ABSTRACT OF THE DISCLOSURE

A surgical instrument for the removal of a polyp from within a body cavity which includes a tubular stem member having a clamp unit releasably connected with its front end so as to constitute a forward extension or head portion on the stem member. The clamp unit has a pair of pivoted jaw members movable to open and closed positions relative to the polyp to be removed. Coacting means on the stem member and clamp unit releasably connect the stem member with the clamping unit. An actuating means includes an actuator rod mounted within the stem member for relative longitudinal and rotational movement. Rotation of the actuator rod opens and closes the jaw members and longitudinal movement of the actuator rod operates the coacting means to provide for the connection and disconnection of the clamp unit with the stem member.

SUMMARY OF THE INVENTION

The invention provides a surgical instrument wherein a clamp unit releasably attached to a stem for insertion in a body cavity has a pair of serrated jaws capable of being manipulated to clamp therebetween an interior body growth in the cavity. With the jaws of the clamp unit closed about the growth, the stem is released from the clamp unit and withdrawn. The clamp unit shuts off the supply of blood to the growth thereby causing the growth to dry up. When this occurs the growth, with the aid of the clamp unit falls away from the living tissue for passage, together with the clamp unit, from the body cavity.

DETAILED DESCRIPTION OF THE INVENTION

Further features and advantages of this invention will become apparent from the following description when taken in connection with the accompanying drawings, wherein:

FIG. 1 is a side elevational view of the surgical instrument of this invention;

FIG. 2 is an enlarged, foreshortened longitudinal sectional view of the instrument;

FIG. 3 is a sectional view of a clamp unit and inner end portion of a stem member, which form part of the surgical instrument of this invention, illustrated in changed positions relative to their showing in FIG. 2;

FIG. 4 is an enlarged plan view taken along the line 4--4 of FIG. 3; and

FIG. 5 is a detail perspective view of the inner end portion of the stem member with parts broken away to more clearly show its construction.

With reference to FIG. 1, the drawing, the surgical instrument of this invention, designated generally as 10, includes a tubular body member 11 having a clamp unit 12 releasably connected to its front or inner end section 13, and an actuating or control assembly 14 carried on and projected from its outer or rear end section 15.

The clamp unit 12 (FIGS. 2 and 3) includes a tubular housing 17 of a cylindrical shape having an axial bore 18 for slidably receiving a jaw supporting slide member 19 of a cylindrical shape and formed with a threaded bore 21, that is open to the end 22 of the slide member 19. Pivotally connected at 23 to the opposite end of the slide member 19 is a pair of alligator jaws 24 having their inner adjacent surfaces formed with serrations 26 that are adapted for interlocking engagement, as shown in FIG. 2, when the jaws 24 are closed against each other.

The forward end of the bore 18 terminates in what will be referred to as a cavity 27 (FIGS. 2 and 4) of a substantially rectangular shape in transverse cross section. The cavity 27 has flat side walls spaced apart a distance substantially equal to the diameter of the bore 18 and end walls 28 of a concave shape arranged in a concentric relationship with and spaced outwardly from the bore 18. The edges 29 (FIGS. 2 and 3) of the cavity side walls 28 are in bearing engagement with corresponding cam portions 31 formed on the outer surface of each jaw 24 at its connected or pivoted end. These cam portions 31 are yieldingly urged against the cavity edges 29 by a flat biasing spring 32 of a U-shape that is positioned about the pivot pin 23 with its leg sections acting against the adjacent inner surface portions of the jaws 24 to yieldingly spread the jaws away from each other.

Thus, in response to the movement of the slide member 19 inwardly of the bore 18, and the resultant movement of the connected ends of the jaws 24 within the cavity 27, the riding action of the cam portions 31 on the cavity edges 29 provides for a progressive movement of the jaws 24 inwardly toward each other to their closed positions shown in FIG. 2. It is apparent of course that this inward movement of the jaws takes place against the action of the spring 32. Conversely on movement of the slide member 19 in a direction outwardly from the bore 18, the jaws 24 are yieldingly urged apart by the spring 32, with the riding action of the cams 31 on the cavity edges 29 providing for a progressive opening of the jaws 24 to their open positions shown in FIG. 3.

The reciprocal movement of the slide member 19 within the bore 18 takes place over a path of a predetermined length, and with the ends of the path defining the open and closed positions of the jaws 24. This path of travel is limited to the axial length of a depressed flat section 33 (FIGS. 2 and 3) formed in the peripheral surface of the slide member 19 so as to have shoulders 34 and 36 at its opposite ends. The flat section 33 and the opposite adjacent inner peripheral surface of the tubular housing 17 forms an axially extended slot for receiving a pin 37 having its ends supported in the housing 17. The pin is thus engageable with the shoulders 34 and 36 to limit the axial reciprocal movement of the slide member 19 and to hold the slide member 19 against movement out of the bore 18.

