

[54] **METHOD AND APPARATUS FOR ANASTOMOSING AND INCISING**

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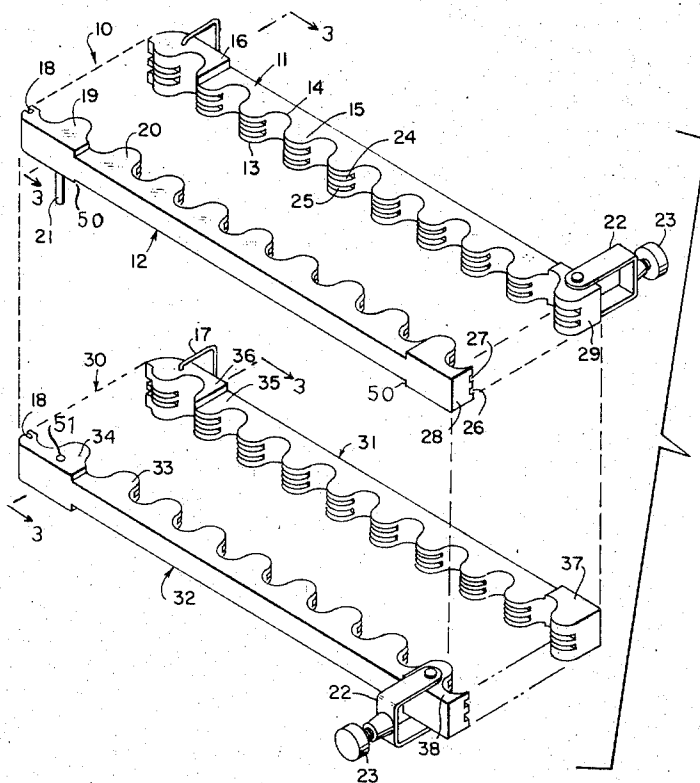
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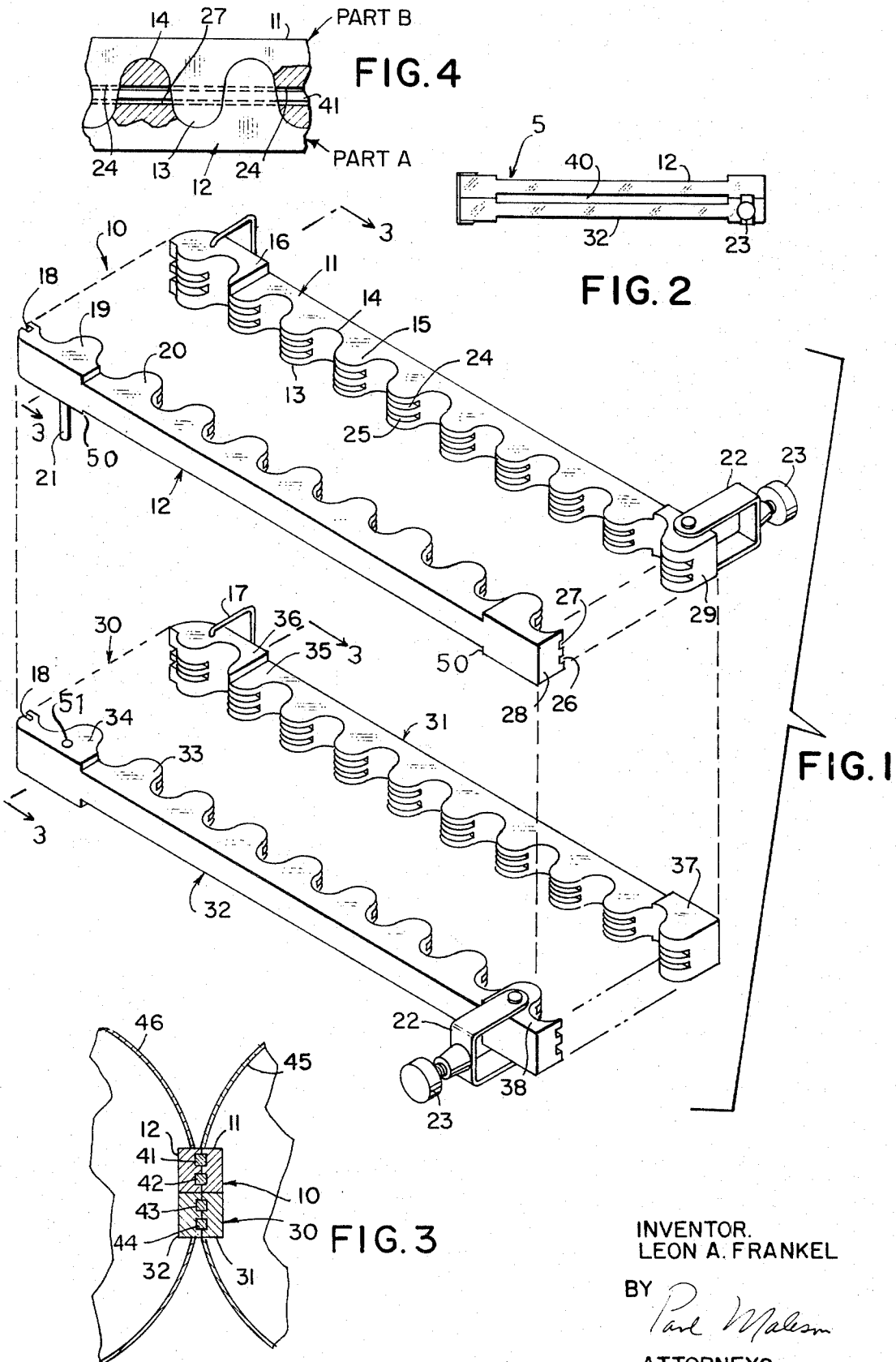
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[57] **ABSTRACT**

