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334, 335, 337; 227/8, 19, 76, 109

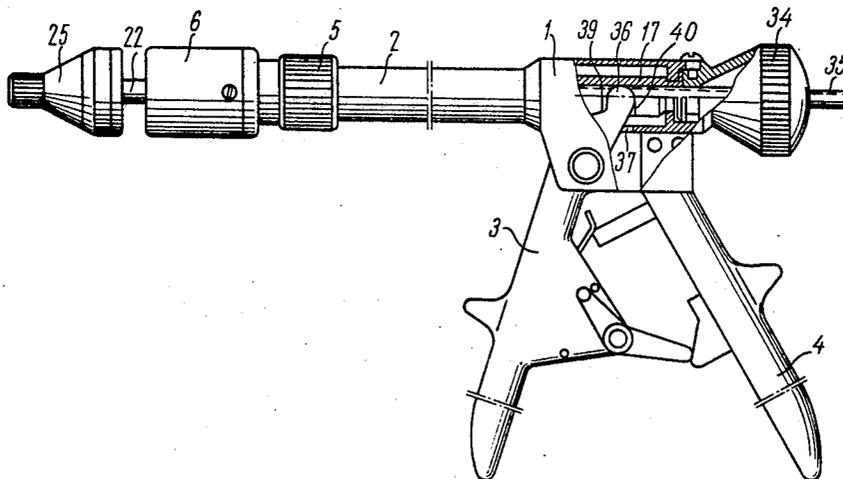
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[54] **INSTRUMENT FOR CIRCULAR SUTURING OF**
HOLLOW BODY ORGANS
 4 Claims, 11 Drawing Figs.

[52] U.S. Cl. **227/76,**
128/334, 227/19;

ABSTRACT: An instrument is provided for placing circular staple anastomoses between the organs of the alimentary canal during a surgical operation. The instrument has an extension tube for engaging interchangeable operating heads of different diameter, the operating heads carrying a staple head and a staple ejector. Additional extension tubes of different length can be added so that the instrument may have variable length to permit placement of anastomoses at different depths.



