Dec. 8, 1964 G. J. CHISMAN 3,160,157

SURGICAL NEEDLE

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Fig. 1.

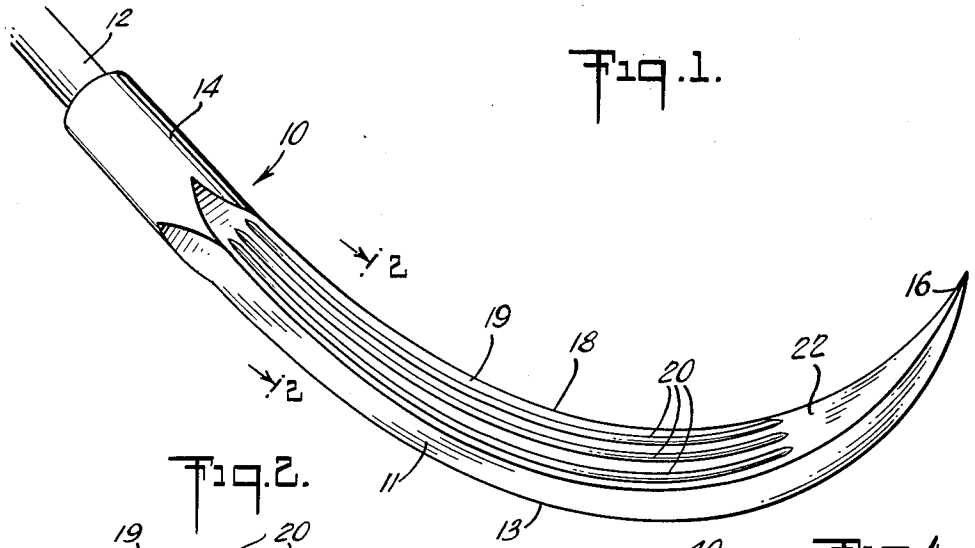

Fig. 2.

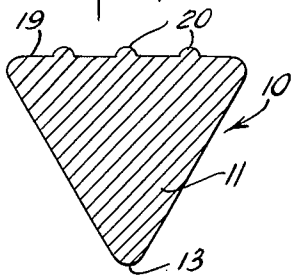

Fig. 4.

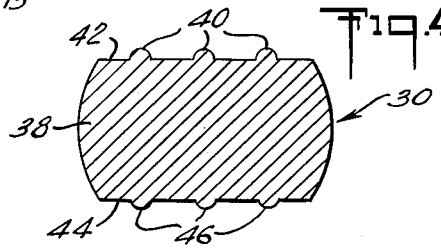

Fig. 5.

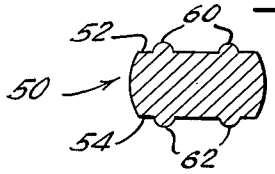

Fig. 3.

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Fig. 6.

