IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of:	Shelton, IV	
U.S. Pat. No.:	8,479,969	Attorney Docket No.: 11030-0049IP9
Issue Date:	July 9, 2013	
Appl. Serial No.:	13/369,609	
Filing Date:	Feb. 9, 2012	
Title:	DRIVE INTERFACE FOR OPERABLY COUPLING A MANIPULATABLE SURGICAL TOOL TO A ROBOT	

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PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 8,479,969 PURSUANT TO 35 U.S.C. §§ 311–319, 37 C.F.R. § 42

TABLE OF CONTENTS

EXHIBITS

IS1001	U.S. Pat. No. 8,479,969 to Shelton, IV ("the '969 Patent")
IS1002	Prosecution History of the '969 Patent (Serial No. 13/369,609)
IS1003	Declaration of Dr. Bryan Knodel (Prisco as Primary Reference)
IS1004	Reserved
IS1005	Reserved
IS1006	U.S. Patent No. 8,545,515 to Prisco et al. ("Prisco")
IS1007	U.S. Patent No. 6,817,974 to Cooper et al. ("Cooper")
IS1008	U.S. Patent No. 6,699,235 to Wallace et al. ("Wallace")
IS1009	U.S. Patent No. 6,331,181 to Tierney et al. ("Tierney")
IS1010	Reserved
IS1011	Reserved
IS1012	Reserved
IS1013	Reserved
IS1014	U.S. Patent App. No. 2008/0167672 to Giordano et al. ("Giordano")

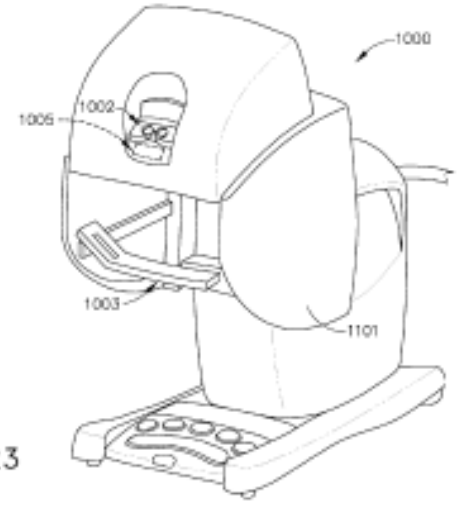
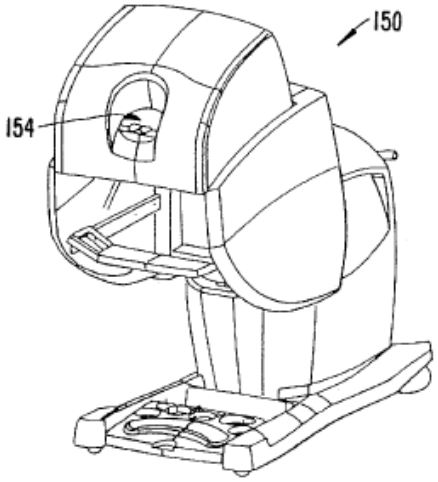
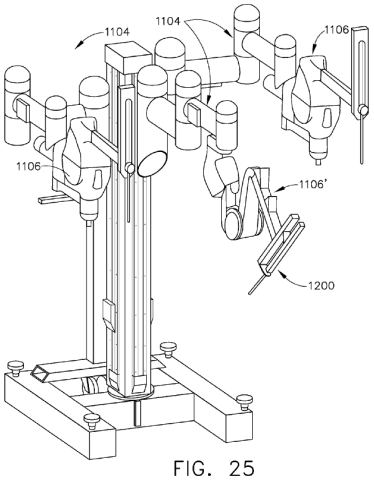
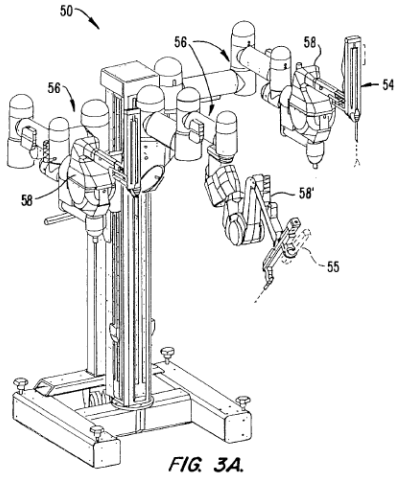
I. INTRODUCTION

