

United States Patent

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[54] **VACUUM ROTARY DISSECTOR**
 7 Claims, 8 Drawing Figs.

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 30/133, 30/240

[51] Int. Cl. A61b 17/32

[50] Field of Search 128/2 B,
 304, 305, 310, 311, 317, 133, 240; 285/277;
 30/29.5

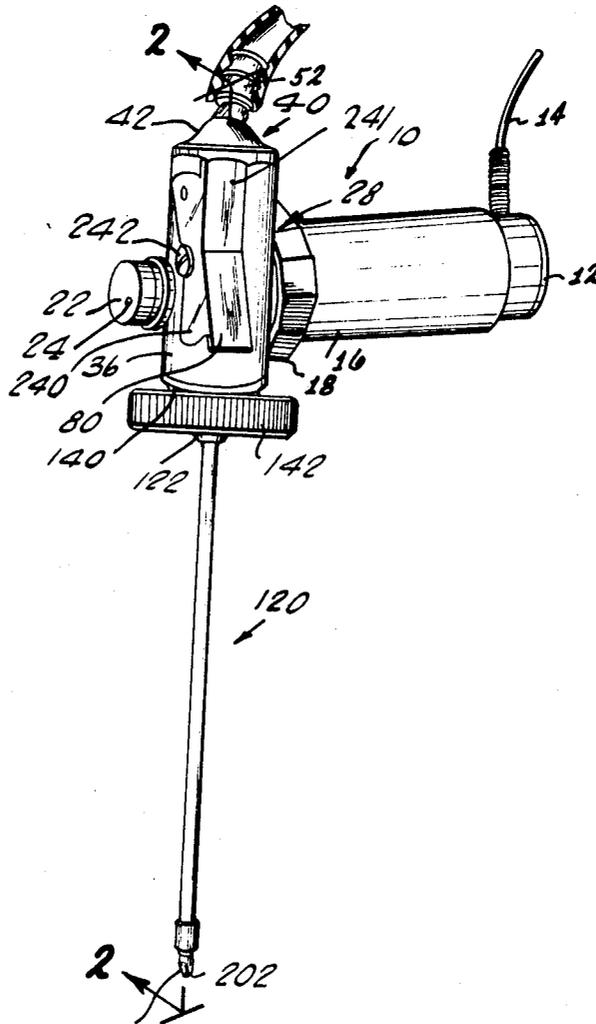
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ABSTRACT: The device is a surgical instrument appropriately termed a vacuum rotary dissector, for purposes of performing delicate surgical operations such as brain operations for removing undesired tissue, etc. A thin elongated tubular member or sleeve which is motor driven, rotates within another elongated sleeve having a bullet-shaped end with a side opening in it. At the end of the inner sleeve, there is a cutout providing side edges which are cutting edges that rotate adjacent to the side opening in the outer sleeve, the tip end of the inner sleeve also being bullet shaped to conform to the interior contour of the tip and of the outer sleeve.

The improvements reside in the contours of the tip ends of the sleeves, the particular shape of the side opening in the outer sleeve, and the particular configuration of the cutting edges or surfaces on the inner sleeve. Also, axial pressure is maintained on the outer sleeve to urge its end surfaces into engagement with surfaces of the tip of the inner sleeve.



