means in the form of a set screw is associated with the opposite handle.

This invention relates to a hemostatic clip applicator. The applicator is specifically designed for use in conjunction with hemostatic clips used in the strangulation of blood vessels and other fluid ducts in the human body.

Applicant's copending application Ser. No. 399,753, and now Patent No. 3,363,628, provides a description of hemostatic clips of the type referred to. As in the case of this copending application, the concepts of this invention will be specifically described with reference to the strangulation of blood vessels. Other uses of the constructions described herein are also contemplated.

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; 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 taxes the ability of even the most skilled surgeon. It will be apparent that in 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.

The clip constructions described in the aforementioned application provide the desired improvements. This application also refers to an applicator for the clips which embodies certain highly desirable features. The applicator is characterized by certain drawbacks, however, in that difficulties are encountered during sterilization and due to the fact that the spring means associated with the applicator is susceptible to deformation whereby consistent operation could not be insured.

It is a general object of this invention to provide a hemostatic clip applicator which is particularly suitable for use in conjunction with hemostatic clips.

It is a more specific object of this invention to provide

a hemostatic clip applicator which includes structural elements designed to facilitate proper sterilization and designed to provide consistency in operation.

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

FIGURE 1 is a plan view of a hemostatic clip applicator characterized by the features of this invention;

FIGURE 2 is a longitudinal, sectional view taken about the line 2—2 of FIGURE 1;

FIGURE 3 is a longitudinal, sectional view taken about the line 3—3 of FIGURE 1;

FIGURE 4 is an enlarged fragmentary view illustrating the inner face of a jaw member;

FIGURE 5 is an enlarged fragmentary cross-sectional view taken about the line 5—5 of FIGURE 1; and,

FIGURE 6 is an enlarged fragmentary view, partly cut away, illustrating the manner in which a clip is removed from a clip holder.

The applicator of this invention is specifically designed for use with hemostatic clips having interconnected parallel arm portions. The applicator is of standard design in that it includes opposed jaw members adapted to hold a clip and opposed handles comprising continuations of the jaw members; the handles and jaw members being provided on opposite sides of a pivotal connection. Spring means are interposed between the handles to normally maintain the jaw members in an open position.

One specific improvement of this invention comprises a spring retaining means positioned on one of said handles. Means are associated with one end of the spring means for connection with the retaining means. This connection is maintained in all positions of the applicator between the maximum spreading accomplished by the spring means and the closed position.

The connection between the spring means and the handle is adapted to be broken when the handles are forced apart to a point beyond the opening provided by the spring means. When the connection between the handles is broken, the applicator can be opened to a position of maximum exposure, particularly in the area of the pivot point, whereby thorough sterilization can be accomplished. The connecting means is such that the applicator can be quickly restored to operating condition.

A further feature comprises a means for adjusting the spring tension. This is of importance since the springs employed may become slightly distorted after a period of use whereby the spring characteristics will change. With the adjusting feature, such changes can be compensated whereby consistent operating characteristics can be achieved. The adjusting means is also of importance when the applicator is newly assembled in view of natural variations in the spring means employed.

The accompanying drawing illustrates an applicator **10** embodying the characteristics of this invention. The applicator includes opposed jaws **12** and handles **14** formed as continuations of the jaws. A "boxed hinge" is formed by opposed sections **16** formed intermediate the jaws and handles. These sections pivot about the pin **18**. The extremities **20** of the handles **14** define finger holes for use in operating the applicator.

The jaws **12** and handles **14** are normally held in spaced apart relationship by means of a leaf spring **22** interposed between the handles. One end **24** of the leaf spring is secured to one handle by means of the screw **25**. The opposite end **26** is releasably held by means of pin **28**.

The end **26** of the leaf spring defines an open ended slot **30**, and the shank of the pin **28** is normally received

in this slot. Enlarged head of the pin serves to hold the end of the spring in the desired position.

FIGURE 6 illustrates a holder **32** for retaining hemostatic clips **34** of the type shown in the aforementioned application. As explained in this application, the jaws **12** preferably define V-shaped grooves **36** which terminate in ridges **38** formed at the outer ends of the grooves. The spring **22** should provide a space between the jaws **12** which will permit automatic gripping of a clip by the applicator. The spacing is such that the ridges **38** will be spaced apart by a distance similar to the width of the clip **34**. The jaws **12** will be forced apart as the ridges **38** move along the outer surfaces of the clip **34**. When the ridges **38** reach the end of the clip, the spring action will cause the jaws to snap into the position shown in FIGURE 6 with the grooves **36** confining the clip whereby the clip can be easily removed.

The instant invention provides a unique means for adjusting the pressure of the spring whereby the desired spacing of the jaws **12** can be achieved. In the embodiment shown, the adjusting means consist of a set screw **40** threaded into one of the arms **14**. The inner end of this set screw bears against the spring **22**. The other end of the set screw is exposed through the arm whereby rotation of the screw can be accomplished. It will be appreciated that movement of the set screw will result in an adjustment of the pressure exerted by the spring. Simple means are, thus, provided for achieving a spacing of the jaws **12** which will permit operation of the applicator in the manner described.

