

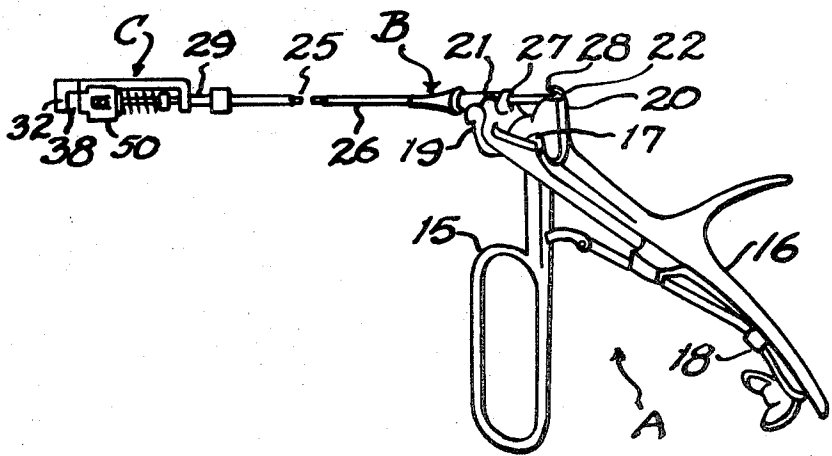
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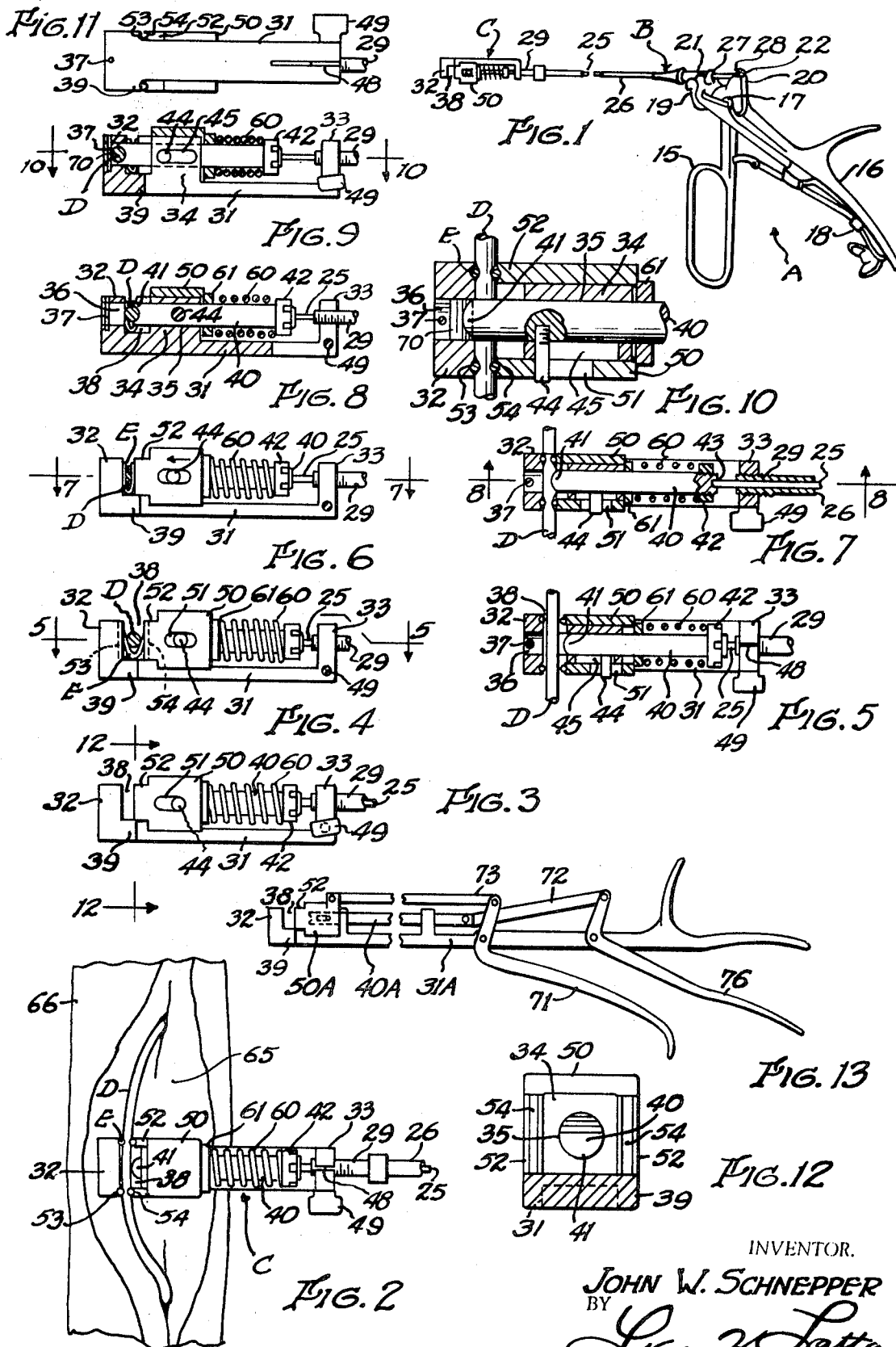
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[54] **TRANSECTION AND SPECIMEN-TAKING INSTRUMENT**
7 Claims, 13 Drawing Figs.
[52] U.S. Cl. **128/2 R,**
128/326, 128/335
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ABSTRACT: An instrument for surgical transection, specimen-taking and end-sealing of vessels, nerves and the like (as in vagotomy) having; (1) a clip-setting head to clamp spaced areas of a nerve or vessel and to apply and set hemostatic clips for sealing off those areas, having; (2) a shear for transecting the length of nerve or vessel between the sealed areas, and having; (3) a pocket to receive and hold the transected part for subsequent use as a biopsy specimen.





