Sept. 14, 1937. F. W. CARRUTHERS 2,093,145

SURGICAL SUTURE OR LIGATURE

Filed Dec. 17, 1936

Fig. 1.

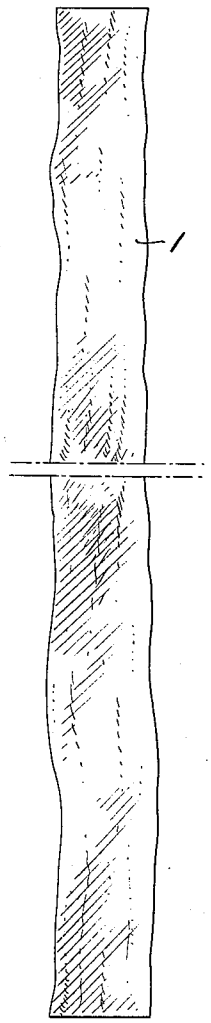


Fig. 2.

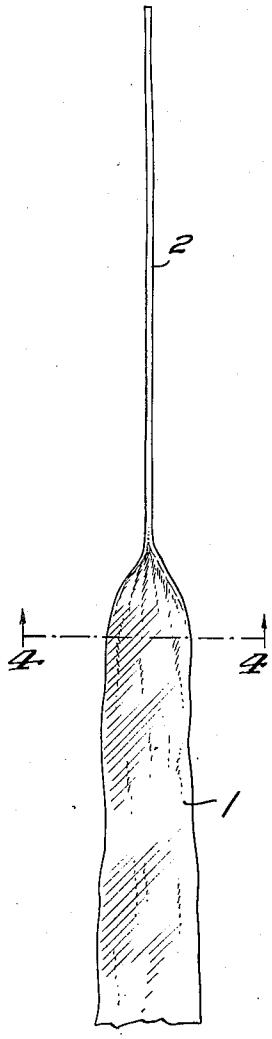


Fig. 3.

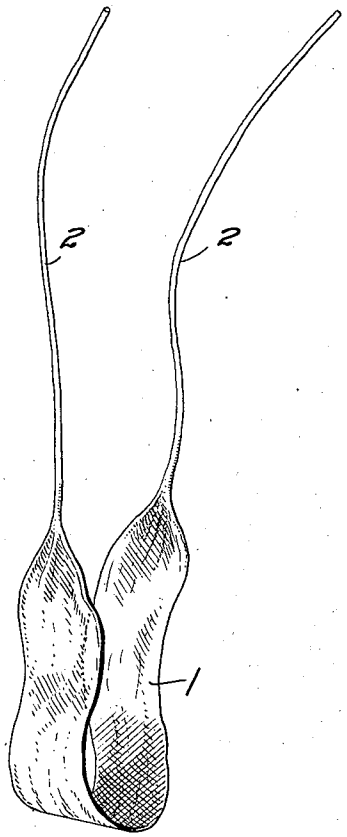
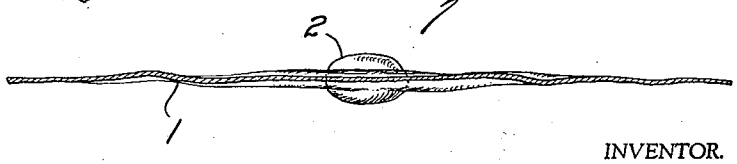


Fig. 4.



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SURGICAL SUTURE OR LIGATURE

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4 Claims. (Cl. 128—335.5)

The present invention relates to a ligature or suture and to a method of preparing the same.

The principal object of the invention is the provision of a ligature or suture or absorbable animal tissue of requisite tensile strength and absorptive properties, which will not have these properties adversely affected by heat sterilization, to devise a novel method of preparing the same.

In the application of sutures in the repair of broken bones the material frequently used consists of drawn wire of stainless steel or of silver mixed with copper. Silver wire and steel wire each possesses considerable tensile strength, but the wire must be fastened by twisting the ends because of the difficulty in knotting it. In employing such metallic sutures in holding broken or fractured bones, the wire sutures are threaded through holes drilled in the bones and hence merely hold the broken fragments together without providing any support to the fracture line. Even in breaks producing overlapping ends, such metallic ligatures, being relatively narrow, do not support the fracture line. This constitutes the greatest disadvantage of wire sutures or ligatures in bone surgery.

Another objection to the use of metallic sutures or ligatures is that the wire is not absorbable; and until such time as it may disintegrate, the metal is apt to act as a mechanical irritant to the tissues. Still another objection to the use of metallic wire sutures or ligatures is that when a Roentgen-ray (X-ray) photograph is made of those tissues in or around which the metallic suture or ligature has been placed, such metallic suture or ligature is readily visible on the photographic plate or film as a foreign body. The presence of such foreign body in the tissues might result in legal action on the part of the patient against the surgeon for malpractice in leaving a foreign body in the tissue.