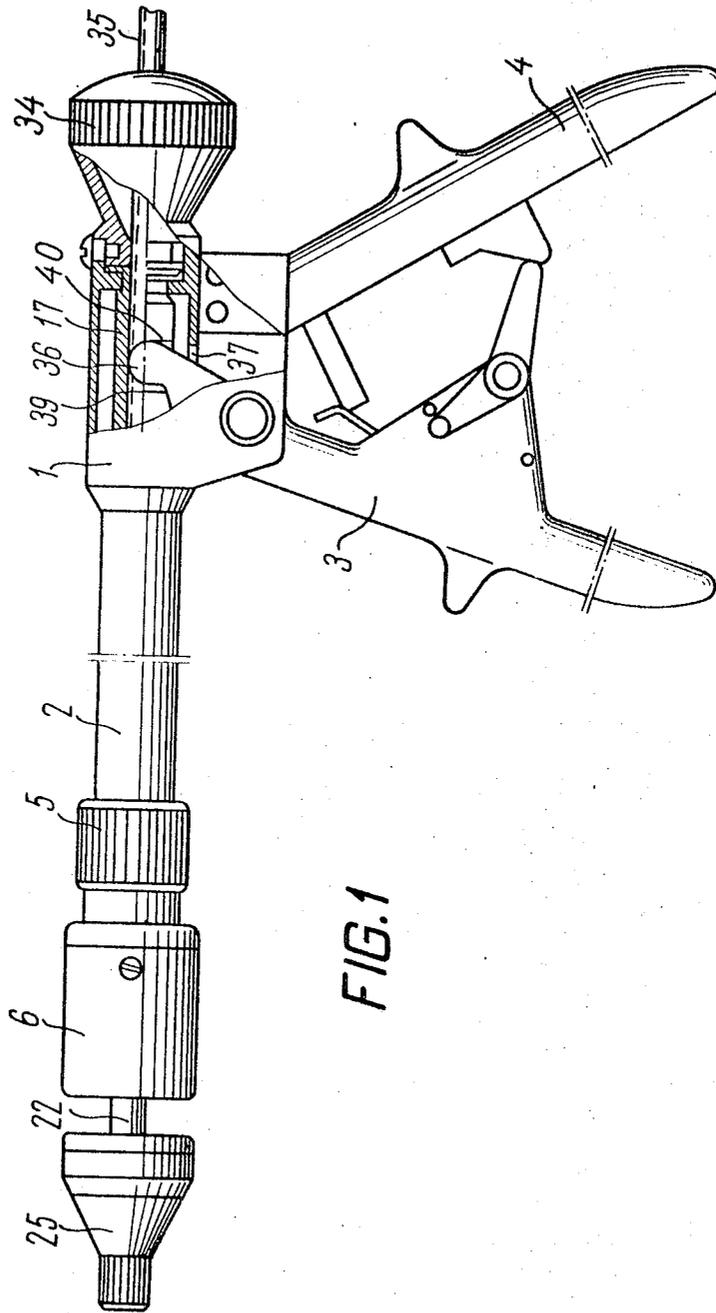


FIG. 1

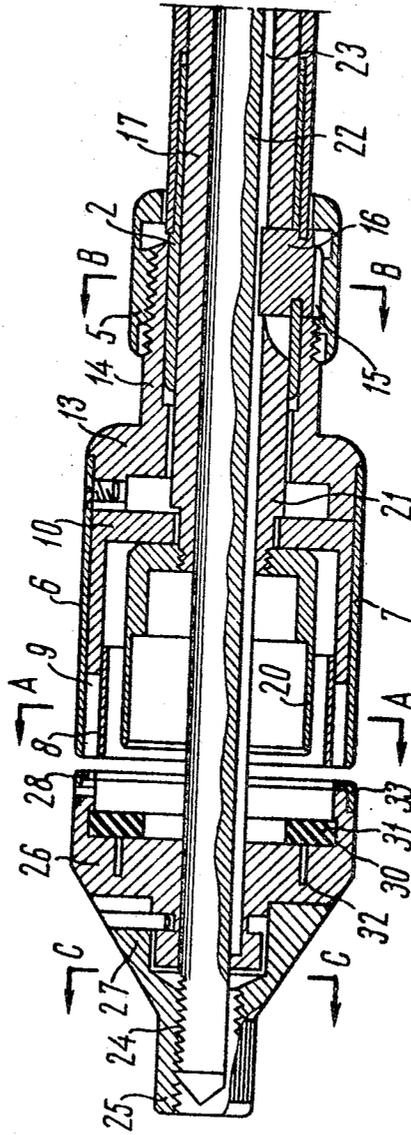


FIG. 2

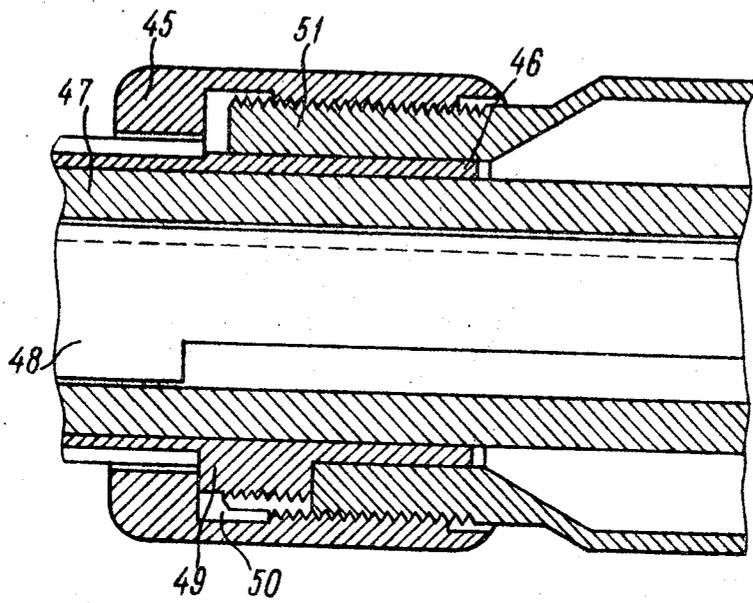


FIG. 11

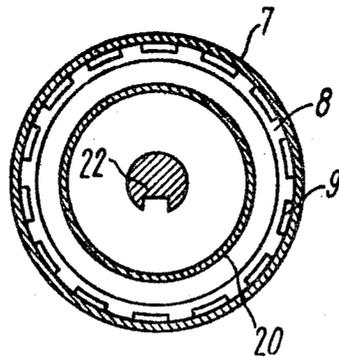


FIG. 3

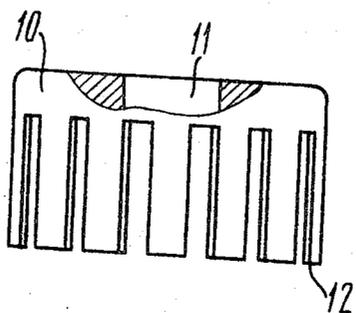


FIG. 4

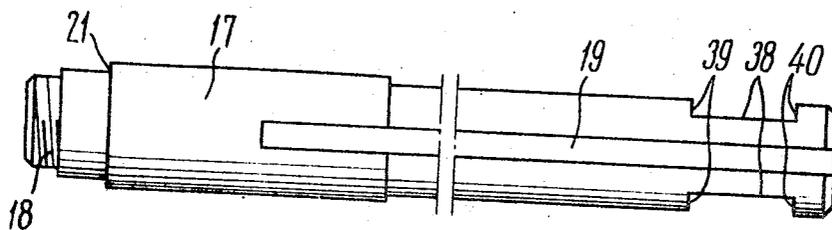


FIG. 6

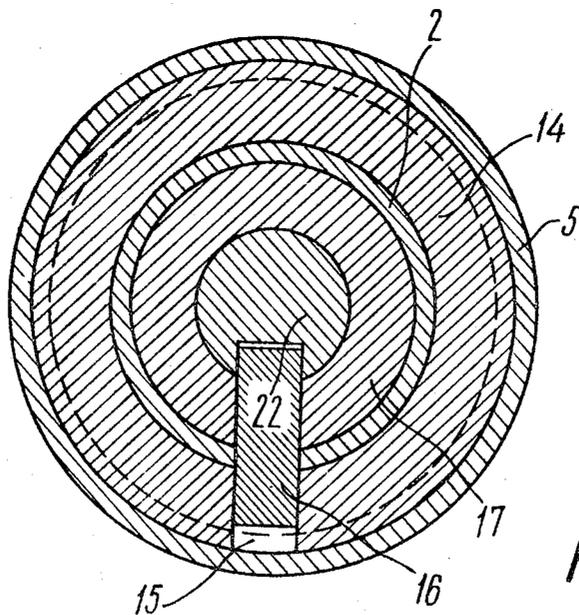


FIG. 5

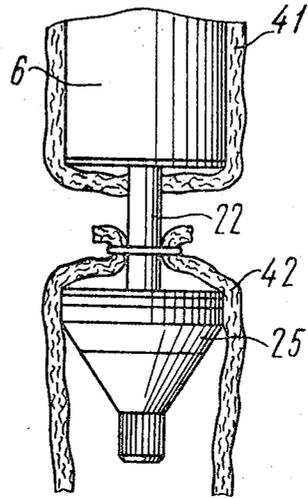


FIG. 8

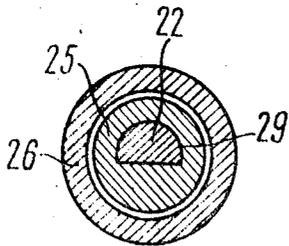


FIG. 7

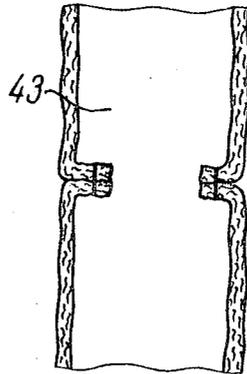


FIG. 9

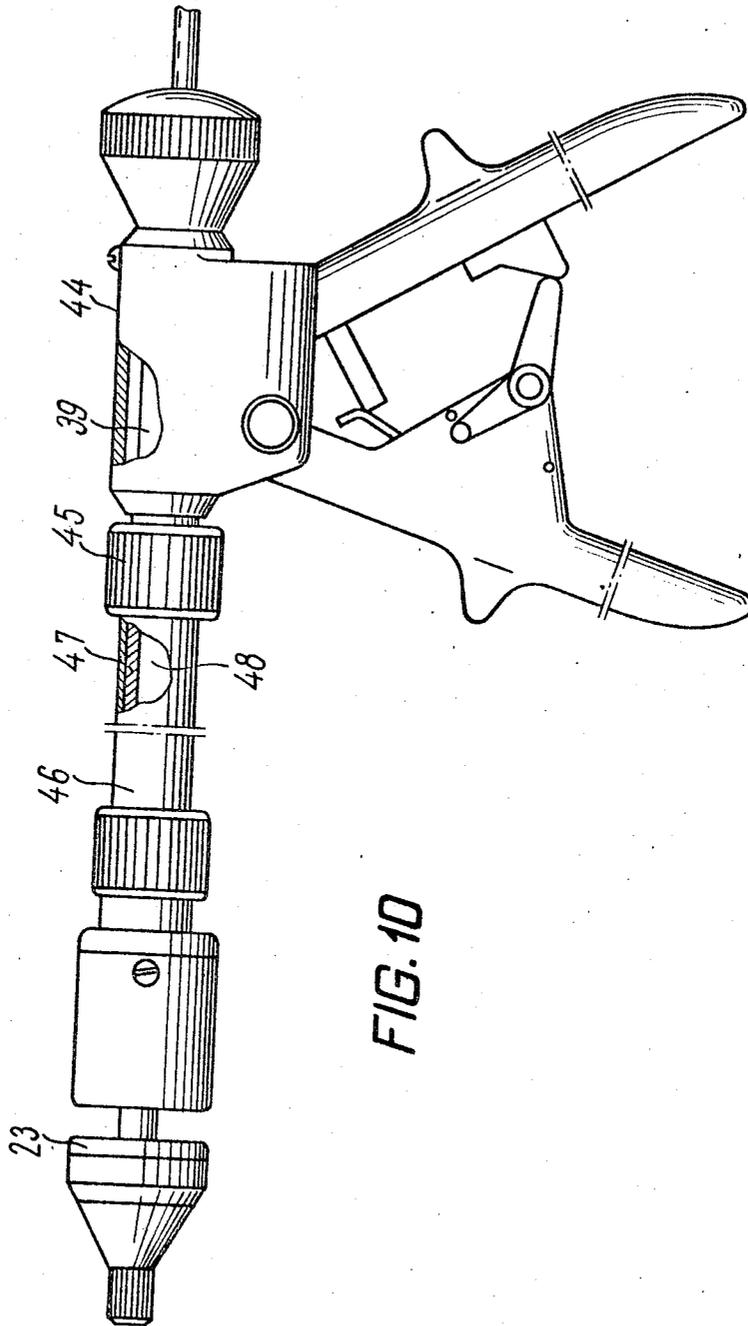


FIG. 10

INSTRUMENT FOR CIRCULAR SUTURING OF HOLLOW BODY ORGANS

The present invention relates to surgical instruments for applying circular staple sutures when placing anastomoses on hollow organs, and particularly to instruments for placing circular anastomoses between the organs of the alimentary canal.

There are known in present day surgical practice instruments for placing circular anastomoses between hollow organs (cf. USSR Author's Certificates Nos. 195,041 and 141,589; Patents: British No. 942,122, Canadian No. 736,256, U.S. No. 3,193,165, Swiss No. 407,407, French Nos. 1,349,201 and 1,461,464, Italian Nos. 674,175 and 724,978, Japanese No. 456,544, Belgian No. 668,917). Said instruments feature a tubular body which houses a central stem and a hollow movable rod carrying a cylindrical-shaped knife and a staple ejector, a staple portion, a detachable head with radial depressions for the staples to bend and with a recess for a replaceable semirigid washer.

A principal disadvantage inherent in the known surgical instruments of the character set forth hereinabove resides in the fact that each particular instrument is only suitable for applying circular staple sutures to the organs of a certain diameter, which depends upon the diameter of the tubular body of the instrument involved, in whose end face are provided grooves for staples.