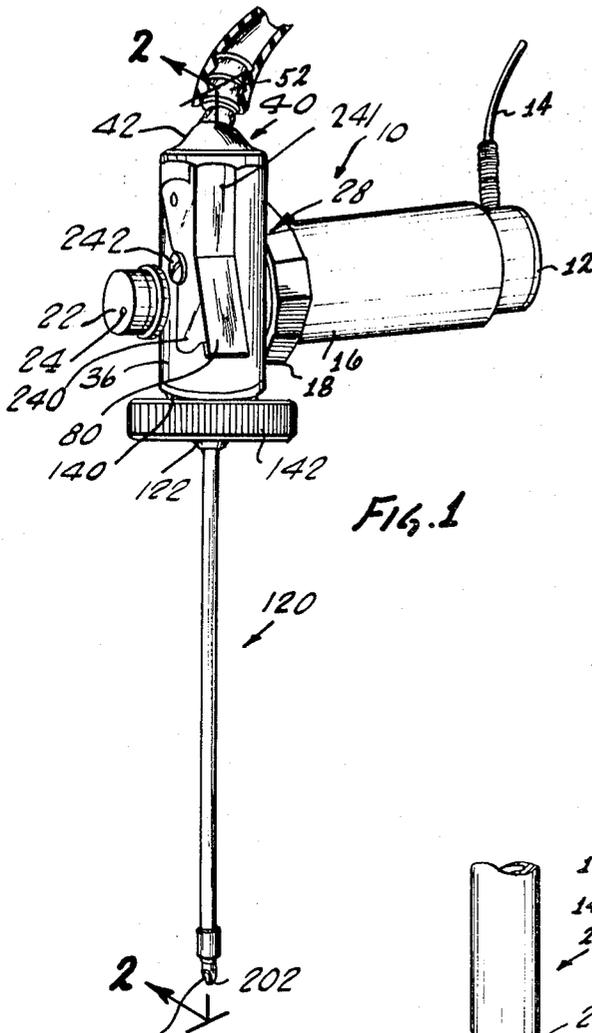


Fig. 1

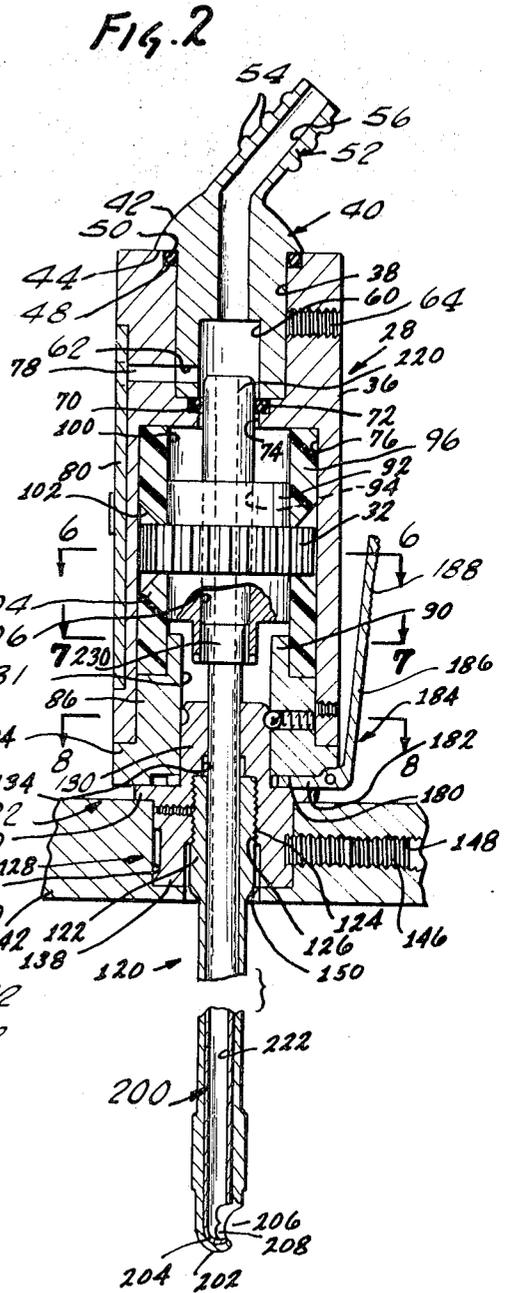


Fig. 2

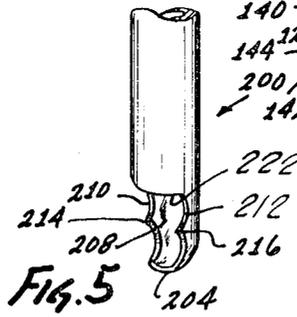


Fig. 5

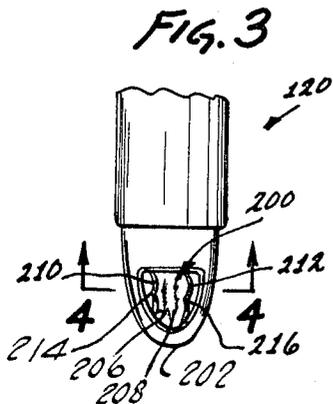