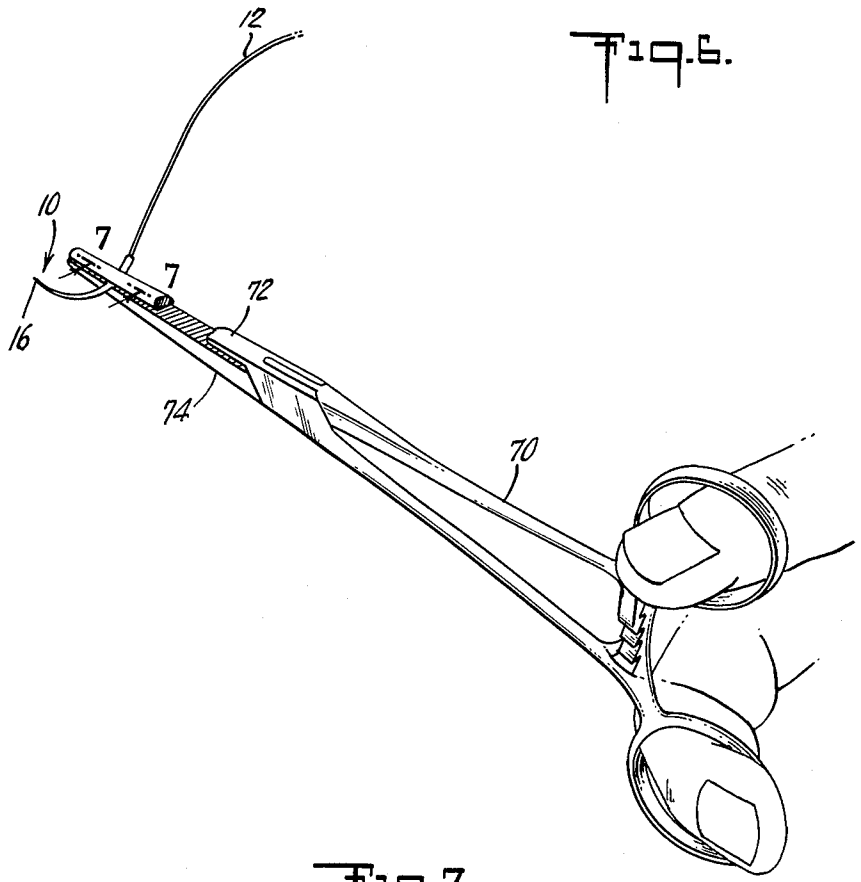
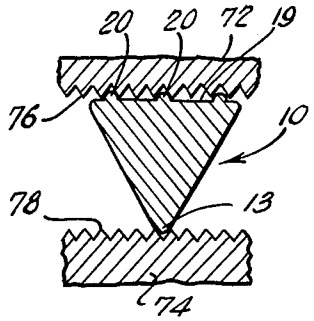


Fig. 7.



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3,160,157

SURGICAL NEEDLE

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6 Claims. (Cl. 128—339)

This invention relates to an improved surgical needle and more specifically to a surgical needle having one or more flattened surfaces between the needle point and the needle end to which a suture is attached with one or more longitudinal ribs on at least one flattened surface.

In suturing during surgical operations, the surgical needle is grasped by a needle holder between the point of the needle and the rear of the needle to which the suture is attached and the needle is positioned at an angle of approximately 90° with respect to the jaws of the needle holder. The point of the needle is inserted in tissue to be sutured and the needle is pushed through the tissue. During insertion of the needle in tissue, a conventional needle, which has one or more flat surfaces or is round at the portion grasped by the needle holder, tends to move in an angular manner with respect to the jaws of the needle holder and to rotate about its longitudinal axis, particularly if the serrated jaws of the needle holder are worn and if the needle is being passed through tough tissue. Angular and rotational movements of the needle in the needle holder during suturing detract from the surgeon's control of the placement of the needle and reduce the speed and efficiency of suturing, which is obviously deleterious since it increases the operating time. The problem presented by angular and rotational movements of a needle with respect to the jaws of the needle holder in which it is held has long been recognized, and attempts have been made to eliminate the difficulty by improving the jaws of the needle holder and by providing one or more flattened areas on the portion of the body of the needle grasped by the needle holder. Although such structural modifications have reduced the tendency for angular and rotational movements of the needle with respect to the jaws of the needle holder, such movements have not been satisfactorily eliminated by the needle holder and needle modifications heretofore adapted, particularly if the serrated surfaces of the jaws of the needle holder which come in contact with and grasp the needle are worn, which is frequently the condition of needle holders which have been repeatedly used.

It has now been discovered that the difficulty caused by angular and rotational needle movements in the jaws of the needle holder during use in suturing may be substantially eliminated by providing at least one rib positioned longitudinally on at least one flattened surface between the point of the needle and the end of the needle to which the suture is attached.