It is common knowledge that tubular organs that constitute make the human alimentary canal (i.e. the esophagus, large and small intestines) feature different diameters at various levels even in the same man. Variations in the diameters of said organs take place in dependence of the age and habitus of a man, etc.

In order to place circular anastomoses between the organs of the alimentary canal, both the instrument body and its supporting head are introduced into the inner space of the organs being sutured. It is evident that the diameter of the instrument must correspond to that of the organs to be sutured.

Another disadvantage of the known surgical instruments for placing circular staple sutures is that the bodies of said instruments are fixed in length.

However, the experience of clinical application of the known instruments has proven that for placing anastomoses on the organs situated in deep operational wounds, instruments of greater length are required as compared to those to be employed for placing anastomoses on the organs located in shallow wounds.

In connection with the above, a necessity arises for a complete set of instruments incorporating tubular bodies of different diameters and lengths which is inexpedient from the economical viewpoint, especially for users to whom the acquisition of a number of such instruments will be rather costly.

In keeping with all set forth hereinabove, an object of the present invention is to devise a surgical instrument for placing circular anastomoses on all the organs of the human alimentary canal irrespective of the diameter thereof.

Another object of the present invention is to provide an instrument capable of placing a suture at any depth of the operational field.

Said objects are achieved in that in the surgical instrument for placing circular anastomoses, according to the present invention, the staple portion thereof is made as an individual structural component, i.e. a staple head with a built-in slidable staple ejector, and is adapted to be mounted with the possibility of rapid removal at the end of an extension tube which connects the staple head to the body, said tube being provided with a device enabling the staple body, the stem and the tubular rod to be aligned with respect to one another, whereby staple heads of different size can be mounted on said extension tube so that the staple slots be positioned strictly opposite to the depressions in the supporting heads.

For insuring simple and reliable operation of the instrument, said aligning device incorporates a double-headed key fixed in position at the end of said extension tube and adapted to fit into the longitudinal guide slots of the staple head, tubular rod and stem.

In order to provide for a quick removal or mounting of the staple head, according to the invention, its tailpiece is threaded, whereas on the extension tube a union nut is loosely set which is screwable onto the tailpiece of the staple head.

According to the invention, the slidable staple ejector built in into the staple head, is fixed to the tubular rod directly via a knife screwed onto the rod end projecting from the hole in the bottom of the staple ejector.

With the purpose of varying the length of the instrument, according to the invention, the replaceable extension tube is made fast on the body by a union nut loosely set on said tube and screwable onto the threaded end of the body.

In order to accurately align the extension tube with the body, a groove is cut in the threaded portion thereof, whereas the corresponding end of the tube carries a key to fit into said groove.

Other objects and advantages of the present invention will become evident upon considering an embodiment thereof described hereinafter by way of example with reference to the accompanying drawings, wherein:

FIG. 1 is a diagrammatic side view of the surgical instrument for placing circular anastomoses, according to the present invention;

FIG. 2 is a longitudinal sectional view of the working portion of the instrument represented in FIG. 1;

FIG. 3 is a section on line A-A of FIG. 2;

FIG. 4 is a diagrammatic side view of the staple ejector;

FIG. 5 is a section on line B-B of FIG. 2;

FIG. 6 is a diagrammatic bottom view of the tubular rod;

FIG. 7 is a section on line C-C of FIG. 2;

FIG. 8 is a schematic diagram of the arrangement of the organs to be sutured, prior to placing an anastomosis;

FIG. 9 is a cross-sectional view of an anastomosis placed by the instrument of the invention;

FIG. 10 is a diagrammatic view of the instrument for placing circular anastomoses provided with interchangeable tubes; and

FIG. 11 is a portion of the instrument shown in section at the place where an interchangeable tube is coupled to the instrument body.

In describing the particular embodiment of the present invention illustrated in the appended drawings, specific terminology has been resorted to for the sake of clarity. It should be understood, however, that the present invention is in no way limited to the terms so selected and that each such term covers all equivalent elements operating in a similar manner and employed for solving similar problems.

Now referring to FIG. 1, the instrument of the invention comprises a body 1 rigidly secured to an extension tube 2, a movable handle 3 articulated to said body and a fixed handle 4 rigidly coupled thereto.