Fig. 3

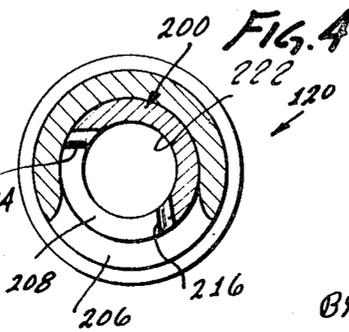


Fig. 4

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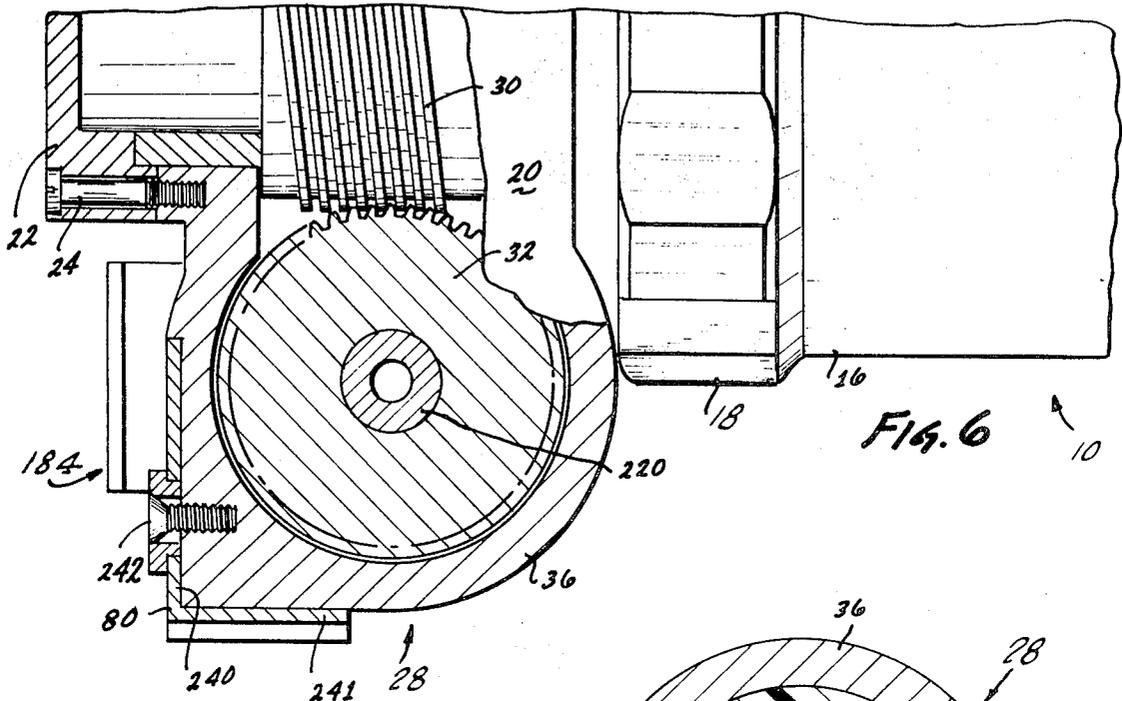


