

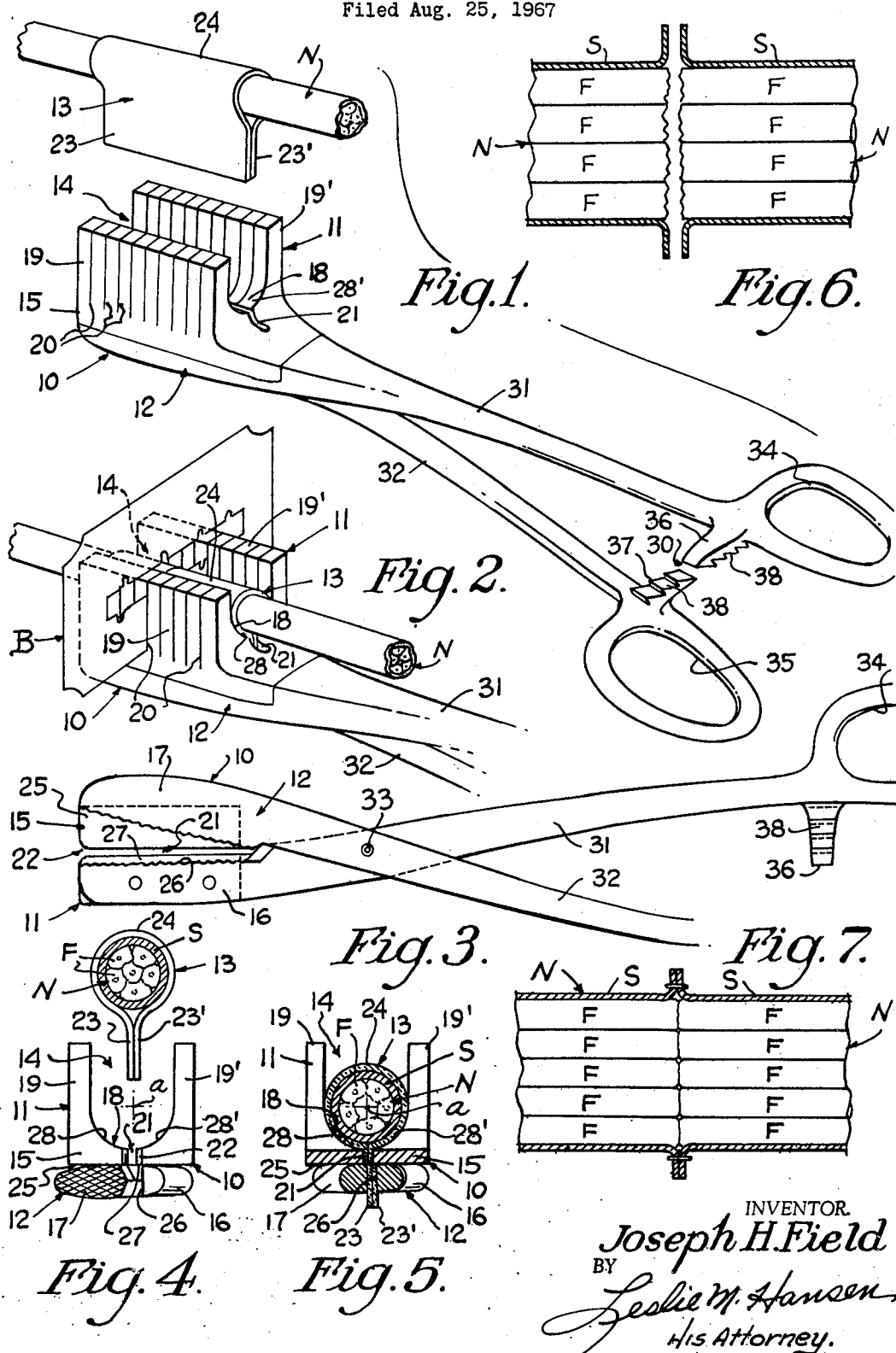
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NERVE HOLDER AND GUIDE FOR PERPENDICULAR CUTTING

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NERVE HOLDER AND GUIDE FOR PERPENDICULAR CUTTING

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ABSTRACT OF THE DISCLOSURE

A combined nerve holder, clamp and cutting guide tool for cutting slices from damaged nerve ends. A tool in the nature of a mitre box for guiding a blade perpendicular to a nerve and means for clamping and holding such nerve in cylindrical form within such blade guiding box.