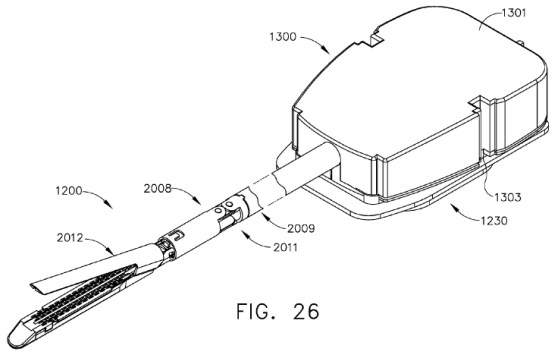
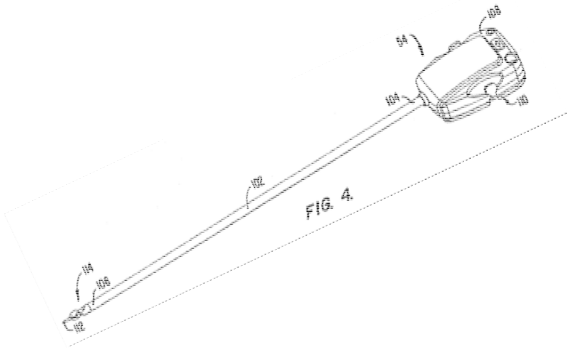
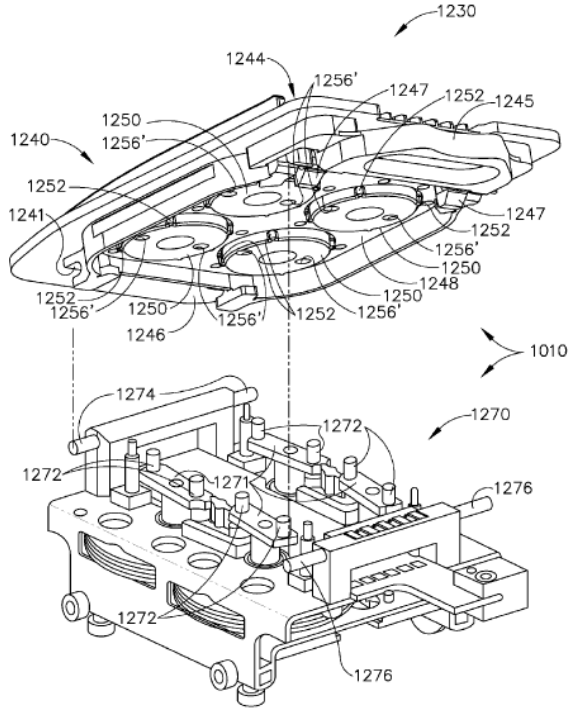
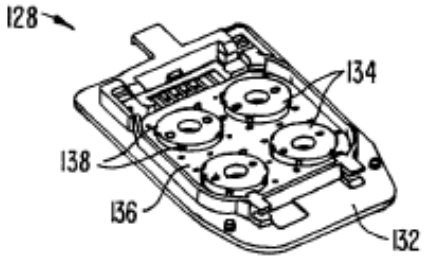
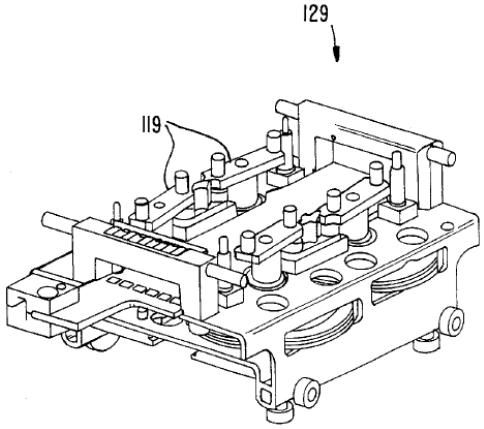
Intuitive Surgical, Inc. ("Petitioner") petitions for *Inter Partes* Review ("IPR") of claims 23-26 of U.S. Patent 8,479,969 ("the '969 Patent"). The '969 Patent is entitled "Drive Interface for Operably Coupling a Manipulatable Surgical Tool to a Robot." Drive interfaces for surgical robots were well-known in the prior art. In fact, the '969 Patent incorporates by reference, and largely copies, the prior art drive interfaces designed by Petitioner and disclosed in its prior art patents:

> [T]he tool arrangement described above may be well-suited for use with those ***robotic systems manufactured by Intuitive Surgical, Inc***. of Sunnyvale, Calif., U.S.A., many of which may be described in detail in various patents incorporated herein by reference. The unique and novel aspects of various embodiments of the present invention serve to ***utilize the rotary output motions supplied by the robotic system*** to generate specific control motions….