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TRANSECTION AND SPECIMEN-TAKING INSTRUMENT

BACKGROUND OF THE INVENTION

Instruments for rapid hematoses combining a ligator and a scissors-type cutter for severing a blood vessel between spaced clips clamped upon the vessel to effect ligature, are disclosed in the U.S. Pats. to Vogelfanger No. 3,006,344 and Wood No. 3,175,556, Surgical Problems Dealt with and Their Solution by the Invention.

In vagotomy, where a vagus nerve is transected (severed); e.g. for treatment of an ulcer, it is necessary to seal the cut ends of the nerve to arrest bleeding. Similar measures are required in the transection of blood vessels.

The vagotomy portion of the surgical treatment of peptic ulcer constitutes a procedure done in the chest, or at least within the rib cage, usually through an abdominal incision. This immediately suggests difficulties which inevitably appear in the patient whose costal angle is low and whose cardia is high. The desire to avoid difficult bleeding or esophageal injury accounts for a rare number of incomplete transections which, with improperly completely emptying procedure, produce the inevitable failure rate to say nothing of prolonged operating time. Experience often has led to blind dissection and avulsion without placing a marking and hemostatic clip and sometimes even to omitting removal of the confirmatory biopsy specimen. A measure of speed can be of importance in surgery. Postoperative complications following the depth and time of anesthesia required to do either a selective or truncal vagotomy may be proportional to the time utilized. In using conventional tools and methods, there is a minimum number of ten movements required. After the dissection and exposure of the nerve it must be clamped, clipped, and cut; then again clipped and cut to produce a specimen and leave the marker. When one side is done the procedure is repeated on the other side. The straightforward progression of the steps is more often than not interrupted with straining by the patient or relaxation by the assistant. Furthermore, most steps require visual control which may be impeded by either poor lighting, poor retraction, or inadequate anesthesia.