Surgical needles are of several types, including straight and curved needles, both of which may be triangular or round in cross-section substantially throughout the length thereof with about one-third or one-fourth of the length tapered to a point. Triangular needles generally have the shape of an equilateral triangle in cross-section with one or more sharpened edges, and generally have one face parallel to the needle axis of curvature; however, one edge of the needle may face either internally or externally of the needle arc. The suture may be attached to the needle by passing through an eye at the end of the needle opposite to the point, swaging into a channel or in a hole drilled into the end of the needle. Needles are provided in a range of sizes and except in a few instances suturing is performed by using a needle holder to grasp the needle at an area close to the end of the needle to which the suture is attached, thus leaving the point and major portion of the needle free to pass through tissue. When a needle of triangular cross-section is used in suturing, one flattened surface and the edge of the triangle opposite the flattened surface are grasped by a needle holder. Round needles and some cutting needles are provided with two flattened surfaces both parallel to the needle axis of curvature and positioned on the portion of the needle next to the end to which the suture is attached and when this needle is used, the jaws of the needle holder clasp the two flattened surfaces. During suturing, a needle held by a needle holder is pushed through tissue until the jaws of the needle holder come close to the tissue. The needle holder is then removed and attached to the needle near the point, and the needle and the suture are pulled through the tissue. Troublesome angular and rotational movements of the needle with respect to the jaws of the needle holder take place when the needle is pushed through tissue.

The needle of my invention substantially eliminates angular and rotational movements of the needle in the jaws of a needle holder when the needle is pushed through tissue, and this and other advantages of the invention will be apparent from the following description and accompanying drawings.

Referring to the drawings:

FIG. 1 shows a view in perspective of a curved surgical needle triangular in cross-section having three longitudinal ribs on one flat surface of the needle.

FIG. 2 is a view in cross-section in the direction of the arrows taken along the line 2—2 of FIG. 1.

FIG. 3 shows a view in perspective of a curved surgical needle round in cross-section having two flattened surfaces with three longitudinal ribs on each.

FIG. 4 is a view in cross-section in the direction of the arrows taken along the line 4—4 of FIG. 4.

FIG. 5 is a view in cross-section of a modified form of the needle of FIG. 3 showing two flattened surfaces with two longitudinal ribs on each.

FIG. 6 is a view in perspective with parts broken away showing a curved needle triangular in cross-section and attached suture grasped by a needle holder with serrations on the internal surfaces of its jaws.

FIG. 7 is a view in cross-section in the direction of the arrows taken along the line 7—7 of FIG. 6.

Referring to FIG. 1, the needle generally indicated at 10 consists of a curved needle body 11 which has substantially the shape of an equilateral triangle in cross-section with face 19 of the triangle parallel to the needle axis of curvature and edge 13 facing externally of the needle arc. A needle of this type is called a reverse cutting edge needle. The needle has a point 16 and a first triangular section 22 tapering gradually from the point to the rear with a cutting edge on each apex of the triangle. A second triangular section 18 has edges which are slightly rounded or flattened so that they are not sharp enough to cut tissue. The shape of the needle changes at the rear so that the triangular section is smoothly faired into round section 14 and the suture 12 is attached to the round section. Longitudinal ribs 20 are positioned on face 19 of the second section of the needle. The first section of the needle is preferably substantially shorter than the second section. When used in suturing, the second section is grasped by a needle holder and the longitudinal ribs and the edge of the needle opposite to the ribbed needle surface mesh with the serrated internal surfaces of the jaws of the needle holder so that angular and rotational movements of the needle in the needle holder are substantially eliminated. FIG. 2 illustrates in cross-section the positioning of longitudinal ribs 20 on face 19 of needle body 11 and their relation to edge 13 of the needle body.

Referring to FIG. 3, the needle generally indicated at 30 consists of a curved needle body 32 having a point 36 and a first section 33 which is round in cross-section and tapering gradually from the point to the rear. Second section 38 of the needle has two flattened areas, a first flattened area 42 which is parallel to the needle axis of curvature and facing internally of the needle arc and flattened surface 44, not illustrated in FIG. 3 but illustrated in FIG. 4, facing externally of the needle arc. The shape of the needle changes at the rear so that the flattened areas are smoothly faired into round section 35 to which suture 31 is attached. Longitudinal ribs 40 and 46 are positioned on the faces of flattened areas 42 and 44. Cross-sectional view 41 illustrates the manner of positioning longitudinal ribs 40 and 46 on flattened surfaces 42 and 44 of the second section 38 of the needle body. The cross-sectional view of FIG. 5 illustrates a modification of the needle of FIG. 3 in which the needle generally illustrated at 50 is smaller in cross-sectional area and has flattened surfaces 52 and 54 with longitudinal ribs 60 and 62 positioned thereon. It is contemplated that the smallest type of needles, such as ophthalmic needles, would have only one longitudinal rib positioned on each flattened surface of the needle body. Although not illustrated in the drawings, a needle with two parallel flattened surfaces, such as the needles of FIGS. 3, 4 and 5, may have one or more longitudinal ribs positioned on only one flattened surface.