Fig. 7

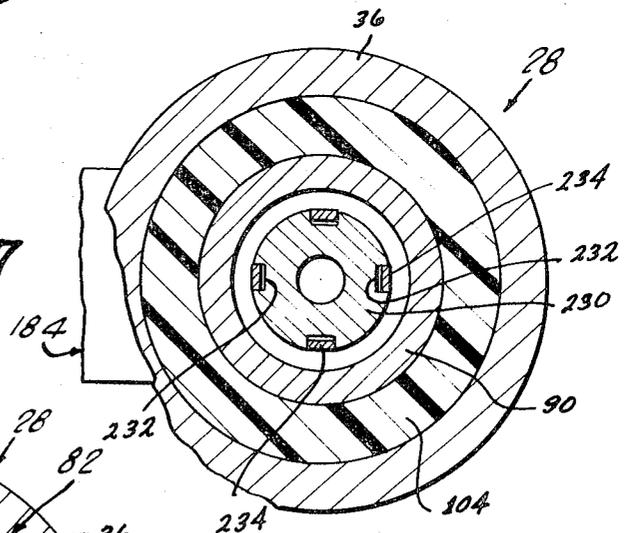
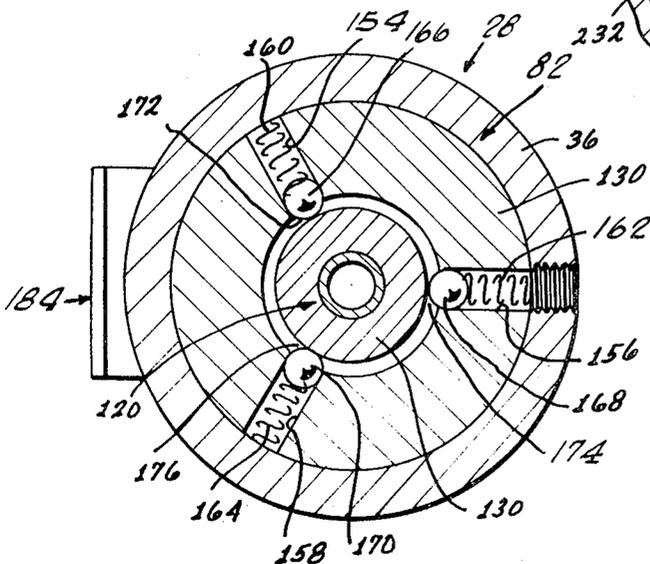


Fig. 8



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VACUUM ROTARY DISSECTOR

SUMMARY OF THE INVENTION The device of the invention is a motorized surgical instrument described technically as a vacuum rotary dissector. It is an instrument for performing delicate surgical operations such as brain operations where it is necessary to remove undesirable tissues or cut them away in difficult to reach internal locations.

The instrument is of a type embodying an elongated tubular member or sleeve which is motor-driven by way of a motor mounted in the body of the instrument which can be held in one hand. The sleeve which is rotated is the inner sleeve, and it rotates within a second elongated outer sleeve. The outer sleeve is bullet shaped at the end, that is, ogival in shape. The tip end of the inner sleeve is also bullet-shaped, or ogival, being contoured to engage the inner surfaces of the tip end of the outer sleeve which has a side opening of a particular shape. The tip end of the inner sleeve has a cutout, the sides of which form cutting edges that rotate adjacent to the side opening in the outer sleeve by which the cutting or dissecting operations are performed. A particular technique is utilized as described in detail hereinafter in preparing the contiguous surfaces to insure that the surfaces of the tip end of the inner sleeve closely and precisely engage and are contiguous to the inner surfaces of the tip end of the outer sleeve. The cutting edge surfaces at the tip end of the inner sleeve are provided each with an intermediate point to insure that these cutting surfaces will cut into the tissue and not bind or stall.

The inner sleeve is motor-driven by way of a motor embodied in the body of the instrument, the outer sleeve being manually adjustable to adjust the position of the side opening in the tip end. The outer sleeve is removable from the instrument and the inner sleeve is similarly removable, it having a splined connection to the motor drive means. Means are further provided to normally apply an axial force to the outer sleeve to insure that its tip end engages the outer surface of the tip end of the inner sleeve whereby the purposes of the instrument are effectively and efficiently realized as will be made more clear hereinafter.

The inner end of the inner sleeve makes connections with the motor drive in sealing relationship so that a vacuum can be applied to the bore of the inner sleeve and thus enable the instrument to effectively draw away tissues that have been cut by the instrument. A flexible connection is associated with the body of the instrument for applying the vacuum.

In the light of the foregoing, the primary object of the invention is to provide an improved surgical instrument of the vacuum rotary dissector type, the improvements in effectiveness stemming from unique constructions and configurations of the cutting surfaces and edges of the instrument.

Another object is to provide an improved instrument as in the foregoing wherein an elongated sleeve rotates within a second elongated sleeve, the inner sleeve having cutting edges that move adjacent to a side opening in the tip end of the outer sleeve and each of the cutting edges on the inner sleeve having an intermediate point to insure effective cutting into tissues.

Another object is to provide an improved instrument as in the foregoing wherein the tip end of the inner sleeve is bullet shaped and the interior contours of the tip end of the outer sleeve is of bullet shape with these surfaces held in contiguous relationship during operation.

