

United States Patent

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[54] **SURGICAL INSTRUMENT**
 7 Claims, 8 Drawing Figs.

[52] U.S. Cl. **72/410,**
 128/322, 128/326, 227/19

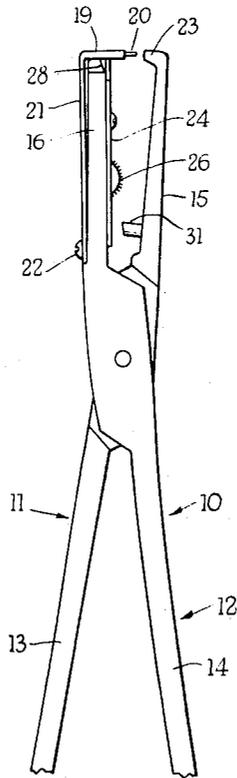
[51] Int. Cl. **B21d 9/08**

[50] Field of Search 72/409,
 410; 128/321, 322, 326; 227/108, 155, 144, 19

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ABSTRACT: A pair of forceps for inserting a staple into the edges of an incision in a blood vessel, the forceps comprising two jaw portions, a head at the tip of one jaw, a cage surrounding the head and adapted to receive and support a staple on the head, resilient means enabling the cage to move reciprocally relative to the head and an anvil at the tip of the other jaw portion adapted to depress the cage relative to the said one jaw portion, as the jaws are closed, and set the staple.



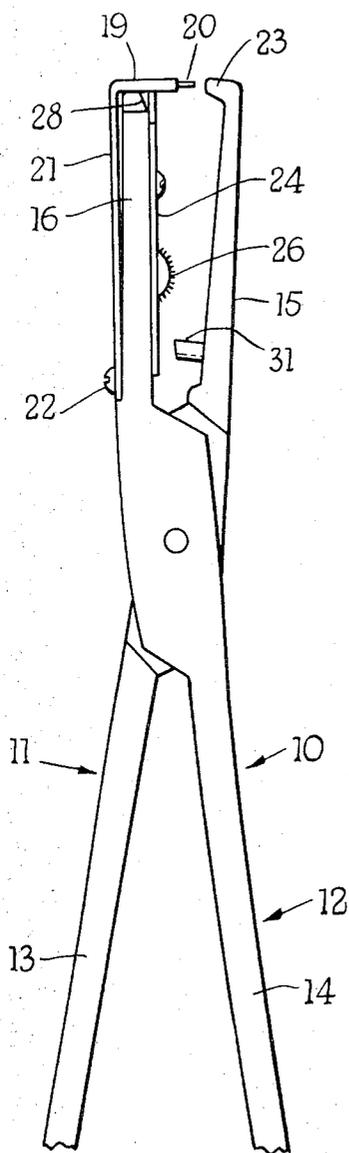


FIG. 1.

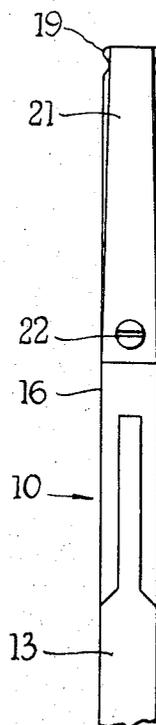


FIG. 2.

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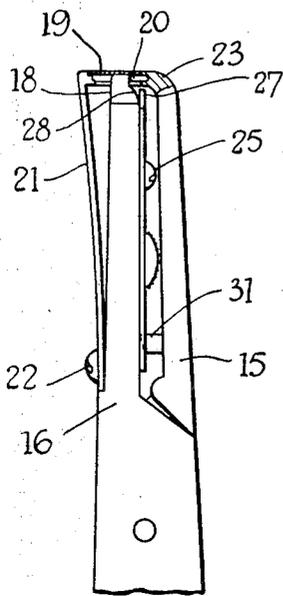


FIG. 3.

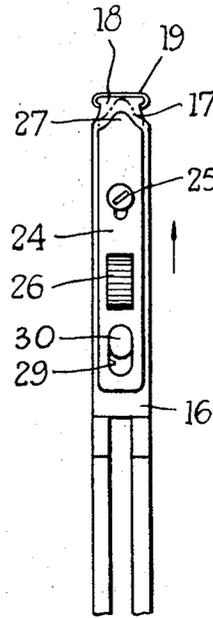


FIG. 4.

