

Feb. 9, 1954

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2,668,538

SURGICAL CLAMPING MEANS

Filed Jan. 30, 1952

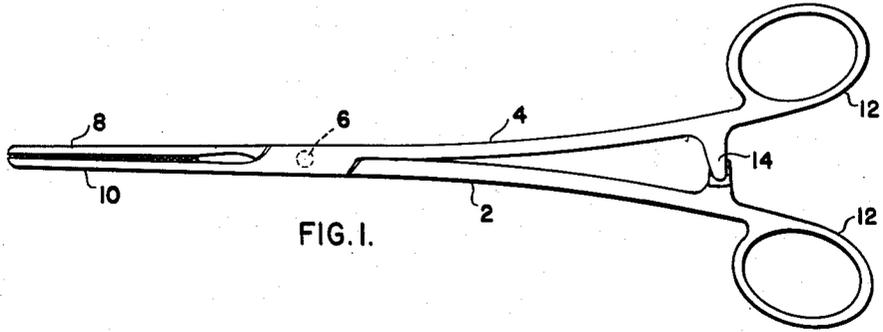


FIG. 1.



FIG. 2.

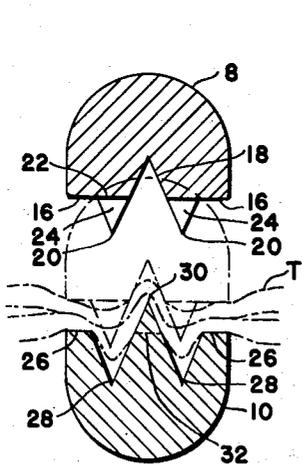


FIG. 4.

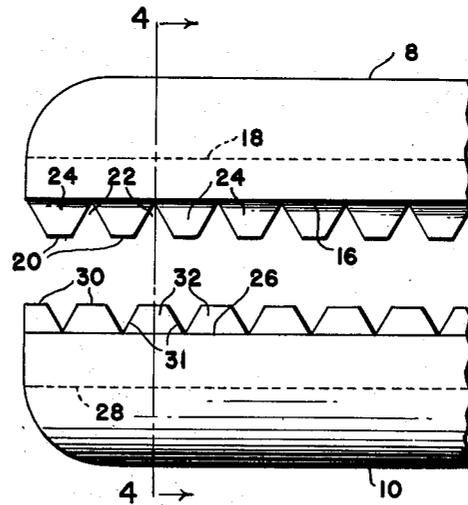


FIG. 3.

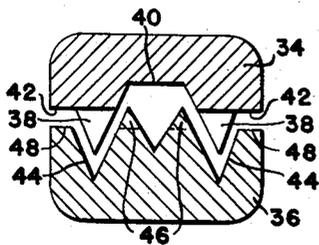


FIG. 5.

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2,668,538.

SURGICAL CLAMPING MEANS

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Application January 30, 1952, Serial No. 268,983

11 Claims. (Cl. 128—321)

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This invention relates to surgical forceps or other clamping means and particularly to clamping means adapted to clamp tubular vessels of the body or other tissues during surgery.

Surgical forceps which are in general use are made with a great variety of types of jaws having smooth, variously grooved, serrated, perforated or the like surfaces. These forceps have their advantages for various purposes but also have faults which appear in particular uses. In arterial surgery, for example, it is necessary to provide a clamp which will not slip but, at the same time, it is desirable to prevent penetration of the tissues or other destruction thereof by, for example, cutting action. Similar problems arise in connection with the surgery of other tubular members of the body or various other tissues.

The general object of the present invention is the provision of forceps which provide ample clamping for arteries or other tubular members of the body, or the like, with the least destructive action to the clamped tissues; the forceps reducing the possibility of slipping as well as aiding the secure clamping by the provision of teeth or points in particular relations to each other and to other structural features of the jaws. The general object of the invention as well as subsidiary objects having to do with particular features of construction will become apparent from the following description read in conjunction with the accompanying drawing in which:

Figure 1 is a plan view of a forceps provided in accordance with the invention;

Figure 2 is an elevation of the same;

Figure 3 is a fragmentary view showing the ends of jaws of the forceps greatly enlarged;

Figure 4 is a section taken on the plane the trace of which is indicated at 4—4 in Figure 3; and

Figure 5 is a section similar to Figure 4 but showing an alternative arrangement of the jaws.

Clamps provided in accordance with the present invention may be of any conventional construction aside from the formation of the clamping surfaces of the jaws. Figures 1 and 2 show, for example, forceps comprising the members 2 and 4 which are hinged at 6 and provided with finger-receiving rings 12 and a latching arrangement indicated at 14 comprising interengaging toothed projections. The jaws 8 and 10 may have conventional shapes aside from the clamping surface structure and it will be understood that the invention is quite generally applicable to a great variety of forceps and other clamps having straight or curved jaws of various dimensions

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depending upon the particular uses for which they are intended. The handles or other manipulating means may be of various types including springs, wedges, cam devices, screws or the like for the purpose of closing or adjusting the jaws.