IS1001 at 31:52-59.[1] Not surprisingly, the robotic surgical system described in the '969 Patent is uncannily similar to the prior art robotic surgical system described in Petitioner's patents, including, for example, Petitioner's prior art "Tierney" patent (U.S. Patent No. 6,331,181). IS1002 at 280-284; IS1009 ("Tierney"):

[1] Emphasis added in quotations throughout.

'969 Patent	**Tierney Prior Art**
Robotic Controller	
 FIG. 23	 FIG. 8B.
Robotic Manipulator	
 FIG. 25	 FIG. 3A.

'969 Patent	**Tierney Prior Art**
Surgical Tool With Proximal Tool Holder	
 FIG. 26	
Tool Drive Assembly	
 FIG. 27	 FIG. 7A.  FIG. 7J.

IS1001, FIGs. 23, 25-27; IS1009, FIGs. 3A, 4, 7A, 7J, 8B.

The grandparent application to the '969 Patent was directed to a hand-held

surgical instrument. Essentially, the '969 Patent simply adds a surgical robot and attempts to patent the obvious combination of a surgical instrument adapted for a robot. Moreoever, the '969 Patent does not add just any surgical robot, but specifically the prior art surgical robot of Petitioner, Intuitive Surgical, Inc.

Not surprisingly, the Examiner found that the original claims of the '969 Patent read directly on Petitioner's prior art patents. Specifically, the originally-filed independent claims were rejected as anticipated and obvious over Tierney.

The applicant then amended the claims, adding details it contended were not disclosed in Tierney. However, the details supposedly absent from Tierney were well-known in Petitioner's other robotic surgical patents, as exemplified by Prisco, Cooper, and Wallace. IS1003, ¶28. Indeed, the Prisco reference, which serves as the primary reference for all grounds in this petition, is a prior art patent assigned to Petitioner that discloses a robotic surgical system of the type described in the '969 Patent. In addition, the system disclosed in the Prisco prior art patent is specifically designed to interface with a variety of surgical instruments, including those of the type described in the '969 Patent, such as surgical scissors, tissue graspers, and needle drivers. IS1006, 6:7-37; 8:34-44; 13:38-48; FIGs. 1A-3; 9A-9E.

Prisco (alone or in combination with other references) renders at least the challenged claims invalid as anticipated and/or obvious. Petitioner requests IPR of

the challenged claims on Grounds 1-4 below.

II. MANDATORY NOTICES UNDER 37 C.F.R § 42.8

A. Real Parties-In-Interest Under 37 C.F.R. § 42.8(b)(1)

Intuitive Surgical, Inc. is the real party-in-interest. No other party had access to the Petition, and no other party had any control over, or contributed to any funding of, the preparation or filing of the present Petition.

B. Related Matters Under 37 C.F.R. § 42.8(b)(2)

The '969 Patent is the subject of Civil Action No. 1:17-cv-00871-LPS, filed on June 30, 2017, in the United States District Court for the District of Delaware. Concurrently with this petition, Petitioner is filing two more IPR petitions related to the '969 Patent directed to different sets of claims, different statutory bases, and/or different primary references.

C. Lead And Back-Up Counsel Under 37 C.F.R. § 42.8(b)(3)

Petitioner provides the following designation of counsel.

LEAD COUNSEL	BACK-UP COUNSEL
Steven R. Katz, Reg. No. 43,706 3200 RBC Plaza, 60 South Sixth Street Minneapolis, MN 55402 Tel: 617-542-5070 / Fax: 877-769-7945	John C. Phillips, Reg. No. 35,322 Tel: 858-678-5070 Ryan O'Connor, Reg. No. 60,254 Tel: 858-678-5070

D. Service Information

Please address all correspondence to the address above. Petitioner consents to electronic service by email at IPR11030-0049IP9@fr.com (referencing No.

11030-0049IP9 and cc'ing PTABInbound@fr.com, katz@fr.com, phillips@fr.com, and oconnor@fr.com).

III. PAYMENT OF FEES – 37 C.F.R. § 42.103

Petitioner authorizes the Office to charge Deposit Account No. 06-1050 for the petition fee set in 37 C.F.R. § 42.15(a) and for any other required fees.