A method and surgical apparatus to provide incision and anastomosing guidance through viscera positioned in side-by-side relation. The apparatus, applicable to either open or closed methods of anastomosis, includes two pairs of longitudinally extending and horizontally engageable members. The paired members are in vertically displaced contact and engage the viscera on opposing surfaces whereupon the thin walled membranes are forced into an undulating path forming folds in a longitudinal path. The apparatus provides passages through which a double layer of sutures may be passed repeatedly intersecting opposing visceral folds. A guide path is formed in a longitudinal direction between the contacting paired members to permit a longitudinal incision through the viscera. Positioning of the apparatus in a fixed relation throughout the operation is accomplished by fixed and adjustable clamps fastened to opposing ends of the paired members.

15 Claims, 3 Drawing Figures





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METHOD AND APPARATUS FOR ANASTOMOSING AND INCISING

BRIEF OF THE INVENTION

1. Field of the Invention

This invention relates to the field of surgical instruments used for open or closed methods of anastomosis. In particular this invention relates to a method and apparatus used to perform incisions and suturing through viscera positioned in side by side relation. More particularly this invention relates to the field of gastrointestinal surgery to connect bowel sections or bowel sections to a stomach forming a single chamber therebetween.

2. Prior Art

Surgical instruments to perform anastomosis are known in the art. Prior art has provided instruments where viscera may be clamped and restrained by insertion of a longitudinal pin through folds in an undulating viscera path. However, prior art has not provided an instrument which will allow both incision of the viscera combined with a direct suturing. In addition, prior art has utilized a device having a handle to positionally restrain the device and clamped viscera during the operation which due to body cavity dimensions provides a restriction on the type of operation and ease of insertion of the device. Further, prior art in this field has not shown an instrument to be easily adaptable to both open and closed methods of anastomosis since a closed method necessitates the device to be clamped external to the viscera being incised. Prior instruments in the field also do not provide the surgeon with the option of providing a double or single layer suturing of the side by side viscera on vertically opposing sides of the incision.

