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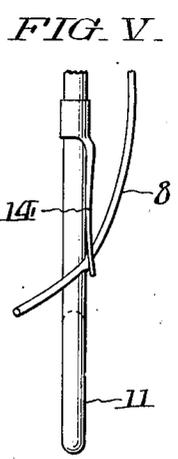
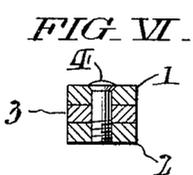
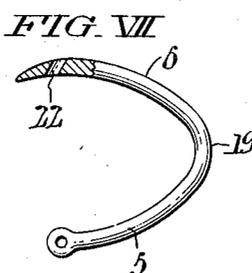
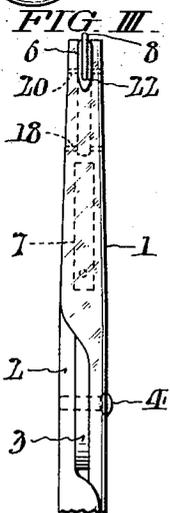
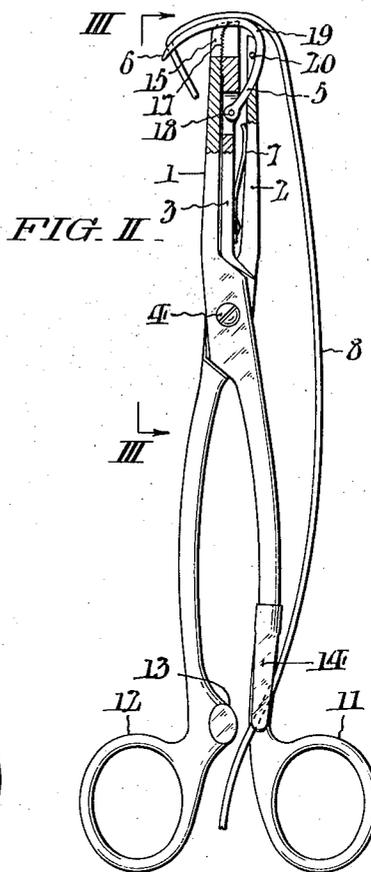
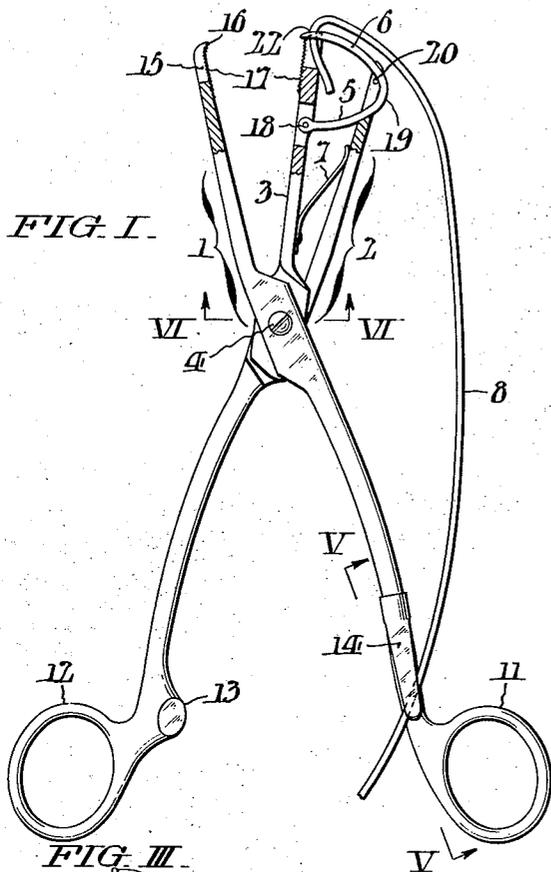
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2,213,830

SUTURING AND LIGATING INSTRUMENT

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2 Sheets-Sheet 1



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SUTURING AND LIGATING INSTRUMENT

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This invention relates to surgical instruments and more specifically to suturing and ligating instruments. In the past many forms of instruments have been developed for aiding the surgeon in stitching wounds, cuts, incisions and the like. Surgeons have long been interested in means for accelerating suturing and ligating in order to reduce operation periods and thereby lessen the shock and strain to the patient. Frequently much time is consumed because the surgeon's work must be done in awkward and restricted spaces such as in a deep abdominal operation. Thus it is important that a suturing and ligating instrument be capable of easy and efficient operation in a restricted space.