BACKGROUND

The repair of damaged or divided nerves requires meticulous preparation in order to assure axial alignment of the proximal, live ends with the axones or detached ends of the nerves.

It is well accepted among surgeons that rough cutting with scissors or knives alone leaves much to be desired. Such rough cutting results in jagged edges and a mashing of the nerve ends and irregular shaping thereof such that misalignment and even incorrect connection thereof occurs with the tubes or sheaths of the detached ends. The use of razor blades is an accepted practice for obtaining clean, unmashed cuts. Here again a problem exists in that the proximal end of the nerve must be cut back to living, undamaged fibers or tissue to assure against scarring or unnatural enlargement after healing at the line of suture.

In 1964 a paper prepared by Gaylord L. Clark, M.D., entitled A Method of Preparation of Nerve Ends for Suturing, was published by The Williams & Wilkins Co. in vol. 34, No. 3, of Plastic and Reconstructive Surgery. In this disclosure the use of a band of paper looped about the nerve with the ends of the paper clamped together was proposed to hold the nerve within a paper sheath while the cutting is done with a safety razor blade. The article also mentions the use of a mitre box for holding the stump of the nerve while sectional cuts to clean tissue are made.

A later article, in the same entitled publication, Plastic and Reconstructive Surgery, vol. 38, No. 1 dated 1966, on this subject is authored by Goran J. Gabrialson, M.D., and Sten J. Stenstrom, M.D., of Umea, Sweden. This later publication actually shows a mitre box type holder. The mitre box holder is shown as a flat base with comb-like sidewalls extending perpendicularly and at right angles upward at each side of the flat base. The base between these sidewalls has a pair of spaced slits through which the separate ends of a strip of kraft paper are inserted while the bight portion of the paper surrounds the upper zone of the nerve. The author explains that the kraft paper is held taut between the thumb and forefinger (of one hand) while the razor blade cuts, slice after slice, until the severed surface has a normal appearance. It is apparent from this disclosure that the limp nerve end, when drawn down upon the flat base will conform to that surface and result in a distortion of the sheath and nerve tissues during cutting.

THE PRESENT INVENTION

It is an object of the present invention to provide a tool for clamping nerve ends in cylindrical form within

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a guide means for making perpendicular cuts. In this connection the present invention contemplates the provision of a cutting guide and clamp combination for holding a nerve in perfect shape during perpendicular slicing and cutting.

The tool of the present invention employs a cutting guide on the order of a mitre box having cross slits for guiding an ordinary safety razor blade transversely of a nerve confined within such box. The invention resides in combining a clamp with the cutting box to tauten and hold a wrap-around band about a damaged nerve. The combination further contemplates the provision of a rounded base surface within the cutting box conforming to nerve diameter and cooperating with the wrap-around band for maintaining the damaged nerve as close as possible to its normal diameter during the cutting and/or slicing operation. In this connection it is a further object to provide a single slit in the rounded base for receiving both ends of the wrap-around band, the slit being offset from the jaws of the clamp for tightening the band firmly around the nerve and for wedging the ends of the band together and between the base and clamp jaws to thereby automatically take up slack in the band during closing of the jaws.

These and other objects of the present invention will become more apparent from a reading of the following description in the light of the accompanying drawing in which:

FIG. 1 is a perspective view of the tool embodying the present invention about to receive a damaged nerve for cutting.

FIG. 2 is a fragmentary perspective view of a portion of FIG. 1 with the nerve depicted in place during cutting.

FIG. 3 is a bottom plan view of a portion of FIG. 1.

FIG. 4 is an end view of the tool shown in FIG. 1 and as seen from the left hand end thereof.

FIG. 5 is a cross sectional view through FIG. 2 as seen along one of the cutting slits thereof.

FIG. 6 is an enlarged longitudinal sectional detail through two severed nerve ends about to be sutured.

FIG. 7 is an enlarged longitudinal sectional detail through sutured nerve ends.

