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SURGICAL NEEDLE AND SUTURE ASSEMBLY AND METHOD OF MAKING THE SAME

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Fig. 1.



Fig. 2.

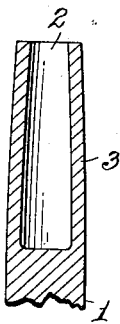


Fig. 3.

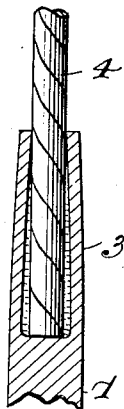
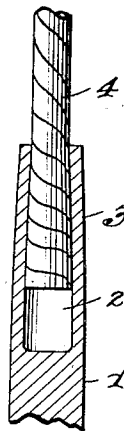


Fig. 4.



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SURGICAL NEEDLE AND SUTURE ASSEMBLY AND METHOD OF MAKING THE SAME.

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To all whom it may concern:

Be it known that I, HARRY D. MORTON, a citizen of the United States, residing in the city of New York, borough of Manhattan, in the county of New York and State of New York, have invented certain new and useful Improvements in Surgical Needle and Suture Assemblies and Methods of Making the Same, of which the following is a specification.

The following is a description of a needle-and-suture assembly and methods of making the same embodying my invention in the form and manner at present preferred by me; but it will be understood that various modifications and changes may be made without departing from the spirit of my invention and without exceeding the scope of my claims.

My invention will best be understood by reference to the accompanying drawings, in which I have illustrated the preferred manner of carrying out my invention, and in which Fig. 1 shows, partly in elevation and partly in section, a needle having in its shank a substantially longitudinal recess, cylindrical in form; Fig. 2 shows in section an enlarged view of the shank end of said needle, but with the recess altered to the form of a truncated cone tapering toward the neck of said recess; Fig. 3 shows the same view as Fig. 2 of the shank end of said needle, but with a liquid in said recess adapted to soften or to adhere to the end portion of a suture inserted therein; and Fig. 4 shows the same view as Fig. 2 of the shank end of said needle, but with the inserted end of the suture conforming to and anchored within the recess.

Like reference characters indicate like parts throughout the drawings.

Referring to the drawings, 1 is a needle which may be of any desired body form; 2 is a recess formed in the shank thereof, in any suitable manner, such as by drilling or swaging and drawing—said recess being preferably cylindrical in form and of such diameter relative to the outside diameter of the shank as to leave only a thin surrounding wall. 3 is the shank of the needle after it has been so formed, as by spinning or swaging, that the wall surrounding the recess is tapered toward the end of the shank; 4 is a suture such as is commonly employed in surgery. In order to strengthen the needle at the juncture of the solid shank and

the shell portion formed by the wall of the recess, I preferably leave a fillet between the bottom of the recess and the wall thereof.

The invention comprises simple, effective and inexpensive means whereby a suture may be firmly attached to a needle in such a manner that it can, with greater convenience and more satisfactory results than are possible by present methods, be drawn through perforations formed in tissue by said needle.

It has been customary in surgery to thread a suture through an eye formed in the shank of a needle and transversely of the axis thereof. Where there has been employed suture material such as catgut, which, in its dry state, is hard and unyielding, it has been usual for surgeons, after threading the needle, to immerse the shank thereof in some fluid such as warm water, in order to soften the portions of the suture adjacent the needle, so that they might not, in passing through the opening in live tissue formed by the needle, too greatly enlarge such opening and thereby cause unnecessary laceration. In emergency cases, the surgeon can ill afford to take the time required for thus softening the end of the suture. If the suture is not softened before being used, and if it is of a size approaching that of the shank of the needle, the perforation formed by the needle is necessarily enlarged by the drawing therethrough of the double thickness of suture material—the size of the perforation being thereby increased to about three times that of the diameter of the suture. When sewing a wound in delicate tissue, it frequently occurs that, in its passage through the perforation, the shoulder formed by the loop of hard suture material causes such extensive laceration that the stitches tear out.

