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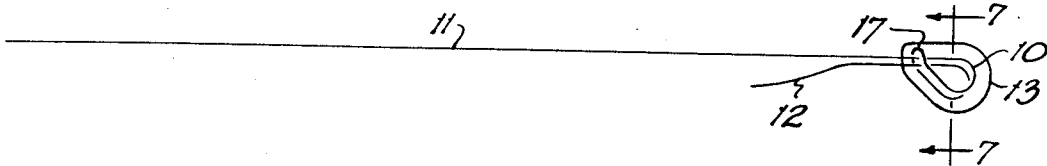
[54] **PRE-TIED SUTURE AND METHOD OF SUTURING**
 8 Claims, 7 Drawing Figs.

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 128/326, 289/1.5, 289/4

[51] Int. Cl. **A61L 17/00**

[50] Field of Search 128/335,
 326, 327, 335.5; 112/156; 289/1.5, 2, 4, 18;
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ABSTRACT: A surgical suture or the like including a pair of butterfly-loops secured in superimposed registering relation by a casing through which the loops are visible, and a pair of tails extending from the loops. A suturing method wherein one of the tails is used as a suture which pierces the tissue to be sutured and is passed through the superimposed loops, the tails then being pulled tight to convert the interlooping formation into a square knot.



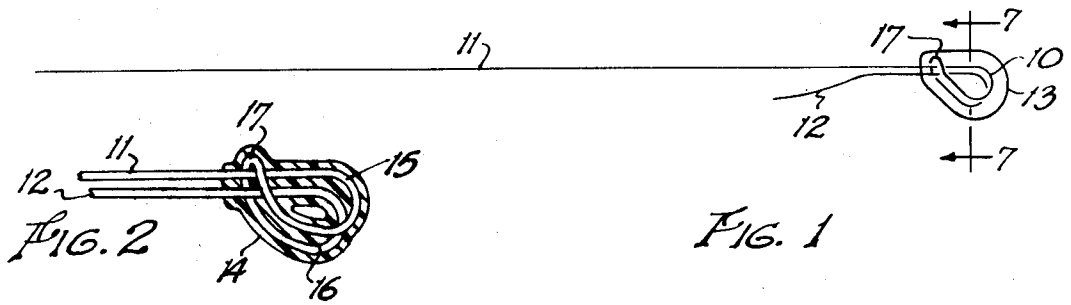


FIG. 2

FIG. 1

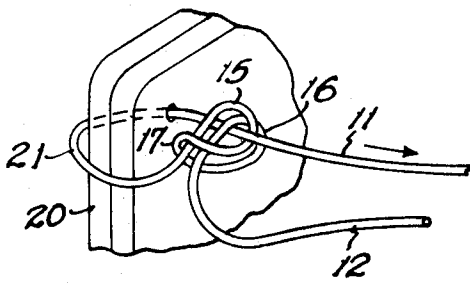


FIG. 3

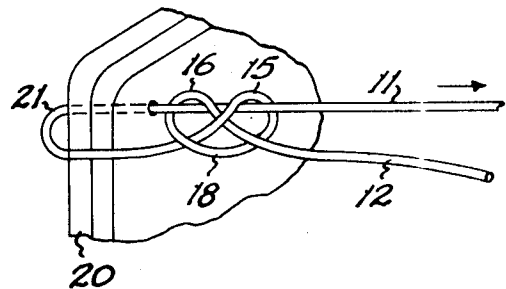


FIG. 4

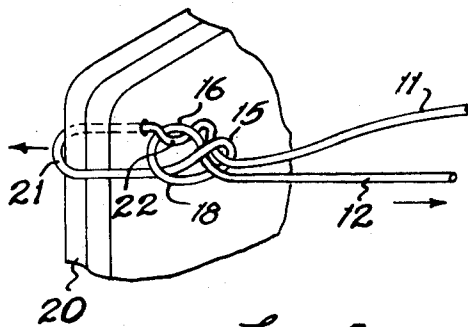


FIG. 5

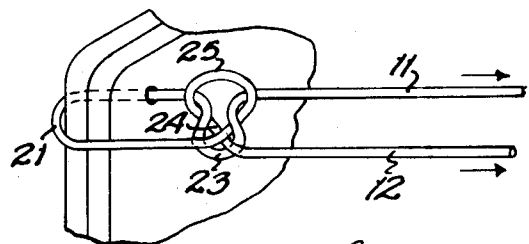


FIG. 6

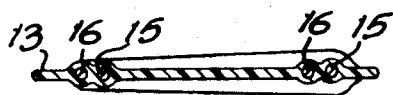


FIG. 7

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PRE-TIED SUTURE AND METHOD OF SUTURING