A replaceable staple head 6 (FIGS. 1, 2) is fastened at the end of the extension tube 2 by means of a union nut 5.

The staple head 6 incorporates a cylindrical sleeve 7 inside which a splined ring 8 is fixed in position to form staple slots 9 (FIGS. 2, 3) in association with the sleeve surface.

Furthermore, accommodated inside the sleeve 7 is a slidable cylindrical staple ejector 10 (FIG. 4) provided with a hole 11 at its bottom and with peripherally spaced toothlike tabs 12 to drive the staples out of the slots 9. The ejector 10 is held in place inside the head 6 by means of a cover 13 (FIG. 2) which has a tubular tailpiece 14 provided with male thread for threadably engaging the union nut 5.

A groove 15 is provided in the tailpiece 14. In order to insure that the replaceable heads assume a definite position with respect to the extension tube, the latter is provided with an aligning device made as a double-headed key 16 fixed in place at the end of the extension tube 2. When mounting a staple head onto the extension tube, the outer head of the key 16 engages the groove 15 in the tubular tailpiece 14 of the staple head cover (FIGS. 2, 5).

Thus, a strong and reliable fastening of the replaceable staple head 6 at the end of the extension tube 2 in a strictly definite position is attained. It is evident that the staple heads

may be made for both recurrent and single use, i.e. of metal or plastic, respectively.

Extending inside the extension tube 2 and the body 1 is a tubular rod 17 (FIGS. 2, 6) provided with a front threaded portion 18 and a longitudinal groove 19 which serves for passage of the inner head of the key 16, whereby the rod 17 is fixed to assume only its definite position.

A replaceable cylindrical knife 20 is screwed onto the threaded end 18, said knife forcing the ejector 10 against a projection 21 of the tubular rod, thus preventing its spontaneous movement towards the staple slots 9, whereby a premature staple ejection is obviated.

A stem 22 passes inside the tubular rod 17, said stem being provided with a longitudinal groove 23 for the passage of the inner head of the double-headed key 16.

The pointed front end of stem 22 is provided with a thread 24 onto which a replaceable supporting head 25 (FIG. 2) is screwed.

The supporting head is a composite of three portions: a cylindrical portion 26, a taper portion 27 and a die portion 28.

The cylindrical and taper portions are interconnected with the possibility of independent rotation of the taper portion around its axis when the cylindrical portion remains immovable.

The cylindrical portion 26 has a hole 29 so profiled as to suit the shape of the cross-sectional area of that portion of the stem 22 whereon the supporting head is mounted (FIG. 7).

The provision of such a shape of hole makes it possible to set a replaceable supporting head in a strictly definite position with respect to the stem 22.

A cylindrical depression 30 is made in the supporting head 25 for accommodating a single-use semirigid washer 31, said washer protecting the cutting edge of the knife 20 from becoming blunt and contributing to the complete excision of the tissues during operation (FIG. 2).

An annular recess 32 is provided at the bottom of the depression 30, the diameter of said recess being equal to that of the cutting edge of the knife 20 (FIG. 2).

The die 28 has thrust depressions 33 for the staple ends to bend when suturing (FIG. 2).

A nut 34 (FIG. 1) is mounted at the end of the body 1, whereby the stem 22 together with the supporting head 25 is moved. The end of the stem facing the instrument body is provided with a thread 35 which corresponds to that of the nut 34.

In order to displace the tubular rod 17 and, consequently, the staple ejector 10 together with the knife 20, use is made of the movable handle 3. A shorter effective arm of the handle 3 is made as a fork so as to enter the body 1 through a port 37 and to straddle flat side surfaces 38 of the rod 17 (FIG. 6). When moving the handle 3, its arm 36 presses upon projections 39 or 40 on the tubular rod 17, thereby causing the latter to travel in either direction along the instrument depending upon the direction of movement of the handle 3.

INSTRUMENT APPLICATION TECHNIQUE

Prior to making use of the instrument of the invention, it should be prepared for operation, for which purpose the diameter of the supporting and staple heads with the knife required for the operation should be determined. Then, the slots 9 in the staple head are loaded with staples and a semirigid replaceable washer is placed into the depression 30 in the supporting head, whereupon the staple head and the knife, as well as the supporting head are mounted in position on the instrument. This done, both heads are brought together as far as they will go. In that position, the instrument is sterilized.