Another object is to provide an instrument having the characteristic as in the foregoing object and means to exert an axial force on the outer sleeve to insure that the said surfaces are held in contiguous relationship whereby to more effectively realize the purposes of the cutting edges of the instrument.

Further objects and additional advantages of the invention will become apparent from the following detailed description and annexed drawings wherein:

FIG. 1 is a pictorial view of a preferred form of the invention;

FIG. 2 is a sectional view taken along the line 2—2 of FIG. 1;

FIG. 3 is a view of the tip end of the outer sleeve;

FIG. 4 is a sectional view taken along the line 4—4 of FIG. 3;

FIG. 5 is a perspective view of the tip end of the inner sleeve;

FIGS. 6, 7 and 8 are sectional views taken along the lines 6—6, 7—7 and 8—8 of FIG. 2.

FIG. 1 shows the instrument in a position with the rotary dissector aligned vertically, although it is to be understood that the instrument as shown may be gripped like a pistol, and in use, the dissector stem may extend in any direction, but more usually in a generally horizontal direction.

The instrument embodies a cylindrical body 10, having an end closure 12, of smaller diameter to which flexible electric cable or cord 14 is connected for supplying power to the motor. At the end of the cylindrical housing part 16 is a flange part 18 with scalloped edges to facilitate unscrewing the motor housing 16. The end of the housing 16 is threaded onto a threaded boss from which extends an integral cylindrical part in which is received the shaft of the motor that drives the instrument. At the end of the cylindrical part is an end cap 22 held on by a small screw 24. Integral with this extending cylindrical part is the cylindrical body 28 which houses the drive mechanism for the dissector. The shaft of the motor 16 drives worm 30 which is within the cylindrical portion 20, and this worm meshes with a gear 32 which will be described more in detail presently.

The body part 28 of the instrument comprises a cylindrical barrel part 36. At the upper end of this barrel part is a bore 38 in which is received a fitting 40 having an upper tapered part 42 providing an annular shoulder 44 that fits against the upper end of the barrel 36. Numeral 48 designates an annular counterbore in which is a sealing O-ring 50 that seals the fitting 40 in the end of the barrel 36.

The fitting 40 has an angled fitting or nipple 52 which is externally ribbed, as shown at 54, to receive a flexible tubular connection. The fitting 40 has a bore 56 whereby vacuum may be applied to the interior of the instrument, as will be described. The fitting 40 has a larger end counterbore 60, and numeral 62 designates a channel in the side wall of this part of the fitting 40. The fitting 40 is held secure in the bore 38 by means of the setscrew 64. At the end of the bore 38 in body 36 is a counterbore 70 which receives sealing O-ring 72, this counterbore being adjacent to a smaller bore 74 that connects to a larger channel 76 in the body 36. The bore 62 in the fitting 40 registers with a transverse bore 78 in the body 36, which is for purposes of controlling the degree of vacuum applied to the interior of the instrument and which is controlled by a manually actuated valve member or shutter 80, which will be described more in detail presently.

In the lower end of the bore 76 is a head or fitting 82 which has an end part 84 that engages against the end of the body 36 and a portion 86 of smaller diameter that fits inside of the bore 76. The fitting 82 has an extending end or flange part 90.

Numeral 92 designates a bushing that is aligned within bore 76 and on which is mounted the gear 32, this bushing having a bore 94. Numeral 96 designates a bushing made of a synthetic material such as Teflon or material of similar type which does not require lubrication which fits within the bore 76. This bushing has a bore 100 within which an end part of the bushing 92 fits. The end of the bushing 96 adjacent to the gear 32 is tapered as shown at 102, so as to eliminate unnecessary friction between the bushing and the gear. Numeral 104 designates a bushing that is similar to the bushing 96 on the opposite side of the gear 32 and fitting in the bore 76, and it having a similar bore 106. As may be seen, the Teflon bushings provide a substantially frictionless rotary mounting for the bushing 92 that carries gear 32 and one that does not require lubrication or maintenance.

Numeral 120 designates the outer elongated sleeve of the vacuum dissector. The inner end of the sleeve is enlarged as shown at 122 and it has a threaded part, as shown at 124, the threaded end being threaded into a threaded bore 126 in fitting 128, which engages with the fitting 82 in the end of the body 36 as will be described.