SUMMARY

A method and apparatus for incision guidance through viscera and anastomosing which comprises a first and second pair of opposing elongated longitudinal members. The longitudinally extending members of both the first pair and second pair are horizontally opposed and have mutually engageable coacting undulating surfaces with the second pair of members being disposed in vertically displaced contact and longitudinally aligned with the first pair of members. An incision guide path is provided between the vertically disposed contacting first and second paired members with each of the pairs of members having a continuous longitudinal passage therethrough repeatedly intersecting the engageable surfaces. Vertical alignment and clamping means align and maintain the first and second paired members in a predetermined opposed engageable relationship.

An object of this invention is to provide an improved method and surgical instrument in the performance of open or closed anastomosis.

It is another object of this invention to provide an instrument which will allow combined incision and suturing of viscera in a minimum of time and steps.

It is a further object of this invention to provide an instrument which is optimally configured to the various body cavities within which the surgeon must operate.

It is still another object of this invention to provide a surgical instrument which may adjustably clamp the viscera in a fixed position without causing damage to sensitive tissue areas.

TOOTH DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded perspective view of the anastomosis apparatus;

FIG. 2 is an elevational view of the anastomosis apparatus in a clamped position;

FIG. 3 is a cross-sectional view of the anastomosis apparatus restraining side by side viscera taken along the section line 3—3 of FIG. 1; and,

FIG. 4 is a partial plan view of the apparatus showing the horizontally opposing teeth in a clamped position and suturing guide path.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1, 2, and 3 there is shown a self-double suturing apparatus or assembly 5 to provide for incision and anastomosing guidance as well as placement restraint between viscera 45 and 46 positioned in side by side relation. In general, assembly 5 is suitable to provide an incision and anastomosing guidance path for the connection of pliable membrane tubes such as between sections of the bowel or duodenum to stomach sections to form a singular cavity therebetween.

Suturing apparatus 5 comprises a first and second pair of longitudinally extended members 10 and 30 including elongated members 11, 12, 31 and 32. In construction, paired members 10 and 30 are formed of stainless steel or other such metal substantially inert to chemical reactions with internal bodily organs. Assembled, members 11 and 12 are horizontally engageable and coacting throughout the longitudinal extension of pair members 10. In similar fashion members 31 and 32 of second pair 30 coact with each other in a horizontal direction and contact respective members 11 and 12 in a predetermined vertical contact displacement to form the generally rectangular and longitudinally extended apparatus 5. Members 11, 12 as well as members 31, 32 interface and are engageable with each other along the common boundary of viscera 45 and 46 with members 31 and 32 contacting elongated members 11 and 12 respectively in the longitudinal direction and substantially horizontal plane.

Longitudinally extended members 11, 12, 31 and 32 of first and second paired members 10 and 30 have respectively formed thereon a plurality of mutually opposed horizontally extending teeth 15, 20, 35 and 33. Teeth 15, 20, 35 and 33 are substantially directed normal to the longitudinal extension of paired members 10 and 30 and are displaced longitudinally with respect to each other in order to permit a continuous interface between crest 13 and root 14 between two consecutive teeth on an opposing extended member to provide a coacting undulating interface between paired members 10 and 30 when respective members 11, 12 and 31, 32 are engaged.

The total tooth depth between crest 13 and root 14 of teeth 15, 20, 35 and 33 is constant throughout the extension of paired members 10 and 30 to provide constant pressure on viscera 45 and 46 along the contacting length thereby eliminating possible stress concentration points. In addition, crests 13 and roots 14 are rounded having an arcuate contour of sufficient dimensions to provide a restraint to viscera 45 and 46 without crushing or causing a puncture in an area where crests 13 engage roots 14 on opposing surfaces of viscera 45

and 46. In practice, a wide variety of tooth sizes have been found to be operative, however, in normal practice the ratio of radius of curvature of crest 13 to total tooth depth usually ranges between $\frac{1}{2}$ and 1. Body cavity openings in gastrointestinal operations of the kind herein described define an optimum overall longitudinal length of apparatus 5 in the range between 4 and 5 inches and a vertical dimension of between 1 and 2 inches when paired members 10, 30 are in an engageable position.