The jaws may be wholly or only partially serrated in accordance with the invention and the general nature of the serrations provided in carrying out the invention will be made clear from Figures 3 and 4 which show a preferred arrangement of the serrations for an aortic clamp.

The two jaws differ in construction and there will first be described particularly the construction of the jaw 8. The formation of this jaw may take place by milling simultaneously clamping edge flats 16 and a V-shaped longitudinal groove 18 having relatively inclined longitudinally extending sides and leaving projected pointed ribs extending longitudinally of the jaw as indicated at 20. Teeth or serrations are then provided by transverse milling or filing of grooves 22 to leave longitudinal rows of wedge-shaped teeth or serrations 24 flanking the groove 18. In the illustrated modification the transverse grooves 22 are sufficiently spaced and formed at such angles that the teeth are wedge-shaped as just described, i. e., having relatively inclined longitudinally extending sides. However, for certain uses it may be more desirable to have the teeth pointed as viewed from the sides of the jaws, the teeth being in the form of individual pyramids of rectangular base.

A cooperating jaw 10 is milled flat at 26 and is provided, desirably in the same milling operation, with a pair of grooves 28 of the characteristics mentioned above leaving a projecting ridge 30 which by transverse milling or filing at 31 provides the teeth or serrations 32 flanked by the grooves. As in the case of the teeth 24, these teeth may be wedge-shaped or pyramidal depending upon the particular use for which the forceps is designed. It will be noted from Figure 4 that the teeth 24 are lined up with, and are adapted to enter, the grooves 28, while the teeth 32 are lined up with, and adapted to enter, the groove 18. For most purposes the angles of the teeth and grooves as viewed in the transverse section constituting Figure 4 will be equal. As illustrated the included angles of both the teeth and grooves in Figure 4 are 45°. The included angles of the transverse grooves 22 and 31 are 60°. The rows of teeth on the respective jaws are thus laterally disposed relative to each other.

Desirably the arrangements are such that, without interposed tissue, if the jaws were brought

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tightly together, the smooth flat surfaces 16 and 26, which extend substantially at right angles to the direction of relative movement of the jaws, would engage to prevent engagement of the teeth in the troughs of their respective longitudinal grooves. Under such circumstances, and since the tissues will, in general, prevent the smooth flat clamping surfaces from approaching very closely to each other, clearances are provided between the approaching surface portions of the jaws which will prevent penetration of the tissues, at any rate to such an extent as would produce undesirable damage.

The desired high insurance against slippage consistent with avoidance or limitation of damage to the tissues is still further secured by the respective arrangements of the teeth in the two jaws as indicated in Figure 3 in which it will be noted that the upper and lower teeth are not directly opposed to each other, as considered in transverse sections, but rather are relatively displaced by one-half the pitch of the teeth, i. e., the teeth of adjacent rows on the respective jaws are in longitudinally staggered relationship, from which it follows that each tooth is aligned with the groove between a pair of teeth in the other jaw.

Figure 4 shows in construction lines the position of the upper jaw 8 in relationship to the lower jaw 10 when tissues T are clamped. It will be evident that the compressed tissues limit the movement of the jaws towards each other and secure holding occurs without penetration of the tissues by the teeth by reason of a wavy condition imposed on the tissues in the section illustrated in Figure 4. Furthermore, by reason of the longitudinally staggered relationship of the teeth it will be evident that, viewed in a section taken longitudinally, the tissues are also disposed in wavy fashion, a tooth of one jaw tending to promote the disposition of a lateral portion of the tissue within a notch between teeth of the other jaw. The result is secure clamping without damaging penetration by the teeth even if the teeth are sharp. It may be here noted that the teeth may be made more or less "pointed" by variation of the angles involved in their formation, and in certain cases it may be desirable to round the edges or points of the teeth as well as the shoulders which are produced where the teeth or grooves intersect the flat surfaces such as 16 or 26.

In the modification so far described, one of the jaws is provided with a single row of longitudinally arranged teeth while the other is provided with two rows of longitudinally arranged teeth, the teeth of the respective rows being received within corresponding longitudinal grooves. It will be evident, however, that numerous variations may be provided involving, for example, additional rows of teeth, different arrangements of grooves, or even an arrangement in which each jaw comprises only a single row of teeth and a groove cooperating with the teeth in the opposed jaw. To indicate one of the many variations which may be provided reference may be made to Figure 5 which shows the cooperating jaws of another type of clamp, the section being similar to that of Figure 4.