BACKGROUND OF THE INVENTION

In existing surgical technique, the common practice is to hand-tie the ends of a suture in a square knot or other non-slipping knot, after first threading the suture through and around the cut edges of tissues to be joined. There has been no satisfactory faster method of securing the ends of a suture, insofar as I am aware.

OBJECTS OF THE INVENTION

The general object of the invention is to speed up the tying of a knot by pre-execution of the preliminary stages of forming the knot, thus eliminating the surgeon's knot-forming procedure wherein the projecting tails of a suture are manipulated into a first intertwined relation and then a second intertwined relation to develop in each of the tails a loop through which two parallel arms of the other loop are drawn. Specific objects are:

a. to provide in one end of a suture or other tie element a preformed loop structure which can be quickly combined with the other end to form a knot;

b. to provide in a surgical suture a preformed double-loop (butterfly) formation which can be converted into a square knot simply by passing a tail of the suture through the two loops thereof and then pulling the interlooped members tight;

c. to provide such a suture including means for preserving the butterfly loops in superimposed, registering relation such that the tail can be easily threaded through both loops, using a suturing needle;

d. to provide such a suture in which the loops are embedded and thus secured in a thin, easily pierced casing of material through which the loops are visible so that a surgeon can pierce the casing with a suturing needle at a point where the suture will pass through the superimposed loops.

These and other objects will become apparent in the following specifications and appended drawings, in which:

FIG. 1 is a plan view of a suture embodying the invention;

FIG. 2 is a fragmentary plan view of the butterfly-loop portion of the suture on an enlarged scale, with a modified form of casing shown in section;

FIG. 3 is a fragmentary perspective view illustrating an intermediate step in the suturing of a pair of cut tissue edges, using the invention;

FIG. 4 shows an early stage of evolution of the butterfly-loop formation toward square knot form;

FIG. 5 shows a more advanced stage of such evolution;

FIG. 6 shows the evolved square knot; and

FIG. 7 is a cross-sectional view taken on line 7-7 of FIG. 1.

DESCRIPTION

Referring now to FIG. 1 in detail, the suture device of our invention consists generally of a length of suture filament which is looped at a point nearer one end than the other, to provide a folded butterfly-loop formation 10, a long tail 11 and a short tail 12, and a thin casing 13 in which the butterfly 10 is embedded. Casing 13 is essentially a thin film coating both sides of butterfly 10, formed by dipping or spraying. It may be of wax or plastic material and is of a nontoxic character when in contact with the flesh of a patient. It may be in the form of a thin flat wafer 13, as shown in FIGS. 1 and 7, or may be simply a sheath 14 of ring form as shown in FIG. 2.

Butterfly 10 comprises a pair of loops 15 and 16 which are superimposed in registering relation in the folded butterfly of the suture article as prepared for use (FIG. 1 or FIG. 2). The casing 13 (or 14) functions to secure the loops 15, 16 in the superimposed, registering relation so that a suturing needle may be easily threaded through the two loops. Loops 15 and 16 are joined by a connecting part which, in the folded butterfly 10, is in the form of a bight 17 and which, in the opened-out butterfly as seen in FIGS. 4 and 5, becomes a bridge 18. In the wafer 13 of FIG. 1, or in the sheath 14 of FIG. 2, the su-

perimposed loops 15, 16 and the connecting bight 17 are completely enveloped by the coating material 13 or 14, which is sufficiently soft or frangible to tear apart or disintegrate so as to allow the butterfly formation to evolve into a square knot.