Suturing guidance paths are provided by a pair of longitudinally directed slots or grooves 24 and 25 formed in each of the plurality of teeth 15, 20, 35 and 33 of respective members 11, 12, 31 and 32. Slots 24 and 25 are rectangularly formed in a horizontal direction within the respective tooth and slightly in excess of the mid-point depth between crests 13 and roots 14 to form a longitudinal through path substantially rectangular in nature displayed by end slots 27, 26 of FIG. 1. As shown in FIG. 3 when paired members 10 and 30 are engaged in operation grooves 24 and 25 overlap with similar slots formed in a horizontally opposing elongated member to form double rectangular through passages 41 and 42 on first pair members 10 and similar through passages 43 and 44 within second pair members 30.

When longitudinally extended members 11, 12 and 31, 32 are horizontally engaged, viscera 45 and 46 are forced into an undulating path at the interface between paired members 10 and 30. As is shown in FIG. 4 the undulating path forms folds in viscera 45 and 46 substantially following the contour of teeth 15, 20, 35 and 33 through which a suture may be passed within passages 41, 42, 43 and 44 throughout the longitudinally extended paired members 10 and 30 to anastomose viscera 45 and 46.

Incision guide path 40 shown in FIG. 2 passes horizontally through apparatus 5 to permit incision of viscera 45 and 46 therein forming a common chamber or cavity. Relief surface 50 provides a longitudinal recess between first end 28 and 29 and second end 16 and 19 on the lower surface of respective members 11 and 12. In a similar manner relief surface 50 provides a longitudinal recess between first ends 38 and 37 and second ends 36 and 34 of respective members 31 and 32 to form at the vertical contact interface between paired members 10 and 30 longitudinal guide path 40 extending in a horizontal direction through apparatus 5. A scalpel or other knife may now be inserted into guide path 40 to longitudinally cut through viscera 45 and 46 when paired members 10 and 30 are engageably positioned.

Vertical alignment of paired members 10 and 30 in an operating condition within respective chambers formed by viscera 45 and 46 is accomplished by extension element 21 formed on second end 19 of longitudinally extended member 12. Extension element 21 is directed substantially perpendicular to the horizontal plane and extends in an outward direction from the lower surface of second end 19. Opening 51 formed within second end 34 of member 32 is substantially the same diameter as element 21 to permit slideable insertion of element 21 within and through opening 51. In this manner, contacting surfaces between extended members 12 and 32 may be brought into vertical alignment in fixed position on one side of viscera 46.

Clamping apparatus to horizontally position respective members 11, 12 and 31, 32 are provided on respective first ends 29, 28 and 37, 38 as well as second ends 16, 19 and 36, 34. Pivoting hook or bale 17 is rotatably attached to recesses in the upper and lower surfaces of second ends 16 and 36. Bale 17 is formed as a U-section having end hooks to engage upper and lower surface recesses and is inserted within recesses 18 formed on an end surface of second ends 19 and 34. Engagement of hook 17 within recess 18 therein provides one point of horizontal restraint between members 11, 12 and 31, 32.

Adjustable clamps 22 are rotatably secured to opposing first ends 29 and 38 on elongated members 11 and 32. Rotation about ends 29 and 38 to an opposed position contacting first ends 28 and 37 is provided by pin attachments through clamps 22 into upper and lower surfaces of first ends 29 and 38. Threaded thumb screws 23 passing through the U-shaped frame of clamps 22 may be brought into contact with respective members 12 and 31 when clamps 22 are in an opposed position. Continual turning of threaded screw 23 permits more force to be applied to the opposing elongated member causing a greater interface engageable pressure to be exerted between members 11, 12 and 31, 32. Adjustment of the force is necessitated by the fact that viscera 45 and 46 must be restrained between paired members 10 and 30 with sufficient pressure to positionally fix but less than that force which would crush or cause any tissue damage.