The jaw 34 of this clamp is provided with teeth 38 which may be wedge-shaped or pyramidal, a groove 40, and flat portions 42. The other jaw 36 is provided with a pair of rows of teeth 46 which may be wedge-shaped or pyramidal, arranged to be received within the groove 40 of

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jaw 34, a pair of longitudinal grooves 44 arranged to receive the teeth 38, and flat portions 48 opposed to the flat portions 42 of jaw 34. In this modification the teeth may be staggered on the respective jaws as described in connection with Figure 3. It will be evident that the jaws illustrated in Figure 5 will clamp tissues in a fashion generally similar to that already described though the jaws may be wider. Numerous other arrangements may be provided in accordance with the invention, and in particular various portions of the jaws may, if desired, be made plain without serrations or grooves. In view of the many variations possible, it is to be understood that the invention is not to be construed as limited except as required by the following claims.

What is claimed is:

1. Surgical clamping means comprising a pair of jaws mounted for movement towards and from each other, each of said jaws comprising at least one longitudinal row of teeth and at least one longitudinal groove located to receive a row of teeth of the opposite jaw, the rows of teeth on the respective jaws being laterally disposed relative to each other.

2. Surgical clamping means comprising a pair of jaws mounted for movement towards and from each other, each of said jaws comprising at least one longitudinal row of teeth and at least one longitudinal groove located to receive a row of teeth of the opposite jaw, the rows of teeth on the respective jaws being laterally disposed relative to each other, and the teeth of adjacent rows on the respective jaws being in longitudinally staggered relationship.

3. Surgical clamping means comprising a pair of jaws mounted for movement towards and from each other, each of said jaws comprising at least one longitudinal row of teeth and at least one longitudinal groove located to receive a row of teeth of the opposite jaw, the rows of teeth on the respective jaws being laterally disposed relative to each other, and said jaws having cooperating relatively smooth clamping surfaces extending substantially at right angles to the direction of relative movement of the jaws.

4. Surgical clamping means comprising a pair of jaws mounted for movement towards and from each other, each of said jaws comprising at least one longitudinal row of teeth and at least one longitudinal groove located to receive a row of teeth of the opposite jaw, the rows of teeth on the respective jaws being laterally disposed relative to each other, and the teeth of adjacent rows on the respective jaws being in longitudinally staggered relationship, and said jaws having cooperating relatively smooth clamping surfaces extending substantially at right angles to the direction of relative movement of the jaws.

5. Surgical clamping means comprising a pair of jaws mounted for movement towards and from each other, one of said jaws comprising at least one longitudinal row of teeth, and the other of said jaws having a groove located to receive a row of teeth on the first mentioned jaw, and said jaws having cooperating relatively smooth clamping surfaces extending substantially at right angles to the direction of relative movement of the jaws.

6. Surgical clamping means comprising a pair of jaws mounted for movement towards and from each other, one of said jaws comprising a longitudinal row of teeth flanked by a pair of longitudinal grooves, and the other of said jaws having

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a longitudinal groove arranged to receive said row of teeth and flanked by a pair of longitudinal rows of teeth arranged to be received by the first mentioned grooves.

7. Surgical clamping means comprising a pair of jaws mounted for movement towards and from each other, one of said jaws comprising a longitudinal row of teeth flanked by a pair of longitudinal grooves, and the other of said jaws having a longitudinal groove arranged to receive said row of teeth and flanked by a pair of longitudinal rows of teeth arranged to be received by the first mentioned grooves, the teeth of the first mentioned row being in longitudinally staggered relationship with the teeth of the second mentioned rows.

8. Surgical clamping means comprising a pair of jaws mounted for movement towards and from each other, one of said jaws comprising a longitudinal row of teeth flanked by a pair of longitudinal grooves, and the other of said jaws having a longitudinal groove arranged to receive said row of teeth and flanked by a pair of longitudinal rows of teeth arranged to be received by the first mentioned grooves, and said jaws having cooperating relatively smooth clamping surfaces extending substantially at right angles to the direction of relative movement of the jaws.

9. Surgical clamping means comprising a pair of jaws mounted for movement towards and from each other, one of said jaws comprising a longitudinal row of teeth flanked by a pair of longitudinal grooves, and the other of said jaws having a longitudinal groove arranged to receive said row of teeth and flanked by a pair of longitudinal rows of teeth arranged to be received by the first mentioned grooves, the teeth of the

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first mentioned row being in longitudinally staggered relationship with the teeth of the second mentioned rows, and said jaws having cooperating relatively smooth clamping surfaces extending substantially at right angles to the direction of relative movement of the jaws.

10. Surgical clamping means comprising a pair of jaws mounted for movement towards and from each other, one of said jaws comprising at least one longitudinal row of teeth having relatively inclined longitudinally extending sides, and the other of said jaws having a groove located to receive a row of teeth on the first mentioned jaw and having relatively inclined longitudinally extending sides.

11. Surgical clamping means comprising a pair of jaws mounted for movement towards and from each other, one of said jaws comprising at least one longitudinal row of teeth, and the other of said jaws having a groove located to receive a row of teeth on the first mentioned jaw, and said jaws having cooperating relatively smooth clamping surfaces extending substantially at right angles to the direction of relative movement of the jaws, interengagement of said cooperating surfaces preventing interengagement of the teeth with their receiving groove.

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