THE METHOD

In the practice of our improved method in the suturing of a pair of cut edges of tissues 20, the long tail 11 is attached to a suturing needle, the folded butterfly 10 is laid against one side of the juxtaposed tissues, the tail 11 is looped around the tissues to form a suturing loop 21, the tissues and then the butterfly 10 are pierced by the needle and the tail 11 is drawn through the tissues and the two loops of the butterfly, as shown in FIG. 3. Tail 11 is then pulled in order to draw the loop 21 closely around the encircled tissues (FIG. 4); and the short tail is also pulled in order to evolve the embryonic knot formation of FIG. 3 into the square knot formation shown in FIG. 6. In order to illustrate the evolution of the knot, FIG. 4 shows the butterfly as it would appear if opened up to spread the loops apart, the loop 16 being shifted upwardly and to the left from its position seen in FIG. 3. FIG. 4 shows the butterfly in alignment with the tail 11 when pulled to a substantially straight position in drawing the suturing loop 21 tight. FIG. 5 shows the initial effect of pulling on the short tail 12 against the resistance of the suturing loop 21, an embryonic loop 22 being developed by the tightening of loop 16 in direct response to the pull of tail 12. In response to further pull on tail 12, embryonic loop 22 is drawn out into the square knot loop 23 of FIG. 6 as the loop 16 is pulled out to a substantially straight condition at 24 in FIG. 6, and the loop 18 is evolved into the other square knot loop 25 of FIG. 6 (shown in upwardly inverted relation to its position in FIG. 5).

The square knot formation is obvious in FIG. 6, but the knot (as well as suturing loop 21) are shown in a loose condition for the purpose of clarity of illustration. It will be understood that the finished knot and loop 21 are drawn tight in the finished suture. The evolving formations of FIGS. 4 and 5, for clarity, are likewise shown in a looser condition than actually exists in the evolving knot formation. Also, it should be understood that the evolution may proceed directly from the FIG. 3 to the FIG. 5 formation, the FIG. 4 configuration being for the purpose of more clearly displaying the characteristic open butterfly shape and tracing the change from butterfly to square knot form.

As one method of prelooping the end of a suture or the like, the invention contemplates the possibility of a surgeon's assistant using a suitable instrument for doing the prelooping just prior to the use of the suture by the surgeon.

Also, the invention contemplates the possibility of performing a slip knot, double square knot or double slip knot, and fixing the preformed loops in the manner described above, for subsequent knot-forming use.

Further, the invention contemplates the possibility of applying a tie element, prelooped as described above, to uses other than in surgery, e.g., industrial applications such as the sewing of clothes, leather, shoes, etc. and the attachment of buttons and other fasteners. A variety of other possible applications will suggest themselves to those who may later become familiar with the invention.

We claim:

1. A prelooped tie element comprising:

- a folded butterfly-loop formation comprising a pair of loops superimposed one upon the other in registering relation, and a bight connecting said loops;
- a tail extending from each of the respective loops, said bight being looped over said tails;
- and a casing of frangible material in which said loops are embedded and secured in said registering relation until broken therefrom by pulling upon the loops in the formation of a knotted tie in which one of said tails is first threaded through said loops.

2. A tie element as defined in claim 1, for use as a surgical suture.

3. A suture as defined in claim 2, wherein one of said tails is a relatively long one, of a length suitable for attachment to a needle and for piercing tissue material, forming therewith a suture loop around said tissue, and passing it through said butterfly loops to start the formation of a square knot;

and wherein the other tail is relatively short, of a length suitable for grasping to apply a pull to said butterfly loops.

4. A tie element as defined in claim 1, wherein said casing is in the form of a thin wafer.

5. A tie element as defined in claim 1, wherein said casing is in the form of a sheath of ring form.

6. A method of surgical suturing comprising:
utilizing a suture including a preformed folded butterfly-loop formation comprising a pair of loops superimposed one upon the other in registering relation, and a bight connecting said loops; and
a tail extending from each of the respective loops, said bight

being looped over said tails;

initially securing the loops of said folded butterfly-loop formation in said superimposed relation by means yielding to a pull on said tails to allow the evolution into a square knot;

placing said butterfly-loop formation against a tissue member to be sutured;

piercing said tissue with one of said tails, looping said one tail around the tissue to form a suture loop, and passing it through said superimposed butterfly loops;

and pulling on said tails to reduce said suture loop to tissue-suturing size and to evolve the loop and tail formation in a square knot.

7. The method defined in claim 6, wherein said initial securing means is a coating of frangible, nontoxic material.

8. The method defined in claim 6, wherein the tail used to form the suture loop is pulled in order to tighten said loop and the other tail is then pulled to develop said square knot.

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