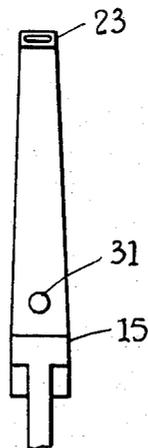


FIG. 5.

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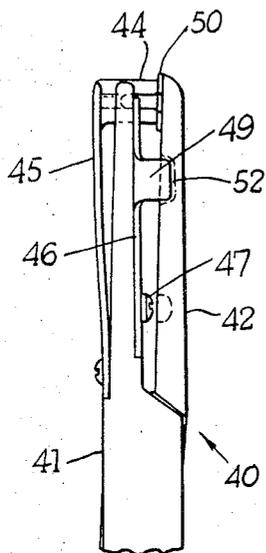


FIG. 6

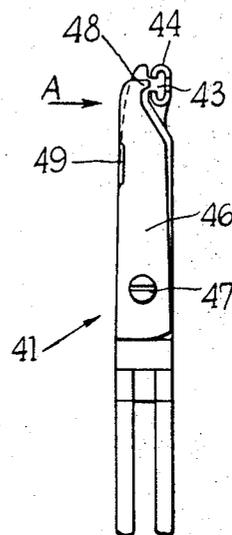


FIG. 7

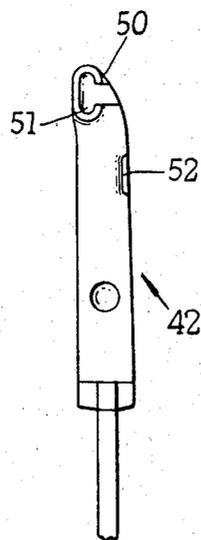


FIG. 8

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SURGICAL INSTRUMENT

BACKGROUND TO THE INVENTION

The present invention relates to an improved surgical instrument which can be used for stapling tissue together and in particular for stapling together the edges of an incision in the wall of an artery.

It is a known surgical practice to staple together the edges of an incision in a patient's blood vessel but hitherto known devices for inserting the staple have been extremely complex and expensive to manufacture.

These known devices have also been limited to placing the staple in position with the web of the staple aligned at right angles to the direction of the jaws of the forceps. Owing to the very limited space in which this type of forceps are used, it is essential in many instances that the staple is inserted in the tissue of the patient with the web of the staple aligned in the same direction as the jaws of the forceps and it is an object of the present invention in one embodiment to provide a pair of forceps which makes this possible.

STATEMENT OF THE INVENTION

According to the invention there is provided a pair of forceps for setting a staple comprising two pivoted jaw portions, one jaw portion having a head at its free end adapted to support the web of the staple, a cage which surrounds the head and is adapted to support and guide the staple so that the ends of the staple project upwardly from the head and resilient means associated with the cage enabling the cage to move reciprocally relative to the head and the other jaw portion having a formed anvil at its free end, the anvil being adapted to depress the cage relative to the head and upset a staple located in the cage when the jaw portions are pivoted towards one another by closing the forceps.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevation of a surgical instrument comprising a pair of forceps incorporating a stapling device;

FIG. 2 is a side view of the forceps of FIG. 1;

FIG. 3 is a view, partly broken away, of the jaws of the forceps in the fully closed position;

FIG. 4 is an elevation of the inside face of the jaw carrying the staple cage;

FIG. 5 is an elevation of the inside face of the jaw carrying the staple anvil;

FIG. 6 is an elevation of the jaw portions of a pair of forceps forming a further embodiment of the invention and showing the jaw portions partially closed;

FIG. 7 is a view on the inside face of one of the jaw portions of the forceps shown in FIG. 6; and

FIG. 8 is a view on the inside face of the other jaw portion of the forceps of FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the drawings a surgical instrument in the form of a pair of forceps is indicated generally at 10. The forceps 10 are formed from stainless steel and they are designed to enable a surgeon to place a staple into tissue with a high degree of accuracy. The preferred staple is made from 0.012-inch diameter silver wire and, in one application can be used for stapling together the edges of an opening or incision in the wall of a major blood vessel, for instance an artery.