Referring to the drawing, FIG. 1 shows the tool 10 of the present invention comprising in general a cutting guide 11 in combination with a clamp 12 for receiving and holding a damaged nerve N in tubular form within a wrap-around band 13 confined within the cutting guide. The nerve N consists of a plurality of fibrous members F confined within a sheath S known as the epineurium. The band 13 may be any cuttable membrane such as paper, plastic, Mylar or the like of suitable tear strength.

More specifically, and in detail, the cutting guide 11 comprises a channel-shaped box 14 having a U shaped trough formed therein. The box 14 consists of a base 15 affixed to one jaw 16 of the clamp 12, the other jaw 17 being movable toward and from the fixed jaw 16. As best seen in FIGS. 1, 2, 4 and 5 the base 15 of the channel-shaped box 14 has an upper surface 18 of semicircular shape, the inner surface of which merges tangentially with side walls 19 and 19' of the box 14 to provide a U shaped trough for receiving the nerve.

The channel-shaped box 14 is of a length such as to receive and hold an appreciable length of damaged nerve N. Moreover, the semi-circular form of the upper surface 18 of the base 15 is struck on a radius such as to conform to the diameter of the nerve sheath S plus a slight clearance for the wrap-around band 13. In other words, the side walls 19 and 19' of the box 14 have their inner surfaces spaced a distance to receive, yet embrace, the

nerve N, sheath S, and band 13 for maintaining the natural tubular shape of the nerve N. The axis of the nerve N is maintained coaxially of the axis *a* of the semi-circular surface 18 of the guide 11.

The channel-shaped box 14 has its side walls 19 and 19' provided with a plurality of cross-cut slits 20 each of a width to receive and guide a conventional safety razor blade transversely of the axis of the nerve supported in the channel 14. The slits 20 are spaced from each other approximately .050 inch apart whereby several slices can be made from the severed end of the nerve until good, clean, live fibrous nerve tissue appears.

Nerve diameters vary from one another. Some may be of $\frac{1}{8}$ inch diameter, others $\frac{1}{4}$ inch and some $\frac{3}{8}$ of an inch round. Accordingly, the diameter of the nerve holding guide 11, i.e., the spacing of the walls 19-19' and radius of the semi-circular surface 18 therebetween may be varied. It will therefore be appreciated that the guide 11 may be interchangeably connected to the clamp 12 if desired.

Referring now to FIGS. 3, 4 and 5 it will be noted that the base 15 of the channel guide 11 has an open ended slit 21 formed vertically below the axis *a* of the semi-circular surface 18 of the channel-shaped box 14. This slit 21 extends throughout the length of the channel-shaped box 14 and has a flared, funnel-shaped open end 22 facilitating insertion of the two ends 23-23' of the wrap-around band 13. The ends 23-23' of the band 13 extend radially down from the mid-portion 24 thereof which surrounds the nerve end as shown in FIGS. 1 and 4. Consequently, upon insertion of the two ends 23-23' into the single slit 21 via the open end 22 thereof, the two ends 23-23' extend downwardly beyond the lower surface 25 of the base 15 and between the jaws 16 and 17 of the clamp 12.

As previously stated one of the jaws 16 of the clamp 12 is relatively stationary with respect to the channel-shaped box 14. As best seen in FIGS. 3 and 4 this stationary jaw 16 has its gripping surface 26 parallel to and offset laterally from the slit 21 formed in the base 15 of the box 14. It will therefore be noted that the moveable jaw 17 of the clamp 12 is disposed to move across the slit 21 to thereby force the two ends 23-23' of the band 13 laterally of the slit 21 and toward the face 26 of the stationary jaw 16. The two ends 23 and 23' of the band 13 are thereby drawn downwardly through the slit 21 and across a portion 27 of the lower face 25 of the base 15. This causes the mid-portion 24 of the band 13 to be tightened about the nerve N which it surrounds. The upper or free portion 24 of the band 13 will thus assume a semi-circular shape around the adjoining portion of the nerve while the adjacent quadrants 28-28' of the mid-portion 24 of the band conform to like curvatures of the semi-circular surface 18 of the channel-shaped box 14. The nerve end confined within the mid-portion 24 of the band 13 is thus held firmly in cylindrical form within the cutting box or guide 11.