The arrangement for securing the end **26** of the applicator comprises an additional highly important feature. As suggested by the dotted line showings in FIGURE 1, the connection of the end **26** is maintained in all normal positions of the applicator. Thus, the solid line showing comprises the maximum spread achieved through the action of the spring **22**. One dotted line showing illustrates the closed position, and spring connection is maintained at points between these two positions.

When the handles **14** are forced outwardly, for example, to the other dotted line showing, the end **26** will be automatically disengaged. This provides a wide opening of the applicator which is particularly critical in the "boxed hinged" area. This area is otherwise extremely confined and, if the applicator is sterilized with the hinge in the confined state, complete sterilization of interior surfaces can be prevented. In the wide open position, this difficulty is virtually eliminated.

The automatic release of the spring **22** is extremely convennient in that it is accomplished by merely forcing the handles apart. Connection of the spring with the pin **28** can be quickly accomplished by locating the slotted end for sliding movement toward the pin **28** after closing of the handles.

The automatic release of the spring also greatly minimizes the danger of distorting the spring **22**. As pointed out, the amount of pressure exerted by the spring is quite important with respect to removal of clips from the clip holder. Without automatic release, forcing of the handles outwardly may cause bending of the spring whereby the spring pressure will be changed.

It will be appreciated that the instant invention provides even further improvement in this regard in that adjustments can be achieved by means of the set screw **40**. The operation of the set screw is enhanced by the spring design illustrated in that the distance *a* between the screw **25** and the set screw **40** is substantially greater than the distance *b* comprising the flat portion terminating in the slotted end **26**. This makes the applicator more susceptible to adjustments and it reduces the amount of downward pressure required to remove a clip from the clip holder. The design also reduces the tendency toward a compressing motion when an applicator loaded with a clip is picked up by a surgeon. This compressing motion is highly undesirable since slight crushing of the clip before closing is intended could cause the clip to fall out when the compression is removed.

It will be understood that various changes and modifications may be made in the applicator described which provide the characteristics of this invention without departing from the spirit thereof, particularly as defined in the following claims.

That which is claimed is:

1. In a hemostatic clip applicator for use with hemostatic clips having interconnected, parallel arm portions, said applicator structure comprising two opposed jaw members, opposed handles formed as extensions of said jaw members, a pivotal connection of the juncture of said jaw members and handles, and spring means interposed between said handles for normally spreading said handles and said jaw members apart to provide a spaced apart relationship therebetween, the improvement comprising a spring retaining means positioned on one of said handles, means associated with one end of said spring means for connecting said one end to said retaining means, the connection of said one end and said retaining means being maintained in all positions of said applicator between the maximum spreading accomplished by said spring means and the closed position, and wherein said connection is automatically broken when said handles are forced apart to a point beyond the maximum spreading caused by said spring means.

2. An applicator in accordance with claim **1** wherein said spring means comprises a flat metal strip having its opposite end secured to the other handle.

3. An applicator in accordance with claim **2** wherein said one end of said spring means defines a slot, said retaining means comprising an upstanding pin formed on said one arm, and slot receiving said pin when said spring means is connected to said retaining means.

4. An applicator in accordance with claim **3** wherein said pin defines an enlarged head for purposes of retaining said one end in position.

5. An applicator in accordance with claim **4** including adjusting means associated with said other handle adapted to engage said spring means at a point adjacent said opposite end, said adjusting means controlling the spacing between said spring means and said other handle at said point.

6. In a hemostatic clip applicator for use with hemostatic clips having interconnected, parallel arm portions, said applicator structure comprising two opposed jaw members, opposed handles formed as extensions of said jaw members, a pivotal connection of the juncture of said jaw members and handles, and spring means interposed between said handles for normally spreading said handles and said jaw members apart to provide a spaced apart relationship therebetween, the improvement wherein the opposite ends of said spring means are connected to the respective handles, and including adjusting means associated with one of said handles, said adjusting means engaging said spring means at a point adjacent the connection of said spring means with said one handle, said adjusting means controlling the spacing between said spring means and said handle at said point.

7. An applicator in accordance with claim **6** wherein said adjusting means comprises a set screw passing through said one handle whereby one end of the set screw contacts said spring means at said point, and wherein the opposite end of the set screw is exposed to permit movement of the set screw.

8. An applicator in accordance with claim **7** including a spring retaining means positioned on the other handle, means defined by the opposite end of said spring means for connecting said opposite end to said retaining means, the connection of said opposite end and said retaining means being maintained in all positions of said applicator between the maximum spreading accomplished by said spring means and the closed position, and wherein said connection is automatically broken when said handles

are forced apart to a position beyond the maximum spreading caused by said spring means.

9. An applicator in accordance with claim 6 wherein said spring means defines a first flat portion extending from said one end to a point adjacent the position of said adjusting means, and intermediate angularly directed portion, and a second flat portion terminating in said opposite end, and wherein said first flat portion defines a length substantially greater than the length of said second flat portion.

References Cited

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RONALD D. CREFE, *Primary Examiner.*