Another product commonly used in bone surgery is the kangaroo tendon, which is obtained from the tail of the small kangaroo, or wallaby. The tendon bundle from a freshly-killed animal is air-dried by the trapper, and then separated into the individual tendons of various diameters constituting the tendon bundle. These individual tendons of various sizes are used for surgical sutures and ligatures; but their disadvantages or limitations in bone surgery are similar to those of metallic wire sutures in that they merely hold broken bones together and do not give any support to the fracture line.

It was this difficulty that suggested investigation of some means of producing a surgical suture or ligature which could be applied to wounds of the human body which need support, such, for example, as the fractured ends of the radius, ulna, humerus, femur and other bones. In other words, the problem was to produce a flat band in the form of a ligature or suture which would have all the characteristics of animal tissue as regards strength and absorbability, and the physical properties of which would not be adversely affected by heat sterilization and, at the same time, would have a flat, band-like portion, rather than round like a string. Such a band has many advantages and a wide field of usefulness in those surgical situations where it is desirable to distribute the pressure, incidental to tissue approximation, over a broad surface, and where support is needed, such, for instance, as in bone surgery.

To this end, the invention contemplates in its broad aspect, a surgical ligature or suture having a band-like or flattened central portion lengthwise, with unflattened ends, that is, the suture or ligature will have a width over a suitable portion of its length so as to permit it to be wrapped one or more times around a bone fracture to lend support to the fracture line, the ends thereof to be tied together over the wrapped portion to maintain the same in the proper position. The invention, therefore, also contemplates methods of preparing such a ligature or suture.

In the drawing:

Fig. 1 is a plan view of the bandlike or flattened central portion of a suture or ligature prepared according to this invention;

Fig. 2 is a partial plan view showing an unflattened end of the suture or ligature of Fig. 1;

Fig. 3 is a perspective view of a complete ligature or suture;

Fig. 4 is a sectional view along the line 4—4 of Fig. 2.

In preparing the ligature or suture of the present invention, suitable animal tendons, such as the larger sizes of kangaroo tendons, usually about 15½ inches long, are first subjected to tanning by the usual or well known chrome-tanning process as applied to animal fibers for the purpose of delaying absorption. By varying the strength of the chemicals used, as well as the duration of the chrome-tanning process, the degree of tanning may be regulated. After the chrome-tanning process, the tendons are air-dried; and their central portion lengthwise plumped by means of a suitable acid or alkaline bath. This central portion is then placed in a press having smooth or slightly roughened surfaces, which may be made of hard wood, metal, stone, porcelain, etc., and

sufficient pressure to produce the desired width of band 1 at this section then applied, leaving the end portions 2, however, in their round or oval condition. The greater the pressure, the wider the resulting band section. The optimum pressure is that which produces a band section of approximately one inch in width and .015 inch in thickness. This pressing process is carried out at room temperature of approximately 20° C., and is maintained until the band is thoroughly dry, or for approximately 48 hours.

When used in bone surgery, the primary purpose of this kangaroo band or animal tendon band is to hold in apposition the fractured ends of certain types of bones. Therefore, to accommodate the various sizes of bones, such as the radius, ulna, humerus, femur, etc., the flat band or central portion of the tendons is made of various lengths, an average being approximately 5½ inches. The length of the band is controlled by the length of the pressing plates. At each end of the band, there is left in its original round or oval shape, a string-like length of tendon of approximately 5 inches. In use, the ligature may be wrapped one or more times around the adjacent ends of the broken bones, the band lending desirable support to the line of fracture, and the unflattened ends then tied together to hold the ligature in place and the bones against displacement.

One outstanding advantage of this ligature or suture from the surgical point of view is that its physical properties are unimpaired by intense heat. This material, therefore, readily lends itself to heat sterilization, which does not affect its tensile strength, nor its absorptive properties.

While the invention has been described with particular reference to special materials and methods of treatment, yet, obviously, I do not wish to be limited thereto, but the invention is to be construed as covering all equivalents thereof and restricted only by the scope of the claims.

I claim:

1. A process of making a surgical ligature or suture which includes the steps of softening the central portion lengthwise of an animal tendon and forming this portion into a flat band while leaving the ends thereof in an unflattened condition.

2. A surgical ligature or suture of absorbable animal material having a central flattened portion and unflattened ends.

3. As an article of manufacture, a treated kangaroo tendon having a central flattened band-like portion, each end of which is left in its original round, string-like form and of a length sufficient to permit of tying the two ends as a ligature.

4. As an article of manufacture, a treated animal tendon having a central flattened band-like portion, each end of which is left in its original round, string-like form and of a length to permit of tying the two ends as a ligature.

F. WALTER CARRUTHERS.