Referring to FIG. 6, jaws 72 and 74 of a needle holder generally indicated at 70 grasp a needle generally indicated at 10 about midway between point 16 and the opposite end of the needle to which suture 12 is attached. The fragmentary view in cross-section of FIG. 7 shows the needle of FIG. 6 grasped in jaws 72 and 74 of the needle holder, and particularly illustrates the manner in which the serrated inner surfaces 76 and 78 of the needle jaws mesh with longitudinal ribs 20 on face 19 and edge 13 of the needle body.

In attaching sutures to the needles of my invention, any conventional method may be used, including swaging the suture into a channel or into a hole drilled in the end of the needle or the suture may be attached by passing through an eye in the end of the needle. In the preferred form of attachment, which is illustrated in FIGS. 1 and 3, the end of the needle is drilled and internally threaded; however, a satisfactory attachment may be made without internal threads. In both instances, the suture is attached by positioning an end of the suture in the drilled end and the needle end is then swaged around the needle. If internal threads are present, they bite into and firmly hold the suture end. If a suture is attached to the end of the needle by means of a channel, the end of the suture is laid in the channel which is present in the suture attaching end of the needle and secured by swaging the sides of the channel about the suture end.

The needles of my invention which are of the reverse cutting edge type, are formed from soft steel wire which is circular in cross-section by swaging, grinding and stamping operations. A round, annealed, soft steel wire is the preferred material for use in making surgical needles because the forming operations are more readily accomplished by its use; however, stainless steel wire may also be used. The wire is first passed through a straightening mechanism and a blank is cut which is of sufficient length to provide a handle. The end of the blank is swaged to provide a taper point, trimmed at the point to the correct length and ground so that the point is sharp. The needle blank is stamped to provide it with a roughly triangular shape which tapers from the point approximately one-half the length of the triangular portion. The die used in stamping the surface of the needle which is to have longitudinal ribs positioned thereon has longitudinal furrows engraved in its surface. Each edge of the triangle is sharpened by grinding throughout the tapered section

to provide three cutting edges. The edge facing externally of the needle arc is ground to destroy the cutting edge at a point beginning after the first section of a needle in which each edge of the needle is sharp. The edges of the face of the needle parallel to the needle axis of curvature are sharp throughout the first two sections of the needle. The triangular portion of the needle is smoothly faired into a round suture attaching section, which has the same cross-sectional area as the wire from which the needle was formed. For needles of triangular and small cross-section and for the needles of smallest cross-sectional area, such as ophthalmic needles, two and one longitudinal ribs, respectively, are positioned on the needle face parallel to the needle axis of curvature.

In making the needles of my invention which are round in cross-section, such as is illustrated in FIGS. 3, 4 and 5, the same operations as above are performed except the needle blank after the end thereof has been swaged to provide a tapered point, trimmed at the point to the correct length and ground so that the point is sharp, is stamped to provide a blank having two flattened areas. The flattened areas are of such a length as to provide a first portion tapering to a point and a needle attaching portion. The dies used in stamping the blank have engraved therein longitudinal furrows which when used in stamping the needle blank provide longitudinal ribs. For needles of round and small cross-section, it may be desirable to provide only two longitudinal ribs on each flattened surface, as illustrated in FIG. 5. It is also contemplated that on very small needles only one longitudinal rib may be provided on each flattened surface of the needle.

Both needles of triangular and round cross-sectional area are subjected to finishing operations involving cutting the handle from the blank and drilling a hole into the end of the suture attaching section followed by curving, heat treating and electropolishing the blank. If the suture attaching means is a channel, the channel is stamped into the blank just after the blank is stamped to give it the triangular shape of FIG. 1 or stamped to provide a needle of round cross-section with two flattened areas, as illustrated in FIG. 3. In this event, the portion of needle wire extending beyond the needle attaching section serving as a handle is removed after the steps of heat treating and electropolishing and removal of the handle is the last operation performed on the needle blank. After heat treating but before electropolishing, the channel or drilled end of the needle is annealed to facilitate the attaching of the suture to the needle.