It has heretofore been proposed to attach a suture to the shank of a needle by annealing and flattening an end portion of the shank, bending such flattened portion into a U-shape, laying an end of the suture in the groove so formed, and bending the sides of the flattened shank portion down over the end of the suture to clinch the same. This construction is open to the objection that it does not leave the surface of the needle smooth, because there are, of course, two seams therein—one being longitudinal, and the other partly circumferential, of the shank. Further, the thin, flattened portion of the shank being soft, there is always the

likelihood that this unhardened end of the needle may become bent, or that one or other of the thin sides may be accidentally turned outward, resulting in unnecessary laceration of the tissue. In annealing the shank of the needle preparatory to flattening the end thereof, a portion of the shank above the point where the flattening is to terminate is necessarily also annealed. It is customary to apply forceps to the needle to draw it through the tissue, and these forceps are quite likely to roughen or distort this unhardened portion of the shank. With my invention it is unnecessary to anneal any part of the needle; and the needle is, moreover, left with an entirely smooth outer surface and of a diameter only slightly greater than that of the suture.

In carrying out my invention, I preferably form in the shank of the needle a substantially longitudinal recess having an inner diameter greater than the neck diameter thereof, and anchor therein an end portion of the suture. For example, as shown in the drawings (Fig. 1), I first form, as by drilling or swaging and drawing, such a recess of substantially cylindrical shape and of a diameter a trifle larger than the diameter of the suture. I then constrict the neck diameter of the recess (as by spinning or swaging) so that it is only slightly greater than the diameter of the suture. The needle is then hardened and tempered in the usual manner. I may then place in the recess a small quantity of some inert material such as cement which will, upon setting, adhere to the suture material, the outer surface of the mass of cement conforming to the shape of the recess—thus effectually anchoring the suture therein. The wall of the recess requires to be only a few thousandths of an inch in thickness, and with this construction but slight taper in the recess is necessary in order to effect a secure anchoring of the suture therein. Thus the needle need not be unduly large, but of only slightly greater diameter than the suture, which therefore passes through the perforation without enlarging the same, hence reducing the possibility of the stitches tearing out.

It will be apparent to those skilled in the art that longitudinal recesses of other forms may be employed, which, by the methods I describe, will permit of effectually anchoring the suture therein. For example, the wall of the recess may be cylindrical and may be tapped with a screw thread to give both large and small internal diameters for anchoring purposes; or the inside of the recess wall may be otherwise scarified in such a manner as to provide adequate anchorage.

With some readily softening suture materials, it is not necessary to employ for

anchorage purposes a substance which, upon setting, adheres to the suture and conforms to the shape of the recess. For example, catgut readily absorbs and is softened by water; and other suture materials may be softened by other suitable means. When employing catgut, water or other suitable fluid may be placed in the recess and an end of the suture immersed therein, which end, when sufficiently softened, may be expanded by pressure applied between the needle and the hard portion of the suture outside the recess. This causes the softened inner portion of the suture to upset and to conform to the shape of the recess. Upon drying, the end of the suture is thereby anchored in the recess. Moreover, some suture materials, such as catgut, are characterized by the fact that, upon being softened by wetting, they expand in diameter, and, upon hardening, they have a diameter larger than before being wetted. With such materials, no pressure may be necessary—the expansion alone being sufficient to insure efficient anchoring. I have found that catgut, upon being wetted and subsequently dried, shows an increase in diameter of from 15% to 20%—apparently without losing its original hardness and toughness. I preferably employ a softening material which does not rust steel. For example, when water is used, I render it non-rusting by dissolving therein soap or some other suitable substance. I may increase and expedite the softening action of the water by raising its temperature through heat applied to the shank of the needle.

It is to be understood that needle-and-suture assemblies made in accordance with my invention are to be sterilized and hermetically sealed, in a well-known manner, and that they are to be employed in a single surgical operation only.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. The method of attaching a suture to a needle, which consists in forming in said needle a blind recess having a constricted opening, inserting an end of a suture in said recess and thereafter attaching said end to said needle by an anchorage of greater diameter than the constricted opening of said needle.