IV. REQUIREMENTS FOR IPR UNDER 37 C.F.R. § 42.104

A. Grounds for Standing Under 37 C.F.R. § 42.104(a)

Petitioner certifies that the '969 Patent is available for IPR, and Petitioner is not barred or estopped from requesting IPR.

B. Challenge Under 37 C.F.R. § 42.104(b) and Relief Requested

Petitioner requests IPR of claims 23-26 of the '969 Patent on the grounds listed below. A declaration from Dr. Bryan Knodel (IS1003) is provided in support.

Grounds	Claims	Basis for Rejections under 35 U.S.C. § 102 and §103
Ground 1	23-26	Anticipated by **Prisco** (U.S. 8,545,515)
Ground 2	23-26	Obvious over **Prisco** in view of **Cooper** (U.S. 6,817,974)
Ground 3	23-26	Obvious over **Prisco** in view of **Cooper** and **Tierney** (U.S. 6,331,181)
Ground 4	25-26	Obvious over **Prisco** in view of **Cooper** and **Wallace** (U.S. 6,699,235), and, if necessary, **Tierney**

As explained in greater detail in Section VIII, *infra*, the '969 Patent is

entitled to a priority date no earlier than May 27, 2011 (filing date of the parent of the '969 Patent). The application that resulted in the Prisco patent was filed Nov. 13, 2009, and claims priority to a provisional application filed Sep. 23, 2009. Prisco therefore qualifies as prior art under at least pre-AIA 102(e). Prisco was not cited during prosecution. *See* IS1002. Wallace issued March 2, 2004, and therefore qualifies as prior art under at least pre-AIA 102(b). Cooper issued on Nov. 16, 2004, and therefore qualifies as prior art under at least pre-AIA 102(b). Cooper was made of record during prosecution as part of an 82-page IDS filed after a notice of allowability that listed over 2,000 references, but Cooper was not substantively addressed or cited in any office action during prosecution. IS1002, 357-438; 280-285. The specific combinations applied in this petition were not considered by the Examiner.

V. SUMMARY OF THE '969 PATENT

The '969 Patent discloses subject matter related to hand-held surgical instruments and to robotic surgical instruments, but the claims all relate to the robotic embodiments. As the title states, the '969 Patent is directed to a "drive interface for operably coupling a manipulatable surgical tool to a robot." IS1001, Title. The disclosed robotic surgical system includes the typical and expected components, for example, a "master controller and robotic arm cart" and a "tool drive assembly" that control the surgical tools. IS1001, 23:50-62; 24:62-25:29;

FIGs. 26-27. As explained above, the robotic surgical system disclosed in the '969 Patent was copied from Petitioner's prior art. Various embodiments of the claimed features are found in the prior art, for example, (1) a tool mounting portion; (2) an end effector (such as a surgical stapler); (3) a shaft assembly for coupling the end effector to the tool mounting portion; (4) an articulation joint; and/or (5) a "tube gear segment 5114" on the shaft of the instrument, which is used to rotate the shaft and end effector relative to the tool mounting portion:

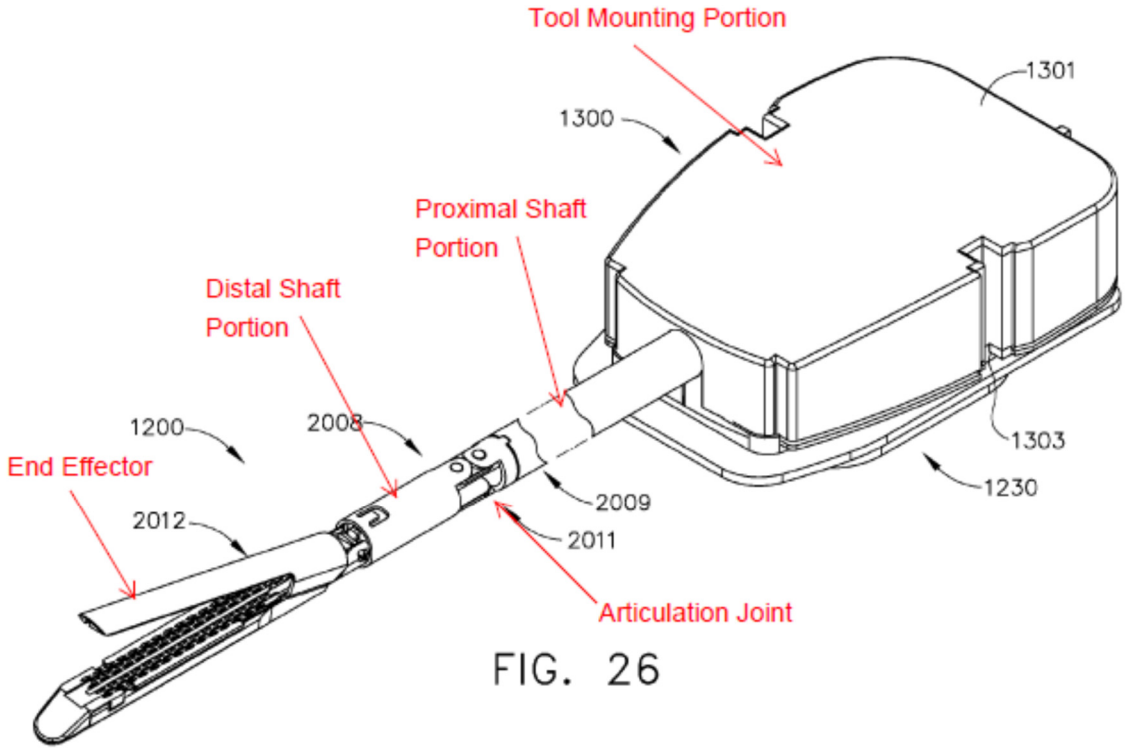


FIG. 26

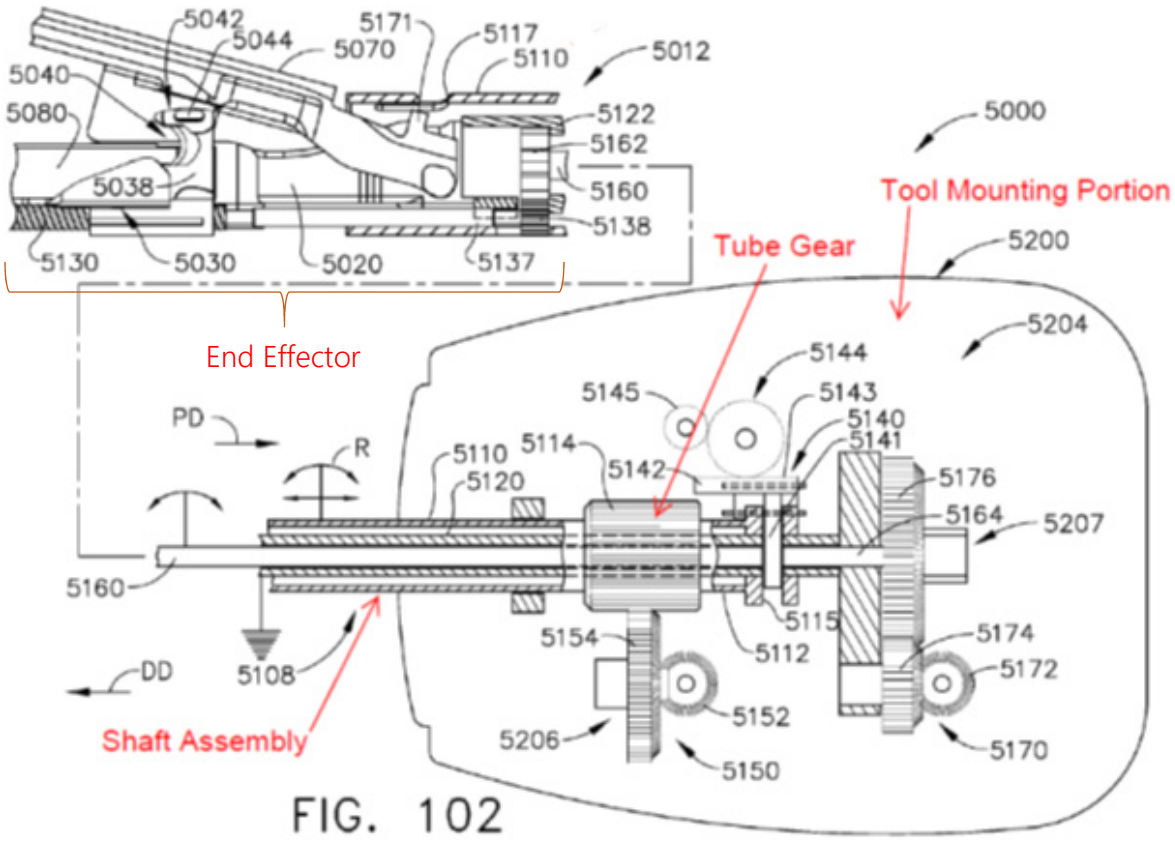


FIG. 102

IS1001, FIGs. 26, 102; 25:1-26:56; 27:19-47; 30:26-64; 65:32-64; 82:42-83:23.