Intestinal walls 41 and 42 (FIG. 8) to be sutured are placed between the end-face portions of the supporting head 25 and the staple head 6 spaced fully apart.

For the purpose of juxtaposing the tissues being sutured, the stem 22, together with the supporting head, is moved with respect to the body 1 by rotating the nut 34 (FIG. 1).

Then, by pressing the handles 3 and 4 together, the rod 17 is made to move, as a result of which the toothlike tabs 12 of the moving ejector 10 act upon the staples so as to move them out of the slots 9; while moving, the pointed ends of the staples pierce the tissues being sutured and, upon meeting the thrust depressions 33 in the head 25, are bent to assume a B-shaped form.

The knife 20, while moving together with the rod 17, forces the tissues being sutured inside the already formed circular suture, then reaches the semirigid washer 31, enters the same and cuts out the tissues, thus forming a circular anastomotic aperture 43 (FIGS. 2 and 9).

The instrument of the invention is applicable for placing "end-to-end," "end-to-side," "side-to-side" and "side-to-end" anastomoses.

An alternative embodiment of the present invention is the same instrument but provided with the replaceable extension tubes, rods and stems, which allow the length of the instrument to be varied so as to be practicable for placing anastomoses at any depth of location of the operational field (FIG. 10).

The principal component part of such instrument is its body 44 on which a replaceable extension tube 46 is fixed in place by means of a union nut 45. Each replaceable tube corresponds to its particular replaceable tubular rod 47 and a replaceable stem 48.

An accurate setting of the intermediate tube on the instrument body is attainable by a key 49 (FIG. 11) fixed in position on the extension tube and engaging a groove 50 provided on a threaded cylindrical portion 51, said groove being provided with a thread for threadably engaging the union nut 45.

As to all other respects, the design of the instrument is entirely similar to that considered hereinabove.

Though this invention has been described hereinabove with reference to the preferred embodiment thereof, it will be understood that various alterations and modifications may be made without departing from the spirit and scope of the invention, as will be readily understood by those skilled in the art.

Such alterations and modifications are to be considered as falling within the limits of the spirit and scope of the invention and the appended claims.

We claim:

1. An instrument for placing circular anastomoses between organs of the alimentary canal, said instrument comprising a body with a cylindrical threaded portion having a groove and a detachable extension tube provided thereon, said tube having ends with aligning means constituted as keys, one being a one-headed key at one end of the tube and the other a double-headed key at the opposite end of the tube, a detachable tubular rod in said extension tube and body and having threads on the forward end thereof and a longitudinal groove receiving the inner end of said double-headed key; a stem including a pointed threaded forward end, said stem having a longitudinal groove receiving the inner end of said double-headed key, said stem being slidable longitudinally within said rod; a replaceable supporting head including two parts coupled so that one part is capable of rotating with respect to the other and having in one of its parts a shaped opening corresponding to the shape of the cross section of said threaded end of the stem, and a central threaded opening in its other part which is detachably secured in a definite position on said end of the stem, said other of the parts of the head having depressions for bending the staples; a replaceable staple head having slots for U-shaped staples and a threaded tailpiece having a longitudinal groove receiving the outer end of said double-headed key for securing said staple head at the end of the extension tube in a definite position with respect to said supporting head so that said staple slots are aligned exactly opposite said depressions; and a slidable cylindrical ejector slidably mounted in said staple head and having a bottom portion with an opening therein for passage of said rod; a cylindrical knife mounted on said rod; and means for moving said ejector and knife.

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2. An instrument as claimed in claim 1 comprising a nut for securing the replaceable staple head to the detachable extension tube, said nut being freely fitted on said tube and screwed to the threaded tailpiece of the staple head.

3. An instrument as claimed in claim 1, wherein said slidable cylindrical ejector is coupled to the tubular rod directly by the knife screwed on the threaded end of the rod projecting

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through the opening in the bottom portion of the ejector.

4. An instrument as claimed in claim 1 comprising a nut securing the detachable extension tube to the body, said nut being freely mounted on said tube and screwed to the cylindrical threaded portion of the body.

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