When surgery is being done in an awkward and restricted space, the problem of positioning or clamping the flesh to be sewed is serious because there is little room for other tools. Also in ligating a blood vessel, an instrument which will clamp the blood vessel as part of the operation of passing the thread around the vessel is desirable. Thus a suturing and ligating instrument which avoids the use of an additional clamping or positioning means greatly aids the surgeon.

When a thread has been passed through flesh it is not always easily accessible to the surgeon for pulling through or tying off; and hence it is desirable that a suturing and ligating instrument operate in such a manner that a thread passed through flesh or around a blood vessel be presented to the easy grasp of the surgeon.

This invention is directed to the fulfillment of the above desiderata in suturing and ligating instruments. The main object of my invention is the provision of a simple and rugged instrument which may be operated by one hand in awkward and restricted spaces to quickly pass a thread through flesh or around a blood vessel. Another object is the provision of such an instrument which will preliminarily grasp the flesh to be sewed or the blood vessel to be ligated and as the final step in its operation present the thread to the easy grasp of the operator. Another object is the provision of such an instrument in a simple form which lends itself to rugged and uncomplicated mechanical structure.

Still further objects and advantages of this invention will become apparent from the following detailed description of an embodiment of this invention with suggested modifications thereof.

Referring to the accompanying drawings, Fig. I shows a view in side elevation of an instrument embodying the hereinafter described in-

vention with portions in section, and showing the relation of the parts when the several members are separated.

Fig. II is an elevation of the instrument with the several members close together and the needle in the position which it assumes when passed through the parts to be sutured or around the blood vessel to be ligated.

Fig. III is a partial view of the top portion of the instrument in its closed position taken as indicated by the lines III—III in Fig. II.

Fig. IV is a fragmentary perspective view of the upper ends of the levers comprising the instrument showing the manner in which the needle is mounted.

Fig. V is a fragmentary view of one of the handles of the instrument showing the clip holding a portion of the thread in place and taken as indicated by the lines V—V in Fig. I.

Fig. VI is a section taken along the lines VI—VI of Fig. I.

Fig. VII is a side elevation of the needle and its operating link formed integrally therewith showing a portion broken away at the point of the needle to expose the eye.

Fig. VIII is a side elevation of a modified form of the invention with portions broken away to show internal structure.

Fig. IX is a side elevation of a further modification of this invention with portions broken away to show internal structure.

Fig. X is a perspective view of a thread clip showing the thread caught as the needle is withdrawn after having passed the needle through flesh to be sutured or around a blood vessel to be ligated.

Fig. XI is a sectional view of the device shown in Fig. X and taken along the lines XI—XI therein.

Fig. XII is a sectional view similar to that shown in Fig. XI showing the clip spread by the needle; and

Fig. XIII is a top view of the device shown in Fig. XII as spread by the needle.

In the following detailed description of the embodiments of this invention shown in the drawings, specific terms will be employed for the sake of clarity, but it is to be understood that such terms are used in a descriptive sense and not for purposes of limitation. Each specific term is intended to include all technical equivalents which operate in a similar manner to accomplish a similar purpose.

The instrument shown in Fig. I comprises a gripping lever 1, a needle operating lever 2, a

secondary gripping lever 3, all of said levers being pivotally connected by a screw 4, a needle operating link 5, a needle 6, a spring 7 and a thread 8. It will be seen that this instrument is generally similar to the usual metal forcep-type of instrument with handles 11 and 12 provided at the lower ends of the levers 1 and 2. The selection of materials for the manufacture of this instrument may be left to those skilled in the surgical instrument art. On the lever 2 there is provided an abutment 13 for contacting with the lever 1 when the instrument is in the closed position to prevent the application of undue pressure by an operator who unintentionally forces the instrument in its closed position.