On the inner end or side of the fitting 128, it has a boss 130 that fits into the bore 130 in the fitting 82 and it can be held in the bore by spring detents as will be described. A seal is provided in a small counterbore 134 at the inner end of the threaded bore 126. The outer part of the fitting 128 as designated at 138 is of larger diameter and between this part and the boss 130 is a flange 140. Received on the outer part or boss 138 is a manual rotating knob or disc 142 having a bore 144 that receives the boss 138 and to which the knob 142 is secured by a setscrew 146 in radial bore 148. The enlarged part 122 at the end of the outer sleeve 120 is in a bore or counterbore 150 in the boss 138 which is of slightly larger diameter.

As may be seen in FIG. 8 the boss 130 of fitting 82 has three radial bores 154, 156 and 158 which are equally angularly spaced and in which are biasing springs 160, 162 and 164. These springs act against balls 166, 168 and 170 which cooperate with recesses or depressions that are complimentary to the spherical balls in the sidewalls of the boss 130 as designated at 172, 174 and 176. The balls and the recesses from spring detents which releaseably hold the fitting 128, and knob 142 and outer sleeve 120 in position, that is in a position which allows release and removal. In the lower end surface of fitting 82 there is provided a transverse groove 180 in which is received a yoke or slide 182 which constitutes one arm of a bellcrank lever 184 which has another arm 186 that extends adjacent to body 36 and the outer end surface of which is knurled as shown at 188 to adapt it to be engaged by the thumb. The bellcrank lever 184, as may be seen by exerting a slight inward push on the arm 186, is rotated so as to rotate the arm 182 and push downwardly slightly against the surface of flange 140 so as to push the assembly of knob 142 and the fitting 128 and the outer sleeve 120 outwardly so as to release the engagement of the ball detents as described in connection with the FIG. 6 and allow the said assembly to be removed. Otherwise this assembly is held in position as described.

Numeral 200 designates the inner sleeve of the rotary dissector. It rotates within the outer sleeve 120. The tip end of the outer sleeve is bullet shaped or ogival, this tip end being designated at 202. The tip end of the inner sleeve 200 is of similar shape as designated at 204, that is ogival, so that it fits into the inside of the tip end of the outer sleeve with the surfaces mutually contoured to be in engagement with each other. The tip end 202 of the outer sleeve 120 has a side opening as shown at 206 which is of slightly less than 180° in lateral extent and the upper and lower sides of which are of configuration as may be seen in FIG. 3. The tip end of the inner sleeve 200 has a side opening also as designated at 208 and the side edges of this opening have a particular contour as will be described. These side edges are designated at 210 and 212 in FIG. 3.

The cutting edge 210 has an intermediate point 214 and the cutting edge 212 has an intermediate point 216 which points serve the purposes of insuring that the edges will cut into the tissue being dissected without binding or stalling of the sleeve 200. The particular shapes of the tip ends of the sleeves contribute to the realization of it being possible to maintain the cutting edges on the inner sleeve. Maintenance of these edges requires a seal between the surface of the tip end of the inner sleeve and the inner surface of the tip end of the outer sleeve, that is, that these surfaces are in contiguous engagement during operation. In preparing these surfaces, they are lapped with lapping compound which is then removed. No air space remains between these surfaces and the inner sleeve is able to rotate effectively maintaining the cutting surfaces without rotation of the outer sleeve.

At the inner end of the sleeve 200 it has a part 220 of slightly larger diameter that is received in the bore 94 and this end passes through the bore 74 and is sealed by the O-ring 74. Sleeve 200 itself, has a bore 222 which communicates with the bore 60 as shown in FIG. 2. At the inner end of the enlarged part 220 of the inner sleeve, there is a collar 230 which has a group of spaced axial spline grooves 232, there being four of these grooves as may be seen in FIG. 5. At the end of the bush-

ing 92 it has four equally spaced axially extending members or splines 234 that engage in spline grooves 232. Thus, when the spline members are brought into engagement axially as may be seen, the bushing 92 will drive, that is, rotate the inner sleeve 200.