The forceps 10 comprise two pivoted arms 11 and 12 each of which consists of a handle portion 13 and 14 respectively and a jaw portion 15 and 16 respectively. The end of the jaw 16 is formed with a neck 17 and a head 18, which is enclosed by a cage 19 adapted to receive a staple 20. The cage 19 is integral with a flat leaf spring 21 which extends along the outer face of the jaw 16 and the free end of which is attached to the jaw 16 by screw 22. The manner in which the spring 21 is attached to the jaw 16 enables the cage to be reciprocated relative to the head 18 from the position shown in FIG. 1 to

the position shown in FIG. 3, the tension in the spring 21 tending to return the cage to the position shown in FIG. 1 in which it projects above the head 18. Thus, when the spring is unstressed the cage 19 projects above the head and the staple 20 is located in the cage with its web lying on the head 18 across the length of the jaw portion 16 and with its two prongs projecting a short distance above the cage.

The jaw 15 has a raised anvil 23 at its free end, the anvil 23 projecting towards the end of the cage 19 on the jaw 16.

In use, as the jaws 15, 16 of the forceps are moved from the open position of FIG. 1 to the fully closed position of FIG. 3 the anvil first strikes the ends of the staple 20 and bends the ends inwardly. It then strikes the end of the cage 19 and as the cage is held the head 18 which continues to close, moves along the cage and drives the staple further against the anvil to set the staple. It will be appreciated that the jaws are closed on to the tissue which it is desired to staple together, although this is not shown in the drawing, so that the staple pierces the tissue and is set in the tissue, for instance to join together the edges of an incision in an artery.

To ensure that the staple 20 does not fall out of the cage when the forceps are moved into position a slide 24 is attached by a screw 25 to the inside face of the jaw 16. The slide 24 is manually movable by a finger grip 26 from the position shown in full line in FIG. 4 into a forward, staple-locking position, which is shown in broken line. The tip 27 of the slide is tapered and in the forward position it projects across the head 18. The surface of the head 18 slopes away from the slide and thus forms a recess 28 beneath the slide in which the web of the staple is seated and retained by the tip 27 of the slide. The slide 24 is also provided with a hole 29 at its rearward end and the hole 29 has a camming surface 30 which cooperates with a pin 31 projecting from the inner surface of the jaw 15 to withdraw the slide as the jaws are closed. When the staple 20 has been inserted in the cage 19, with the web of the staple seated in recess 28, the slide 24 is moved forwardly manually until the tip 27 of the slide locks the staple in position. The jaws are then closed to set the staple and the pin 31 strikes the camming surface 30 as the jaws close, withdrawing the tip of the slide from the staple before the anvil engages the end of the cage and the staple is upset.

In FIGS. 6 to 8 a pair of forceps is indicated generally at 40 which enables the staple to be inserted and set in tissues with the web of the staple aligned in the direction of the jaw portions.

The forceps 40 comprises two jaw portions 41 and 42. The jaw 41 is formed with a T-shaped head 43 which is located on one side of the jaw adjacent the free operative end of the jaw. A cage, 44, which is formed integrally with a leaf spring 45, surrounds the head 43 and the leaf spring 45 normally urges the cage into a position in which it projects above the head 43. The leaf spring is attached to the outer face of the jaw 41 and normally lies flat against the outer face of the jaw. On the inside face of the jaw 41 there is located a locking slide 46 which is pivoted to the jaw at 47. The slide 46 has a finger 48 at one end and the finger 48 is pivotable, in the direction of the arrow A, from the position shown in FIG. 7, into a position in which the finger projects into the cage 44 and across the head 43. The finger 48 is spaced from the upper surface of the head 43, either by forming a raised step in the finger or by stepping the surface of the head down.

The pivotable slide 46 also has a cam 49 which projects upwardly from its outer edge and which is adapted to engage a cam face on the jaw 42.

The jaw 42 is formed with an anvil 50 at its operative end and the anvil 50 is formed with a recess 51 which is shaped to set the ends of a staple. An inclined cam face 52 is formed in a side edge of the jaw 42 for cooperation with the cam 49 on the jaw 41.