In the manner described, apparatus 5 may be inserted within side by side viscera 45 and 46 within respective chambers in fixed relation thereto to provide a guidance path 40 for incision and a set of continuous through passages 41, 42, 43 and 44 through which sutures may be inserted to secure viscera 45 and 46 above and below the incision.

In operation, apparatus 5 has led to a new method for incision and anastomosing of viscera 45 and 46. The first step of the method provides for forming an undulating path for viscera 45, 46 in a substantially longitudinal direction between opposing longitudinal members 11, 12 and 31, 32 of paired members 10 and 30 by inserting elongated members 11, 12, 31 and 32 on opposing surfaces of viscera 45 and 46. Respective members 11, 12 and 31, 32 are interfaced by positioning the respective members in a vertical alignment through insertion of element 21 into opening 51 of elongated member 32, and then further positioned in a longitudinal direction by engaging tooth crests 13 with opposing tooth roots 14 on opposing sides of viscera 45 and 46. Opposing members 11, 12 and 31, 32 are clamped in a horizontal restraint by inserting pivoted hook 17 into opposing member recesses 18 on second ends 19 and 34. First ends 29, 28 and 37, 38 are horizontally restrained by actuation of adjustable clamps 22 about an opposing longitudinally extended member.

The surgeon then cuts the viscera 45 and 46 through path 40 provided between the vertically displaced contacting members 11, 31 and 12, 32. Separate sutures are passed longitudinally through each of passages 41, 42, 43 and 44 by means of needles to provide a connection between cavities of viscera 45 and 46 with a double line of sutures on each side of the incision. Adjustable clamps 22 and pivoting hooks 17 are released from the holding action and members 11, 12, 31 and 32 are removed.

5 The method and apparatus herein described may be used for either an open or closed anastomosis with minor differences not involved in the basic inventive concept. In an open anastomosis members may be inserted directly into chambers formed by viscera 45 and 46. When apparatus 5 is being used in a closed anastomosis incisions must be made on opposing longitudinal ends of the side by side tube members. In this case, members 11, 12, 31 and 32 extend beyond the longitudinally opposed incisions and are clamped external to the viscera chambers.

What is claimed is:

1. A self-double suturing apparatus for guidance of incision and anastomosing of viscera, comprising:
a first and second pair of opposing elongated longitudinal members, said members of said first and second paired members being mutually horizontally opposed and having mutually engageable coacting undulating surfaces, said second pair of members being disposed in vertically displaced contact with said first pair of members and longitudinally aligned therewith;

incision guidance means within each of said elongated longitudinal members comprising a longitudinal viscera incision path between said vertically disposed contacting first and second paired members;

suture guidance means passing through said first and second paired members repeatedly intersecting said engageable surfaces adapted for insertion therethrough of a suture;

alignment means on at least two of said elongated longitudinal members to vertically align said first and second pairs of members in a predetermined orientation; and,

clamping means on at least two of said elongated longitudinal members to maintain said first and second pairs of members in predetermined opposing engaged relationship.

2. The apparatus as recited in claim 1 wherein said first and second paired members include a plurality of mutually opposed horizontally extending teeth formed on said elongated longitudinal members.

3. The apparatus as recited in claim 2 wherein said mutually opposed teeth are longitudinally displaced with respect to each other to permit an interface between a crest of one of said teeth on one of said elongated longitudinal members and the root formed by two of said teeth on said opposing elongated longitudinal member providing an undulating interface between pairs of said opposing longitudinal members when said members are engaged.

4. The apparatus as recited in claim 2 wherein said teeth extend in said horizontal direction substantially orthogonal to said longitudinal extension of said interfacing member pairs.