On the lever 1 there is provided a thread clip 14 for controlling the thread during the suturing or ligating operation. Obviously, the clip 14 and the abutment 13 may be on either lever 1 or 2. The upper end of gripping lever 1 is bifurcated as shown at 15 to receive the needle 6 between the branches of said bifurcation. The inside of the upper end of the gripping lever 1 is provided with points 16 which are aligned with the point of the needle 6 in order that flesh may be gripped between the points 16 and the point of the needle 6. Cooperating teeth 17 are provided on the inner ends of both levers 1 and 3 to provide a firm grip on flesh being sutured, or on a blood vessel being ligated.

The needle operating link 5 is pivotally attached at one end to the lever 3 at 18 as shown. The bottom portion of the link 5 is in sliding engagement with a groove formed in the end of the lever 2 between the branches of a bifurcation thereof. It will be noted that the link 5 is curved downwardly on a curvature similar to that of the needle 6; and the sliding action of the lever 2 along this arc of the link 5 has in practice been found to provide an easy and smooth operation of the instrument. The needle 6 which is formed integrally with the link 5 forms an elbow 19 therewith and on the inside of this elbow 19 a stop 20 is attached to and extended between the branches of the bifurcation in the end of the lever 2, thus limiting the distance which the lever 3 may be separated from the lever 2 to the length of the link 5.

In the normally open position of the instrument these levers 2 and 3 are maintained in the open position by means of the spring 7 attached at one end to the lever 3 and in sliding engagement at the other end thereof with the lever 2. It is obvious that the spring 7 could be reversed and attached to the lever 2 or that another type of spring could be provided such as a coil type. Additional spring means for urging the levers 3 and 2 apart will occur to one skilled in the art.

The lever 3 is also bifurcated at the end thereof to receive the needle 6 between the branches of the bifurcation; and it is to be noted that in the normally open position of the instrument the point of the needle 6 projects a limited distance beyond the lever 3 and into the space between the ends of the lever 1 and the lever 3, thus providing a positioning point to cooperate in a gripping action with the points 16 which will be explained later when the operation of the instrument is taken up.

The needle 6 which is formed integrally with the needle operating link 5 is of a usual curved form and type having an eye 22 near the end thereof. The specific curvature of the needle 6, however, is significant. When an instrument of this type is used for suturing or ligating in a

space which is deep and difficult of access, it appears that, in the case of the prior art devices, even after the needle carries the thread through the flesh to be sewed there will be difficulty in catching the end of the thread which is not carried up toward the operator. One of the outstanding advantages of this invention is that the needle 6 is so formed and so operated that when the instrument is fully closed the end of the needle 6 swings sharply up toward the operator with the thread 8 in the end thereof. This makes it easy for the operator to grasp the end of the thread 8. This is particularly so when the needle 6 is properly threaded from the top with the end of the thread 8 pointing toward the operator. Therefore, the needle 6 is curved along an arc of a circle having a center at the pivotal point 18 where the link 5 is attached to the lever 3. It is to be noted that the curved needle 6 must be swung about a circle coinciding substantially with the circle formed by the continuation of said arc of the needle in order to avoid tearing the holes formed by the needle point. It is to be further noted that the radius of this circle governing the character of the curvature of the needle 6 is substantially less than the distance between the pivotal point 18 and the pivotal point 4 where the levers 1, 2 and 3 are connected. It is thus possible in this instrument to provide relatively long gripping levers 1 and 3 with a needle 6 having a curvature governed by an arc formed on a relatively short radius. It is clear that if the needle 6 were formed on a much flatter arc the point with the thread 8 would not be presented so directly to the grasp of the operator of the instrument as the instrument is closed. It should be noted that the spring 7 should be sufficiently weak that the teeth 17 will grip the flesh or blood vessel firmly without crushing as the needle 6 is operated and this is, of course, a matter of adjustment well within the grasp of the skilled artisan.