The rear end section 38 of the bore 18 is of an enlarged size relative to the intermediate section of the bore 18 to form an annular shoulder 39 (FIGS. 2 and 3). The terminal end of the bore section 38 is formed with an inwardly projected annular retaining bead or flange 41. An Allen screw 42 having a head portion 43 and a threaded shank portion 44 is inserted first within the bore end section 38 for threaded engagement of the shank 44 within the threaded bore 21 of the slide member 19 to a position wherein the under side of the head portion 43 is engaged by the shoulder 39.

It is seen, therefore, that the slide member 19 is reciprocally movable axially of the housing 17, to open and close the jaws 24, in response to a reciprocating rotation of the Allen screw 42. Manipulation of the Allen screw is accomplished by an elongated Allen wrench or actuator rod 46 that is supported within the bore 47 of the tubular body member 11 for rotational and axial movement, with the wrench or working end 48 thereof being movable from the front end of the tubular member 11 (FIGS. 2 and 5).

The bore 47 at the front end of the tubular body member 11 has an enlarged section 49 for receiving in a press
fit a tubular sleeve 51 having a front section 53 of an enlarged diameter extended forwardly from the tubular member 11 and an axial bore 52 of substantially the same size as the bore 47. The sleeve section 53 is formed in its side wall with two pairs of diametrically opposite axially extended slots 54 (FIGS. 5) to provide for the radial expansion and contraction thereof. In its contracted position, the sleeve section 53 is receivable within the annular retained end 41 on the clamp unit 12. On passing through the retaining bead 41 the section 53 is radially expandable for engagement of the shoulder 55 thereon with the bead 41 to releasably connect the clamp unit 12 as a forward extension on the tubular body member 11.

It is to be understood that the radial contraction of the sleeve section 53 takes place when the wrench end 48 of the actuator rod 46 is withdrawn from the sleeve section 53.

On projection of the wrench end 48 through the sleeve section 53, the sleeve section is held against radial contraction whereby to positively lock the section 53 against withdrawal from an engaged position with the retaining bead 41. On further extension of the actuator rod 46 forwardly from the sleeve 51 the wrench portion 48 is receivable within its associated socket in the head portion 43 of the Allen screw 42 to provide for the reciprocal axial movement of the slide member 19 in response to threading and unthreading of the Allen screw 42 relative to the threaded bore 21 in the slide member 19.

The clamp unit 12 is released from the tubular body member 11 by firmly gripping the tubular body member 11 at its rear section 16 and pulling the actuator rod 46 rearwardly from the body member 11. The actuator rod 46 is longitudinally and rotatably manipulated through the control assembly 14 (FIG. 2). The bore 47 is formed with an enlarged section 57 located in the outer or rear end section 16 of the tubular body member 11. The actuator rod 46 has an enlarged rear end section 58 of a cylindrical shape rotatably supported within the bore section 57. The rod section 58 has a hand grip or knob portion 59 projecting rearwardly from the bore section 57.

In turn the actuator rod section 58 has an axial bore 61 for receiving a cylindrical locking pin 62 that has a hand knob portion 63 extended rearwardly from the rod section 58. The inner or forward end of the bore 61 is open to an axial cavity 64 formed in the rod section 58 for receiving a coil spring 66 that is arranged in compression to yieldably urge the locking pin 62 in a rearward direction.

The side wall of the bore 57 is formed with a pair of axially spaced annular grooves 68 and 69. The outer peripheral surface of the locking pin 62 is formed with a semi-spherical shaped depression or dimple 71 and the side wall of the bore section 61 in the actuator rod 46 is formed with a transverse hole 72. The dimple 71 and the hole 72 are movable into and out of registration with the grooves 68 and 69. A ball bearing 74 is carried within the dimple 71 and the hole 72 so as to have a portion thereof projected within a groove 68 or 69. The outer edge of the hole 72 is cramped or turned in as indicated at 76 to limit the projection of the ball 74 therefrom. It is also to be noted that when the ball 74 is within the center of the depression 71 it is located out of a groove 68 or 69 to provide for the axial transfer of the ball between the annular grooves 68 and 69.