The manual control or shutter valve 80 is of angular configuration as may be seen in FIG. 1 and in FIG. 6, having a flat surface 240 that fits against a flat side surface on the body 28. It has another surface part 241 including portions at a slight angle to each other and lying in planes substantially normal to the plane of the part 240. The part 240 is pivoted to the flat side surface of the body 28 on screw or pivot pin 242, a part of the surface 240 lying adjacent to the end of the orifice or channel 78 so as to control the degree of vacuum within the instrument.

The effect of the balls 166, 168 and 170, as described in connection with FIG. 6, is to urge the part 130 and the assembly comprised of fitting 128 and knob 142 and the outer sleeve 120 axially inwardly so that the inside surface of the tip end of the outer sleeve 120 is urged against the surface of the tip end of the inner sleeve.

From foregoing, those skilled in the art will understand the operation of the device. The body 10 provides a pistol grip and the instrument may be gripped in this manner by the surgeon and the stem formed by the inner sleeve 200 and outer sleeve 120 may be pointed or extended in any direction. The angle between body 10 and stem 120 is slightly greater than 90°. The motor is energized for a driving worm 30 which drives the helical gear 32 and consequently the inner sleeve 200 as described in the foregoing, the drive being virtually frictionless and requiring no lubrication. Vacuum is applied to a flexible tube and by way of nozzle 52 to the interior of the instrument and to the interior of the inner sleeve 200. The degree of vacuum is controlled by manual adjustment of the shutter valve 80 by the surgeon's thumb. The tissue is cut at whatever point the operation is being conducted by the rotation of the cutting edges 210 and 212 and points 214 and 216 adjacent the inner surfaces of the tip end of the outer sleeve 120, that is, adjacent to the opening 206 which, as stated, has a lateral extent of less than 180° so that one of the cutting edges is always passing a part of this opening. The vacuum serves to draw the tissue to be cut into the opening, the degree of vacuum being adjusted as necessary to perform this function and to remove the cut tissue. The points 214 and 216 insure that the cutting edges will cut into the tissue without binding. By reason of the configuration of the tip ends of the inner and outer sleeves as described, the cutting edges can be maintained and the cutting edges operate adjacent to the opening 206 in such a way as to insure the desired effectiveness of the instrument. The outer sleeve can be removed as described simply by exerting pressure on the arm 188 of bellcrank lever 184 sufficient to overcome the ball detents to allow them to release for withdrawal of the boss 130.

From the foregoing, those skilled in the art will understand and appreciate the construction and operation of the device of the invention and the manner in which it achieves and realizes all of the objects and advantages as outlined in the foregoing, as well as the many additional advantages that are apparent from the detailed description.

The foregoing disclosure is representative of a preferred form of the invention and is to be interpreted in an illustrative rather than a limiting sense and the invention to be accorded full scope of the claims appended hereto.

I claim:

1. A surgical instrument comprising:
 - a support;
 - an outer tubular member extending from said support and having a closed generally hemispherical distal end and a first laterally directed opening adjacent its distal end and extending axially along said outer tubular member and partially along said generally hemispherical end;
 - an inner tubular member rotatably mounted in said outer tubular member and having a complementary generally

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hemispherical end frictionally bearing on an inner complementary surface of the distal end of said outer tubular member;

said inner tubular member having a second laterally directed opening axially coextensive with said first opening and defining generally axially extending cutting edges coincident with the inner surface of said outer tubular member;

drive means on said support for continuously rotating said inner tubular member relative to said support and said outer tubular member; and

biasing means resiliently urging said tubular members axially relative to each other to maintain said hemispherical ends in close surface contact.

2. An instrument as defined in claim 1 wherein said cutting edges include a pointed portion axially intermediate the ends of said openings.

3. An instrument as defined in claim 1 including means for applying suction to the interior of said inner tubular member.

4. An instrument as defined in claim 3 including means for selectively varying the degree of suction.

5. An instrument as defined in claim 1 including means for selectively rotating said outer tubular member relative to said support to direct said first opening in a selected direction.

6. An instrument as defined in claim 1 wherein said cutting edges are on opposite sides of said second opening and wherein said drive means are reversible.

7. An instrument as defined in claim 1 wherein said biasing means comprise spring-urged ball detents on said support engageable with recess means on said outer tubular member, said ball detent means also releasably holding said outer tubular member on said support.

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