Before taking up the modifications of this invention suggested in the other figures of the drawings, the method of operation of the above described embodiment of this invention will be described. If a surgeon wishes to apply this instrument to an incision or other flesh to be sutured, he first sees that the thread 8 is in place as shown in Fig. I of the drawings with one end projecting substantially through the needle eye 22. He may, if it suits his convenience, clip the standing part of the thread 8 in place by the use of clip 14 on the handle portion of lever 1. The surgeon now takes the instrument and using it as a forcep grasps the flesh to be sutured between the points 16 on the lever 1 and the projecting point of the needle 6. This enables the surgeon to firmly position his instrument before actually passing the needle 6 through the flesh. When the surgeon has satisfied himself that the flesh is properly positioned for a suture at the points grasped by his instrument, he further compresses the handles 11 and 12 bringing the teeth 17 into play for a more firm grasp of the surrounding flesh to be sutured. A further compression of the handles 11 and 12 will cause the lever 2 to swing the link 5 about its pivot 18 urging the needle 6 through the flesh, the point of the needle 6 passing between the branches of the bifurcation on the end of the lever 1. In its closed position the instrument will appear as shown in Fig. II with the end of the thread 8 presented to the easy grasp of the operator by the end of the needle 6 which swings up toward

the operator. The surgeon now disengages the end of the thread 8 from the needle eye 22 and then opens the handles 11 and 12 which releases the grasp of the instrument on the flesh and by means of the stop 20 engaging the elbow 19 retracts the needle 6 from the pierced flesh. The thread 8 is then cut and the suture continued in the usual manner. To repeat the operation the surgeon simply again threads the needle 6 by passing the end of the thread 8 down through the needle eye 22 from the top as before.

If the instrument is used for ligating, the blood vessel to be ligated is grasped firmly between the gripping levers 1 and 3 by the teeth 17 while the needle 6 is urged around the blood vessel carrying the end of the thread 8 around the blood vessel and up toward the operator to be grasped and manipulated as explained above in regard to the performance of the suturing procedure. It is thus clear that this invention provides a simple and rugged form of instrument which efficiently passes the thread for the surgeon in performing either a suturing or ligating operation, presenting the end of the thread 8 to the easy grasp of the operator as the final step in the operation of the instrument.

The above described embodiment of this invention can be modified by the provision of a clipping means on the end of the lever 1 which is substituted for the bifurcation described above. This clipping means is clearly shown in Figs. X, XI, XII and XIII and consists of a spring 25 riveted to the end of the lever 1 and an element 26 riveted to the spring 25. The element 26 is in effect a movable corner of the end of the lever 1 mounted on a spring 25 holding it in place with capacity for being sprung out. In order to guide the point of the needle 6 into place to spread the element 26 outwardly, the adjacent corners of the element 26 and the lever 1 on the side facing the lever 3 are rounded off. In other respects the lever 1 equipped with this modification is the same as the bifurcated type with points 16 and teeth 17 formed thereon.

In operation the needle 6 simply spreads the element 26 from the lever 1 and when retracted the thread 8 is caught as in any spring clip. By this means, the end of the thread 8 may be pulled out by the instrument itself to be more accessible to the operator after the needle 6 has been disengaged from the flesh. This avoids all need of any additional instrument to grasp the end of thread 8.

Figs. VIII and IX are two simplified modifications showing different ways of mounting the needle operating link 5. In Fig. VIII, the link 5 is pivotally mounted at 18a on the gripping lever 1 instead of on a secondary gripping lever 3 which is omitted in this form of the invention. This form of the invention operates in the same general manner as the embodiment described above except for the absence of the secondary gripping lever 3.

In Fig. IX, the needle operating link 5a has been pivotally attached to the needle operating lever 2a at the intermediate point 18b instead of on the gripping lever 1 as in the embodiment of Fig. VIII. The operating link 5a is pivotally attached at an intermediate portion thereof instead of at the end; and at its outer end, an elongated slot 32 is formed which engages with a pin 31 mounted on the lever 1. The operation of the link 5a and needle 6 will be understood from the above description of the other embodiments of this invention. It is to be noted

that in both the embodiments of Figs. VIII and IX the curvature of the needle 6 is determined in the same way as the curvature of needle 6 is determined in the embodiment of Figs. I and II described above and for the same purpose.

Certain illustrative embodiments of this invention have been described above in considerable detail but it is to be understood that many changes and variations may be made therein, as will occur to one skilled in the art, without departing from the spirit of the invention as hereinafter claimed.