Means 30 for locking the jaws 16-17 of the clamp 12 in closed condition upon the two ends 23-23' of the band 13 is provided. In the present disclosure the clamp 12 is shown to be on the order of a surgical needle holder in which the jaws 16-17 are integral parts of scissors arms 31-32 pivotally connected as at 33. The opposite ends of the scissors arms 31 and 32 have finger loops 34 and 35, respectively, formed thereon for manipulating the clamp 12 in a well known manner. The aforementioned locking means 30 is shown to be opposed toothed rack bars 36 and 37 on the respective scissors arms 31 and 32. These opposed rack bars 36-37 are biased toward each other and have interlocking teeth 38-38' which slide past each other during closing of the scissors arms, the teeth engaging each other to lock the arms in closed condition. This locks the jaws 16 and 17 tightly upon the two ends 23-23' of the band 13 and maintains the nerve N in condition for slicing by a razor blade B as shown in FIG. 2.

The slicing of the damaged nerve end is commenced at the first transverse or cross-cut slit 20 of the cutting guide 11. Each slice of nerve end is examined after removal of each slice from the cutting guide, the nerve N remaining therein until, slice after slice, clean, live, nerve fibre appears at the cut end of the nerve. Thereafter, the nerve can be removed from the cutting guide.

With a good clean perpendicular cut at the two severed ends of the nerve to be joined, such ends are brought together with the several inner fibers abutting their precise counterparts and the sheath then sutured peripherally in the usual manner. The clean abutting ends of the nerve fibers thus meet face to face assuring a smooth even regeneration of the whole nerve with a minimum of scar or distortion therein.

Having thus described in detail my new nerve holder and guide for making perpendicular cuts therein, it will be appreciated that the same may be modified, altered and/or varied without departing from the spirit of my invention. I therefore desire to avail myself of all modifications, alterations and/or variations as may fairly come within the purview of the appended claims.

I claim:

1. In a tool for holding a nerve during the cutting of slices of damaged nerve end therefrom with a cutting means, the combination of a cutting guide and clamping means comprising:

(a) a cuttable wrap-around band adapted to embrace the damaged nerve with the ends of said band extending radially therefrom,

(b) a channel shaped box having a U-shaped trough formed therein with an elongated slit at its base for receiving the ends of said band to thereby confine the nerve embraced in said band in cylindrical form; and

(c) a clamp having one jaw affixed to the base of said channel-shaped box adjacent the elongated slit formed therein and another jaw movable toward and from said fixed jaw for gripping the ends of said band.

2. The tool as defined in claim 1 in which the channel shaped cutting box has a plurality of slits formed through the side walls and base of said U-shaped trough for guiding the cutting means transversely of the same and the nerve confined within said band.

3. The tool in accordance with claim 2 in which said clamp includes means for releasably locking the jaws thereof in closed condition upon the ends of said band.

4. The tool in accordance with claim 1 in which said clamp includes means for locking said jaws thereof in closed condition upon the ends of said band.

5. The tool in accordance with claim 1 in which said one jaw of said clamp is affixed to the base of said channel-shaped box in offset parallel relation to the elongated slit formed therein to dispose the movable jaw of said clamp for movement across said elongated slit for wedgingly tightening the two ends of said band incident to gripping the ends of said band.

6. The tool as defined in claim 5 in which the channel shaped cutting box has a plurality of slits formed through the side walls and base of said U-shaped trough for guiding the cutting means transversely of the same and the nerve confined within said band.

7. The tool in accordance with claim 6 in which said clamp includes means for releasably locking the jaws thereof in closed condition upon the ends of said band.

8. The tool in accordance with claim 1 in which said U-shaped trough is formed with a semi-circular base merging tangentially with parallel side walls thereof, wherein said slit is formed parallel to the axis of said semicircular base,

(a) a plurality of slits formed transversely of said U-shaped trough for receiving and guiding the cutting means perpendicular to the axis of said semi-circular base.

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9. The tool in accordance with claim 8 in which said clamp includes means for locking said jaws thereof in closed condition upon the ends of said band.

10. The tool in accordance with claim 9 in which the open ended slit formed in said semi-circular base has a flared-funnel-like form facilitating admittance of the ends of said band into the open end of said elongated slit.

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