2. The method of attaching a suture to a needle which consists in forming a blind recess in the shank of the needle, constricting the neck of such recess, inserting a suture in such recess and maintaining such inserted portion therein by an anchorage of greater diameter than the constricted opening of said needle.

3. The method of attaching a suture to a needle which consists in forming a blind recess in the shank of the needle, inserting an

end of the suture in said recess and expansively anchoring the same therein.

4. The method of attaching a suture to a needle which consists in forming in said
5 needle a blind recess constricted in diameter near the opening thereof, inserting an end of the suture in said recess and upsetting a portion of said end to anchor it in said recess.

10 5. The method of attaching a suture to a needle which consists in forming in the shank of said needle a blind recess having an internal diameter some part of which is greater than its neck diameter, inserting a
15 portion of the suture in said recess and increasing the diameter of such inserted portion to anchor it in said recess.

6. The method of attaching a suture to a needle which consists in forming a recess in
20 said needle, inserting an end of the suture in such recess, softening such inserted end, expanding such end while softened, and permitting such end to harden in an expanded condition.

25 7. The method of attaching a suture to a needle which consists in forming a recess in said needle, inserting an end of the suture in such recess, softening such inserted end, expanding such end by pressure applied
30 between such needle and suture and allowing such end to harden in an expanded condition.

8. The method of attaching a suture to a
35 needle which consists in inserting an end of said suture in a recess formed in said needle, which recess has a constricted diameter near its opening, softening such inserted end, expanding such end while soft and allowing such end to harden in an expanded condition.
40

9. The method of attaching a suture to a needle which consists in forming a recess in said needle, placing in said recess a fluid having the characteristics of softening the
45 suture material and of not attacking the needle material, immersing an end of said suture in said fluid, and allowing said end to soften, expand and harden in said recess, whereby it becomes anchored therein.

50 10. The method of attaching a suture to a needle which consists in immersing an end of said suture in a softening fluid contained in a recess formed in said needle, applying heat to said fluid, allowing said end to absorb at least a portion of said fluid whereby
55 it softens and expands, and allowing said end to harden in an expanded condition and thereby become anchored in said recess.

11. The method of attaching a suture to a
60 needle which consists in immersing an end of said suture in a softening fluid contained in a recess formed in said needle, allowing said end to absorb at least a portion of said fluid while pressure is applied between said suture and needle whereby said end expands,
65 and allowing said end to harden in an expanded condition and become anchored in said recess.

12. The method which consists in forming in a needle a substantially longitudinal blind
70 recess having a constricted opening, hardening and tempering said needle and anchoring a suture in said recess.

13. The combination of a needle element having a blind recess formed in the shank
75 thereof and a suture element expansively anchored in said recess.

14. In combination, a needle having formed in its shank a blind recess with an internal diameter greater than its neck diam-
80 eter and a suture maintained in said recess by an anchorage conforming thereto.

15. In combination, a needle having formed in the shank thereof a blind recess with an internal diameter greater than its
85 neck diameter and a suture expansively anchored in said recess.

16. In combination, a needle having formed in its shank an inwardly-flaring
90 blind recess and a suture having its end inserted in said recess and expanded to conform thereto.

17. In combination, a needle having formed therein a blind recess having a constricted opening and surrounded by a hard-
95 ened and tempered wall and a suture maintained in said recess by an anchorage of greater diameter than said constricted opening.

18. In combination, a needle having
100 formed therein a blind recess having a constricted opening and surrounded by an unbroken hardened and tempered circumferential wall and a suture anchored in said recess.
105

19. The method of making a needle and suture assembly which consists in forming in one end of a blank a longitudinal blind recess having a constricted opening, finishing
110 said blank by pointing, hardening, tempering and polishing the same, inserting an end of a suture in said recess and maintaining the same therein by an anchorage conforming thereto.

HARRY D. MORTON.