Dissatisfaction with the frequent and almost usual interruptions at this stage of the operation has led to development of the instrument of this invention, which eliminates waste activity and permits adequate accomplishment with but a single motion on each side. This instrument also makes it a safe blind procedure. Though thorough circumferential checking of the cardia remains essential, this can still be done without direct visualization. The instrument is capable of applying a clip on the proximal and distal segments as well as snipping out a portion of the vagus for microscopic confirmation. By using a readily available universal handle and extension, a choice of the angle of approach to the nerve is possible by selecting the favored length or curve of the extension. As long as the nerve can be palpated it can be guided into the channel which automatically makes clipping and snipping easily accomplished by one pistol grip motion.

SUMMARY OF THE INVENTION

The invention provides a compact assembly of parts, all movable on a common longitudinal axis, for clamping, ligating, transecting and specimen-holding; including axially opposed fixed and punch elements composed of respective fixed anvil and slidable-ligating jaws having respective axially opposed pairs of spaced clip-positioning recesses; respective slidable punch and fixed shear-die elements in coaxial relation to the anvil and jaw elements; and a specimen holding pocket in the shear-die, the latter being formed simply as a punch-receiving cavity in the center of the anvil, which, has a mouth defined by cutting edges cooperable with cutting edges on the leading end of the punch to effect a transecting operation as the punch enters the cavity with a shearing action. The back area of the die cavity provides the specimen-holding pocket.

DESCRIPTION

The invention, as outlined above, attains the following objects:

1. To effect clamping, ligating, transecting and specimen-collecting in a unitary assembly of fixed parts and coacting opposed parts moving in a common direction and in concert in a continuous succession of operative steps.

2. To transect an elongated anatomical tissue such as a vagus nerve or artery, and in the same operation to apply a closure clip on each of the transected ends and to remove a length of the tissue for biopsy or other examination function.

3. As a preferred aspect of the invention, to provide means to perform these operations in automatically controlled sequence in response to pressure received from a single pressure-applying element.

4. To provide an attachment head applicable to an existing pressure-applying instrument such as the forceps body of a universal laryngeal grasping and cutting forceps so that a surgeon who already possesses such a forceps can convert it into the transecting and specimen-taking instrument of this invention by acquiring the attachment head and coupling it to the forceps body of the laryngeal instrument.

These and other objects will become apparent in the following description and appended drawing, wherein:

FIG. 1 is a perspective view of an instrument embodying the invention, composed of an attachment head and a conventional forceps body to which it is coupled;

FIG. 2 is a plan view of the head and of an incision in which a length of a tissue element is engaged by the head for a transecting, end-sealing and specimen-taking operation;

FIG. 3 is a side view of the head in a normal position of the parts;

FIG. 4 is a side view of the head with closure clips inserted and applied to a tissue element;

FIG. 5 is a longitudinal sectional view taken on line 5—5 of FIG. 4;

FIG. 6 is a side view of the head in an intermediate stage of operation in which a section of the tissue element is sealed off from the adjacent portions thereof;

FIG. 7 is a longitudinal sectional view of the same taken on line 7—7 of FIG. 6;

FIG. 8 is a longitudinal sectional view of the same taken on line 8—8 of FIG. 7;

FIG. 9 is a longitudinal sectional view of the head in a final stage of operation in which a specimen section of the tissue element has been transected and pushed into the holding pocket thereof;

FIG. 10 is a fragmentary longitudinal sectional view of the same, on an enlarged scale, taken on line 10—10 of FIG. 9;

FIG. 11 is an inverted plan view of the head;

FIG. 12 is a cross-sectional view taken on line 12—12 of FIG. 3; and

FIG. 13 is a schematic view of an instrument embodying a modified form of the invention.

Referring now to the drawing in detail, I have shown, in FIGS. 1—12 thereof, as an example of one form in which the invention may be embodied, a transecting and specimen-taking instrument composed of a conventional forceps body A and pressure-transmitting stilet unit B; and a transecting and specimen-taking head C detachably coupled to the stilet-tube unit B and operable to transect a nerve or vessel D; the cut ends of which are sealed by spring silver hemostatic clips E of U- or V-form.