Having thus described my invention, I claim:

1. A suturing and ligating instrument comprising pivotally connected primary and secondary gripping levers, cooperating with a needle-actuating lever, a combination link with an elbowed needle portion, said link being pivotally attached to one of the gripping levers, the needle actuating lever having sliding engagement with said link and the needle portion being curved a substantial distance from the point thereof according to an arc of a circle having as a center the pivotal point of said link, and a point formed on the end of one of the levers aforesaid to coact with the needle point in a gripping action.

2. The invention of claim 1 wherein the operating link portion is formed on an arc having a curvature similar to that of the needle.

3. A suturing and ligating instrument comprising primary and secondary gripping levers, cooperating with a needle actuating lever, all fulcrumed on a common pivot, a combination link embodying a relatively-elbowed thread carrying needle pivotally attached to one of the gripping levers and having sliding engagement with the needle-actuating lever whereby said link may be swung on its pivot and the curve of said link and the curve of said needle for a substantial distance from the needle point being an arc of a circle having as a center the point of pivotal attachment of said operating link to one of said levers, and points formed on the end of the primary gripping lever to jointly coact with said needle point in effecting a suture or ligature grip.

4. A suturing and ligating instrument comprising a primary and secondary gripping levers, cooperating with a needle actuating lever, said three levers being all pivotally mounted on a common center, a link pivotally connected to the secondary gripping lever and in sliding engagement with the needle-actuating lever, a thread-carrying needle forming a part of said link, means for limiting movement of the secondary gripping lever with relation to the needle actuating lever, a spring normally urging the secondary gripping lever to said limit away from the needle including link, and the point of said needle being positioned to move in cooperative relation with the ends of the gripping levers.

5. A suturing and ligating instrument comprising a primary gripping lever, a needle operating lever, a secondary gripping lever, said levers being all mounted on a common pivot pin, an operating link pivotally connected to the secondary gripping lever and in sliding engagement with the needle operating lever, said operating link including a curved thread-carrying needle in continuation of the said link and forming an elbow therewith, a limiting stop mounted on the needle operating lever for engaging the elbow to limit movement of the secondary gripping lever, a spring urging the secondary gripping lever to the limit position away from the needle operating lever, and openings in the ends of the

gripping levers for passage of the needle there-through in operation.

5 6. A suturing and ligating instrument in accordance with claim 5, wherein the thread-carrying needle is curved a substantial portion of its length on the arc of a circle having as a center the pivotal point of said operating link.

7. A suturing and ligating instrument as defined in claim 1, wherein the end of the secondary gripping lever has mounted thereon a spring influenced thread clip which is normally closed, said clip being designed to open by passage of the needle therethrough in operation of the instrument, and to close by recoil action as said needle 15 is withdrawn thereby to grip the thread carried by the needle.

8. A suturing and ligating instrument as defined in claim 5, wherein the thread carried by the needle passes through a hole near the free 20 end of said needle, and a clip is mounted on one of the levers convenient to the operator's hand to hold the thread during operation of the instrument.

9. A suturing and ligating instrument comprising a primary and secondary gripping levers, cooperating with a needle actuating lever, said three levers being all mounted on a common pivotal pin, a link pivotally connected to the secondary gripping lever and in sliding engagement 30 with the needle actuating lever, a thread carrying needle in continuation of said link, said thread

carrying needle being curved a substantial distance from the point thereof according to an arc drawn with a center at the pivotal connection of the aforesaid link, such curvature radius being substantially shorter than the distance between 5 the pivotal connection of the link and the pivotal connection of the several levers, means for limiting movement of the secondary gripping lever with relation to the needle including link, spring means normally urging the secondary 10 gripping lever to its limit away from said link, and the point of said needle being positioned to move in cooperative relation with the ends of the gripping levers.

10. A suturing and ligating instrument in accordance with claim 1, wherein the primary gripping lever outer end is bifurcated to form spaced points for cooperation with the point of the 15 needle in jaw action.

11. A suturing and ligating instrument in accordance with claim 5 wherein a portion of the end of the primary gripping lever is cut away and a spring clip is fastened to said gripping lever, said spring clip and the adjacent edge of the lever cut away being oppositely rounded so that the 25 needle point is guided into and received between the clip and said gripping lever cut away as the spring clip is sprung outwardly, and the thread is caught between the clip and the gripping lever cut away as the latter is retracted. 30

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