None of these features were novel as of the filing of the '969 Patent or its parent application (filed on May 11, 2011) to which the '969 Patent claims priority. In fact, these features were found in petitioner's own prior art patents as described below.

VI. SUMMARY OF THE PRIOR ART

A. Prisco

Prisco describes various embodiments of a surgical tool for use with a robotic surgical system. IS1006 at 6:7-22; 8:4-44. "FIG. 1A is a front elevation view of the patient side cart component 100 of [Petitioner's prior art] da Vinci®

Surgical System." IS1006, 6:14-15.

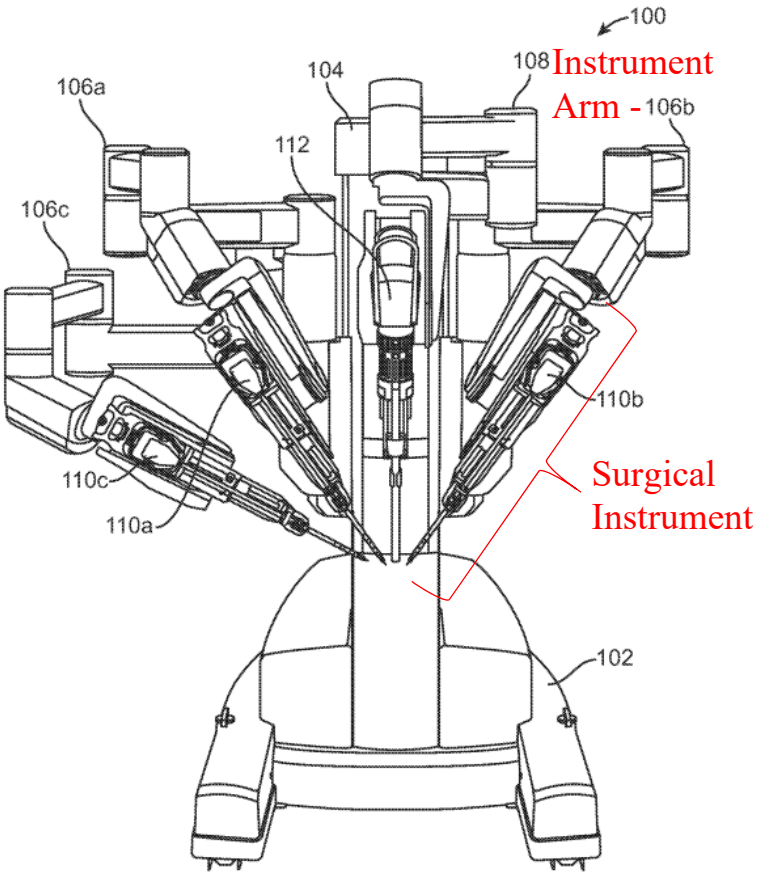


FIG. 1A

IS1006, FIG. 1A.

"FIG. 1A further shows interchangeable surgical instruments 110a, 110b, 110c mounted on the instrument arms 106a, 106b, 106c . . . ." IS1006, 6:26-28. "FIG. 1B is a front elevation view of a surgeon's console 120 component of [Petitioner's prior art] da Vinci ® Surgical System. The surgeon's console is equipped with left and right multiple DOF [(degree of freedom)] master tool manipulators (MTMs) 122a, 122b . . . that are used to control the surgical tools[.]" IS1006, 6:38-42.