Forceps A, in general, comprises handles 15 and 16 pivotally connected at 17 in forceps arrangement; a locking unit 18 for securing them in a selected position of closure; and a pair of jaws 19 and 20 (integral continuations of handles 15, 16) having at their tips respective sockets 21, 22 for coupling the stilet unit B to the forceps.

Stilet unit B comprises a stilet wire 25, slidable longitudinally in a sheath tube 26. At one end of the unit these parts have respective knobs 27, 28; receivable in the jaw sockets 21,

22 to couple the parts to the forceps; and at the other end, the tube 26 has a threaded tip 29 for attachment to head C, and the stilet 25 projects from this tip for pressure engagement against a movable part of head C.

Head C comprises generally a support bar 31 having at one end an integral anvil 32, at its other end an integral bracket 33, and an intermediate, integral slide bearing 34. Between the anvil 32 and the opposed end of bearing 34, there is defined a mouth 38 (FIG. 3), adapted to receive a section of a nerve or vessel D; as shown in FIG. 2. Anvil 32, in side elevation, is L-shaped; including feet 39 projecting beneath the lateral extremities of mouth 38 to provide seats on which closure clips E can be supported. The lateral extremities of anvil 32 project beyond the sides of bar 31 to function as clip-closing jaws, as is more fully described hereinafter. A common slide axis intersects all three of the parts 32, 33 and 34, which, project laterally from bar 31 in a common direction. On this axis, and coaxial therewith, the bracket 33 has a threaded bore to receive the tip 29 of stilet tube 26; the bearing 34 has a slide bearing bore 35; and the anvil 32 has a shear-die cavity 36 crossed by a specimen-retainer pin 37. Bracket 33 and the adjacent portion of bar 31 are bifurcated at 48; and a clamp screw 49 is extended transversely through one of the furcations of the bracket 33 and threaded into the other furcation to lock the bracket 33 to the tip 29 by clamping action.

A punch 40 is slidably extended through the bearing bore 35. It has a leading end projecting into mouth 38, normally in opposed, spaced adjacent relation to anvil 32 and provided with a saddle-shaped notch defined between a pair of cutting nibs 41, with sharp edges, such as may be produced by grinding the notch transversely of the punch axis. At its opposite end, punch 40 is threaded to adjustably hold an abutment nut 42, and is provided with an end depression 43 (FIG. 10), in which the end of stilet 25 is seated in the assembled instrument. The punch is held against rotation by means of a radial key 44, in the form of a screw, threaded into its side and slidable in a keyway slot 45 (FIG. 9) in the side of bearing 34. Thus, the punch is maintained in a position properly oriented for reception of a tissue element in the mouth and between the nibs 41.

A plunger 50, of inverted square channel section, is fitted over the bearing 34 (which is of square cross section) and is slidable thereon, between limit positions determined by engagement of key 44 mouth a slot 51 in one of the side arms of the slide. These side arms are provided with clip-closing jaws 52, opposed to the lateral jaw portions of anvil 32. The latter are provided with clip-holding grooves 53 and the jaws 52 are provided with opposed grooves 54. Clips E are inserted between the respective jaws of anvil 32 and slide 50; their open ends are received in grooves 53 and 54, and their bights are seated on anvil feet 39; thus positioning the clips for proper embracing reception of tissue element D when the latter is received in mouth 38, in opposed relation to the cutting end of punch 40.

Punch 40 extends through a coil spring 60, engaged between the abutment nut 42 and a washer 61, which bears against the back end of slide 50 to transmit spring load thereto. The punch is slidable through the washer 61, so that it may advance into shearing engagement with the tissue element D, after having advanced the slide 50 to clip-closing position by pressure, yieldingly transmitted through spring 60.

OPERATION

In the use of the instrument, a pair of clips E are first inserted between plungers jaws 52 and the lateral jaw portions of anvil 32, pressing the slide 50 backward from its normal position of FIG. 3, against the yielding resistance of spring 60, to the retracted position shown in FIGS. 4 and 5. The head C is then inserted into an incision 65 such as may be made; for example, in the esophagus 66 to expose the vagus nerve, herein represented at D. The physician may lift the nerve into the transecting mouth 38 by inserting his finger under the nerve.