5. The apparatus as recited in claim 3 wherein said crests and said roots of said teeth formed on said elongated longitudinal members include a predetermined radius of curvature to prevent a high stress contact area between said undulating interface of said teeth and said viscera.

6. The apparatus as recited in claim 1 wherein said incision guidance means includes said first and second pairs of members having respective longitudinally directed recesses formed on respective interfacing ver-

tically contacting surfaces and extending through said respective members in said horizontal direction.

7. The apparatus as recited in claim 1 wherein said suturing guidance means includes said plurality of teeth in said first and second pair of members having horizontally and vertically aligned grooves extending longitudinally through said teeth when said pairs of members are engaged.

8. The apparatus as recited in claim 1 wherein said alignment means comprises a pin element rigidly secured to one of said elongated longitudinal members extending in a vertical direction substantially facing said opposing pair of longitudinal members one member of which having an opening to allow slideable insertion of said pin to permit vertical alignment between said first and second paired members.

9. The apparatus as recited in claim 1 wherein said clamping means comprises an adjustable clamp secured to a first end of one of said elongated longitudinal members of one of said pairs of members and rotatable with respect thereto to contact said opposing interfacing longitudinal member with a predetermined force in said horizontal direction when said members are engaged.

10. The apparatus as recited in claim 9 wherein said adjustable clamp comprises:
a frame member pivotally secured to said first end of one of said elongated longitudinal members and rotatable from a first position about said first end to an opposing position on said interfacing member; and,
a threaded screw member passing through said frame member in said horizontal direction and manually adjustable to contact said interfacing elongated longitudinal member.

11. The apparatus as recited in claim 9 wherein said clamping means includes a pivoting hook element secured to a second end of one of said elongated longitudinal members and a recess provided on said opposing interfacing member to receive said hook element and provide restraint between said opposing member when said members are in an interfaced position.

12. The apparatus as recited in claim 11 wherein said first and second paired members have a longitudinal length between 4 and 5 inches and a vertical dimension between 1 and 2 inches when said members are in interfaced position.

13. The apparatus as recited in claim 11 wherein said teeth formed on said first and second paired members have a ratio of said crest radius of circumference to tooth depth of between $\frac{1}{2}$ and 1.

14. A self-double suturing apparatus comprising a first and second pair of opposing elongated longitudinal members to respectively interface in longitudinal direction having an undulating interface said members having a longitudinal slot passing therethrough when interfacing positioned and a longitudinal recess formed said first and second pair of opposing members provide an opening therethrough in a vertical direction;

vertical placement means on at least two of said elongated longitudinal members to position and second paired members in a specific displacement; and,

holding means on at least two of said elongated longitudinal members to fix the position of said first and second paired members in a predetermined placement position.

15. The method for incision and anastomosing of viscera comprising the steps of:
 forming an undulating path of said viscera in a longitudinal direction between a first and second pair of opposing longitudinal members, including the steps of inserting said longitudinal members of said first and second paired members on opposing surfaces of said viscera, interfacing said longitudinal members of said first and second paired members, clamping said longitudinal members to positionally fix said members with respect to said viscera; the step of clamping including the steps of securing interfacing second ends of said paired members through a pivoted hook on one of said elongated longitudinal members to engage a recess in said opposing interfacing longitudinal member, and, 20

fastening interfacing first ends of said paired members through an adjustable clamp rotatable about one member and applying a horizontal force to said opposing interface member sufficient to restrain but less than that to cause damage to said viscera;

incising said viscera in said longitudinal direction between said first and second pairs of opposing members, by inserting a knife between said first and second pairs of opposing members and between said adjustable clamp and said pivoted hook, and moving said knife through said viscera in said longitudinal direction between but not extending as far as said pivoted hook and said adjustable clamp;
 suturing said viscera through folds provided by said undulating path; and,
 removing said first and second pair of opposing members.

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