The forceps 40 are used in a similar manner to the forceps 10. A staple is inserted, web first into the cage 44 so that the web of the staple is seated on the upper surface of the head 43. The pivotable slide 46 is then manually rotated in the

direction of the arrow A until the finger 48 overlies the web of the staple to hold the staple in position. When the staple is locked in position the jaws of the forceps are inserted into the wound in the patient and closed onto the tissues to be stapled together.

As the jaws close the ends of the staple pierce the tissues and then strike the anvil whereupon they are bent inwardly and partially set. As the jaws continue to close the cage 44 strikes the anvil and is held so that the staple is forced, by the head 43 onto the anvil and set in position in the tissues. At approximately the point when the cage strikes the anvil, the cam 49 on the slide 46 strikes the inclined cam face 52 and as the jaws close further the slide is pivoted in an anticlockwise direction, with reference to FIG. 7, sufficiently to withdraw the finger 48 clear of the web of the staple. This ensures that the jaws can be opened and the forceps withdrawn from the wound leaving the staple in position in the tissue.

It will be seen that the forceps 40 are designed to hold a staple with the web of the staple aligned in the general direction of the jaws of the forceps, a feature which is often essential when operating with very little room for movement of the forceps of the tissues to be stapled.

It will also be noted that both the forceps 10 and the forceps 40 are extremely simple and slender in their design and quick and easy to load and operate.

It will be understood that the above description of the preferred embodiment is to be construed as illustrative and not restrictive in nature and that the invention is best described in the following claims.

I claim:

1. A pair of forceps for setting a staple comprising two pivoted jaw portions, one jaw portion having a head at its free end adapted to support the web of the staple, a cage which surrounds the head and is adapted to support and guide the staple so that the ends of the staple project upwardly from the head and resilient means associated with the cage enabling the cage to move reciprocally relative to the head, the other jaw portion having a formed anvil at its free end, the anvil being adapted to depress the cage relative to the head and upset a staple located in the cage when the jaw portions are pivoted towards one another by closing the forceps, wherein locking means are provided on the said one jaw portion for locking a staple in position on the head when the jaw portions are open, the said locking means comprising a slide which is movable to overlie the web of a staple mounted on the head, and wherein release means are provided for releasing a staple as the jaw portions approach the closed position, the said release means comprising a cam surface on the slide and a cam on the said

other jaw portion, the cam being adapted to engage the cam surface as the jaw portions are closed together thereby withdrawing the slide from the locked position.

2. A pair of forceps for setting a staple comprising two pivoted jaw portions, one jaw portion having a head at its free end adapted to support the web of the staple, a cage which surrounds the head and is adapted to support and guide the staple so that the ends of the staple project upwardly from the head and resilient means associated with the cage enabling the cage to move reciprocally relative to the head and the other jaw portion having a formed anvil at its free end, the anvil being adapted to depress the cage relative to the head and upset a staple located in the cage when the jaw portions are pivoted towards one another by closing the forceps and wherein the cage is adapted to hold the web of the staple aligned in the direction of the jaw portions and a slide is pivoted on the inside face of the said one jaw portion, the said slide being pivotable relative to the said head so as to overlie the web of a staple located on the head and means being provided for automatically pivoting the slide away from the staple-locking position as the jaws close.

3. A pair of forceps as claimed in claim 2, wherein the said means comprise a cam on the slide projecting upwardly from the inside face of the said one jaw portion and an inclined camming face on the said other jaw portion, the camming face being adapted to strike the cam as the jaws close and thereby rotate the slide away from the staple locking position.

4. A pair of forceps as claimed in claim 1, wherein the cage is movable relative to the head and normally spring urged into a position in which it projects upwardly from the head towards the anvil on the other jaw portion and wherein the cage is engaged and depressed by the anvil on the other jaw portion as the forceps are closed.

5. A pair of forceps as claimed in claim 4, wherein the cage is integral with a leaf spring, the free end of which is attached to the said one jaw portion on the outside face thereof and which normally urges the cage into the said position.

6. A pair of forceps as claimed in claim 2, wherein the cage is movable relative to the head and normally spring urged into a position in which it projects upwardly from the head towards the anvil on the other jaw portion and wherein the cage is engaged and depressed by the anvil on the other jaw portion as the forceps are closed.

7. A pair of forceps as claimed in claim 6, wherein the cage is integral with a leaf spring, the free end of which is attached to the said one jaw portion on the outside face thereof and which normally urges the cage into the said position.

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