Having positioned the nerve D in the mouth of the instrument, the handles of the forceps A are then squeezed, driving the end of stilet wire 25 against the punch 40 to project the latter toward anvil 32. The punch movement will be transmitted through spring 60, to slide 50, to move the plunger jaws 52 into clamping engagement with spaced areas of nerve D (FIG. 6) with the arms of clips E interposed. The nerve is now securely held with the area thereof, to be transected in proper position for the transection. The extent of clamping action is determined by the spring loading. At the same time, the clips E are closed around the nerve D, and the leading end of the punch is brought into embracing contact with the nerve D (FIG. 7).

Further projection of punch 40 drives it into die cavity 36; shearing through the nerve D at both sides of the punch, so as to remove a specimen section 70 from the nerve D and push it into the cavity 36; which then functions to hold the specimen until it is removed for examination. The retainer pin 37 prevents the specimen from dropping out of the open end of the cavity 36, does not interfere with subsequent removal of the specimen by inserting a suitable pick through the open end, past one side of pin 37. During the final transecting state-of-movement of punch 40, it will slide through the plunger 50, which will advance only slightly to clinch the clips E tightly around the nerve D; the spring 60 being compressed as it yields to the punch movement, and its loading of plunger 50, increasing as it is compressed.

MODIFIED FORM

As shown (schematically only) in FIG. 13; the punch 40A and plunger 50A may be actuated independently by separate forceps levers 76 and 71, pivoted to support bar 31A, connected by linkages 72 and 73 to the punch and plunger respectively. In this arrangement the spring 60, of FIGS. 1-12, may be eliminated.

I claim:

1. In a surgical instrument for transecting a specimen from an elongated tissue element, in combination:

a support;
an anvil, carried by said support, said anvil including a shear die, including clip-positioning means at respective sides thereof;

a punch mounted on said support for longitudinal sliding movement in axially opposed relation to said die, said punch having a leading end receivable in said die with a shearing action;

a plunger, slidably mounted on said support, said plunger having laterally spaced slip-closing jaws provided with clip-positioning means in axially opposed relation to said first mentioned clip-positioning means;

said instrument having a mouth extending transversely between the pairs of opposed clip-positioning means, and between said anvil and the leading end of the punch when in a normal retracted position, said mouth having a tissue element receiving means extending transversely therein, and receiving a pair of open clips held by said clip-positioning means;

means unit B advancing said punch against a section of said tissue element between said clips, to transect said section by shearing action against said die; said die having a cavity providing a specimen-holding pocket; and said punch being positioned to move said tissue section into said die cavity after transecting it, for retention as a specimen for examination.

2. A transecting instrument as defined in claim 1, wherein, said plunger-advancing means comprises a spring, interposed between said punch and said plunger, and yieldingly transmitting a portion of the punch movement to the plunger.

3. A transecting instrument as defined in claim 2, including a slide bearing integral with said support, in which said punch is slidable, the forward end of said slide bearing being axially spaced from said anvil to define a portion of said mouth.

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4. A transecting instrument as defined in claim 3, wherein, said slide bearing is of rectangular section having parallel flat sides, and wherein, said plunger is of rectangular inverted channel section with side members embracing said flat sides of the bearing, and with said jaws being forward extremities of said slide members.

5. A transecting instrument as defined in claim 4, including a spring abutment nut, adjustably mounted on the rear end of said punch and a washer abutting the rear end of said plunger, slidable on said punch, and transmitting the load of said spring

to said plunger; said spring being a coil spring encircling said punch, with its end engaged under compression against said washer and abutment nut.

6. A transecting instrument as defined in claim 1, wherein, said support has a rear end provided with means for detachable anchorage to a pressure-applying forceps.

7. A transecting instrument as defined in claim 1, including separate lever devices for independently transmitting respective movements to said plunger and to said punch.

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