The location of the ball 74 at a groove 68 and 69 defines the position of the wrench end 48 of the actuator rod 46 relative to the sleeve 51. With the groove 69, the wrench end 48 is withdrawn out of engagement with the Allen screw 43 to a retracted position within the tubular sleeve 51 and out of the split sleeve section 53. When the actuator rod 46 is in its retracted position the sleeve 51 is readily movable into and out of the bore section 38 of the housing 17 of the clamp unit 12.

In the use of the instrument 10, assume that the clamp unit 12, the actuator rod 46 and the control assembly 14 are in their relative positions shown in FIG. 2. With the clamp unit 12 functioning as the head end of the instrument, the instrument is inserted within a body cavity such as a colon until the clamp unit 12 is at a polyp or foreign growth to be removed. The jaws 24 are then opened by rotating the hand knob 59 to turn the actuator rod 46, it being apparent that the locking pin 62 also rotates the actuator rod 46. With the polyp positioned between the jaws 24, the rod 46 is manipulated to firmly close the jaws in a secured position on the polyp. During this operation of the jaws 24 the rod 46 is held against axial movement by the location of the ball 74 within the hole 72 with the opposite side portions thereof positioned within and in bearing engagement with a side wall of the annular groove 68 and dimple 71. As shown in FIG. 2 this bearing engagement is maintained by the action of the spring 66.

With the tubular body member 11 held in one hand at its rear end section 16, the locking pin 62 is moved forwardly against the pressure of the spring 66 to permit the ball 74 to drop within the depression 71 and out of the groove 68. The actuator rod 46 and locking pin 62 are then moved axially rearwardly relative to the body member 11 until the ball 74 is opposite the groove 69. The spring 66 acting on the pin 62 moves the ball 74 upwardly into the groove 68 for bearing engagement with the side wall thereof and with the side wall of the depression 71. The rod 46 is then locked against axial movement in a retracted position wherein the wrench end 48 is withdrawn into the sleeve 51 to provide for the release of the split sleeve section 53 from its engaged position with the bead or flange 41.

The body member 11 is then withdrawn from the body cavity and the clamp unit 12 with the jaws 24 closed about the polyp remains in the cavity. When the polyp is atrophied, because of the lack of blood circulation therethrough, it will fall off from the side wall of the body cavity. When the polyp or foreign growth is in the colon, the polyp and clamp unit 12 will have normal passage for removal from the colon. If the cavity is other than the colon, a suture indicated at 77 may be passed through openings of the jaws 24 so that on drying up of the foreign growth, the suture provides for the removal of the clamp unit 12 from the body.

Although the invention has been described with respect to a preferred embodiment thereof, it is not to be so limited since changes can be made therein which are within the full intended scope of the invention as defined in the appended claims.

1. A surgical instrument for the removal of a polyp located within a body cavity, comprising:
(a) a tubular stem member insertable within the body cavity having a front section and a rear section,
(b) a clamp unit including a pair of pivoted jaw members movable to open and closed positions relative to a polyp to be removed,
(c) coacting means on said clamp unit and stem member for releasably connecting said clamp unit with said front section to form a forward extension thereof,
(d) an operating member movably supported on said clamp unit and operable to move the jaw members to open and closed positions therefor, and
(e) means for actuating said operating member and for connecting and disconnecting said coacting means, including an actuator rod mounted within said stem member longitudinally and axially relative thereto, with rotation of said actuator rod, when the clamp unit is connected with the stem member, acting to move said operating member to open and close said jaw members, and longitudinal movement of said actuator rod providing for the connection and disconnection of the clamp unit with said stem member.
2. The surgical instrument as defined in claim 1 wherein:
   (a) said coacting means includes a tubular sleeve member having a radially expandible and contractible end portion extended forwardly from said front section of the stem member, and an opposite end portion seated within said front section, said actuator rod being longitudinally extendible through said sleeve member, and
   (b) said clamp unit having a cavity with an inwardly projected annular bead about the open end thereof, said radially expandible and contractible end portion, when contracted, being receivable within the cavity below said annular bead, and engageable with said annular bead when expanded, said expansion and contraction being in response to the longitudinal movement of said actuator rod relative to said sleeve member.

3. The surgical instrument according to claim 1 wherein:
   (a) said rear section includes a hand grip member and said actuator rod having an enlarged portion movably supported within and projected rearwardly from said hand grip member,
   (b) a hand knob on said projected portion of the actuator rod, and
   (c) coacting means on said enlarged rod portion and on said rear section of the stem member operable to releasably lock said actuator rod against longitudinal movement at longitudinally moved positions therefor providing for said connection and disconnection of the clamp unit with the stem member.

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