Suture attaching operations such as swaging to attach the suture to channel or drilled attaching means may be accomplished in accordance with conventional procedures.

The needle of my invention has advantages in addition to the prevention of angular and rotational movements in the jaws of a needle holder during use in suturing. An additional advantage is the ability of the surgeon to have greater control over the needle as it passes through tissues, and particularly as it passes through dense tissue. It is important during suturing that the needle follow the precise path intended by the surgeon and the more firmly the needle is held in the jaws of the needle holder the more precise the path that the needle may follow in passing through tissue. The addition of a longitudinal rib on at least one flattened surface of a needle also provides an improvement in its strength and particularly in its resistance to bending. It is important during suturing, and particularly in suturing through dense tissue, that the needle have marked resistance to bending and maintain its original shape. Because of the longitudinal ribs on at least one flattened surface of the needle of my invention, it is possible for the flattened area, particularly in a round needle which has two parallel flattened areas, to be narrower than would be the case if the longitudinal ribs were not present. This results in an increase in the thickness in the flattened area and a consequent increase

in the strength of the needle, and particularly in its resistance to bending during use.

While the invention has been shown with some degree of particularity and reference to specific embodiments, it is nevertheless to be understood that the invention is not to be limited to any of the embodiments described but is to be restricted only by the scope of the appended claims.

What is claimed is:

1. A curved surgical needle having convex and concave surfaces pointed at one end, the other end of which is adapted to receive a suture; said needle being round in cross-section and having flattened areas on the convex and concave surfaces thereof extending substantially the entire distance between the needle point and the needle end to which the suture is attached with at least one longitudinal rib positioned on each of said flattened areas and extending the length thereof; the size of said longitudinal ribs being such as to engage the serrations on a needle holder whereby rocking and turning of the needle in the holder is minimized.

2. A curved surgical needle having convex and concave surfaces pointed at one end, the other end of which is adapted to receive a suture; said needle being round in cross-section and having flattened areas on the convex and concave surfaces thereof extending substantially the entire distance between the needle point and the needle end to which the suture is attached with a plurality of longitudinal ribs positioned on each of said flattened areas and extending the length thereof; the size of said longitudinal ribs being such as to engage the serrations on a needle holder whereby rocking and turning of the needle in the holder is minimized.

3. A curved surgical needle having convex and concave surfaces pointed at one end, the other end of which is adapted to receive a suture; said needle being triangular in cross-section and having a flattened area on the concave surface thereof extending substantially the entire distance between the needle point and the needle end to which the suture is attached with at least one longitudinal rib positioned on said flattened area and extending the length thereof; the size of said longitudinal rib being such as to engage the serrations on a needle holder, whereby rocking and turning of the needle in the holder is minimized.

4. A curved surgical needle having convex and concave surfaces pointed at one end, the other end of which is adapted to receive a suture; said needle being triangular in cross-section and having a flattened area on the concave surface thereof extending substantially the entire distance between the needle point and the needle end to which the suture is attached with a plurality of longitudinal ribs positioned on said flattened area and extending the length thereof; the size of said longitudinal ribs being such as to engage the serrations on a needle holder, whereby rocking and turning of the needle in the holder is minimized.

5. A curved surgical needle having convex and concave surfaces pointed at one end, the other end of which is adapted to receive a suture; said needle being triangular in cross-section and having a flattened area on the convex surface thereof extending substantially the entire distance between the needle point and the needle end to which the suture is attached with at least one longitudinal rib positioned on said flattened area and extending the length thereof; the size of said longitudinal rib being such as to engage the serrations on a needle holder, whereby rocking and turning of the needle in the holder is minimized.

6. A curved surgical needle having convex and concave surfaces pointed at one end, the other end of which is adapted to receive a suture; said needle being triangular in cross-section and having a flattened area on the convex surface thereof extending substantially the entire distance between the needle point and the needle end to which the suture is attached with a plurality of longitudinal ribs positioned on said flattened area and extending the length thereof; the size of said longitudinal ribs being such as to engage the serrations on a needle holder, whereby rocking and turning of the needle in the holder is minimized.

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