- Surgeon's Console

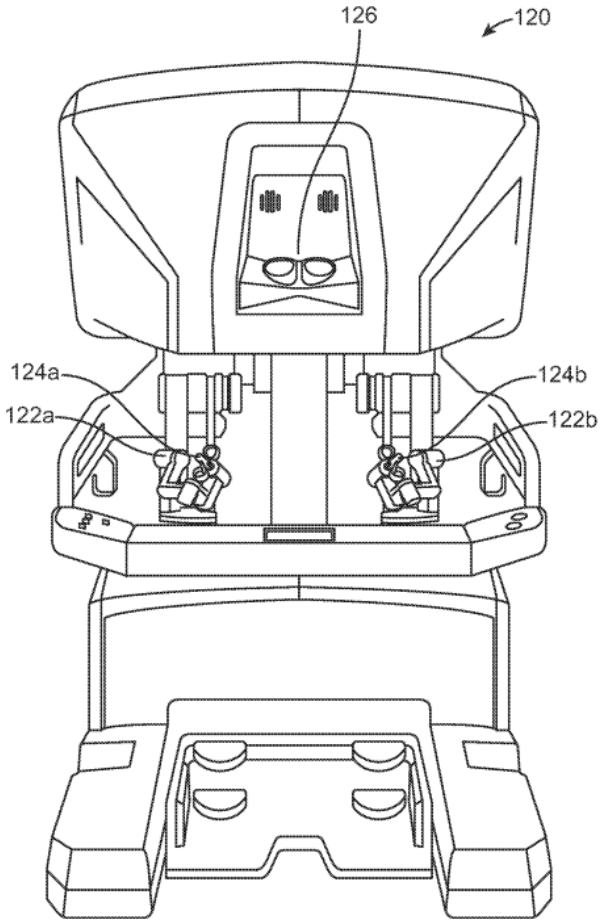


FIG. 1B

IS1006, FIG. 1B.

As shown below in FIG. 2A, each "[instrument] arm [106a, 106b, 106c] is divided into two portions. The first portion is the 'set-up' portion 202, in which unpowered joints couple the links. The second portion is powered, robotic manipulator portion 204 (patient side manipulator; 'PSM') that supports and moves the surgical instrument." IS1006, 8:2-6, Fig. 2A.

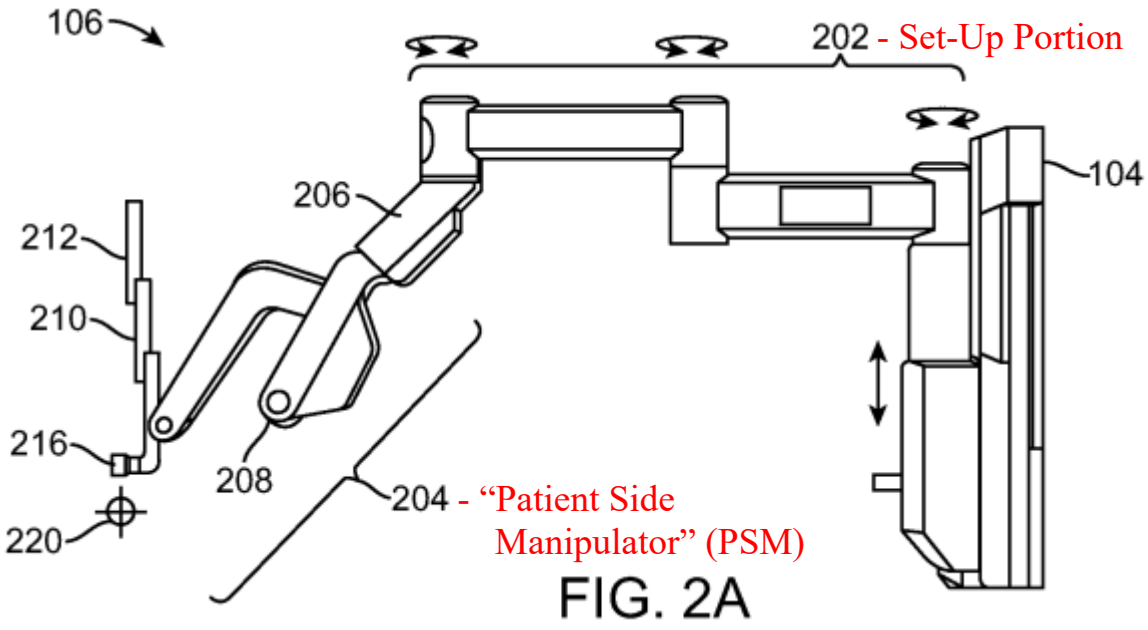


FIG. 2A

"FIG. 2B [(below)] is a perspective view of a manipulator [PSM (patient side manipulator) 204] with an instrument [110] mounted." IS1006, 3:4-5, FIG. 2B.

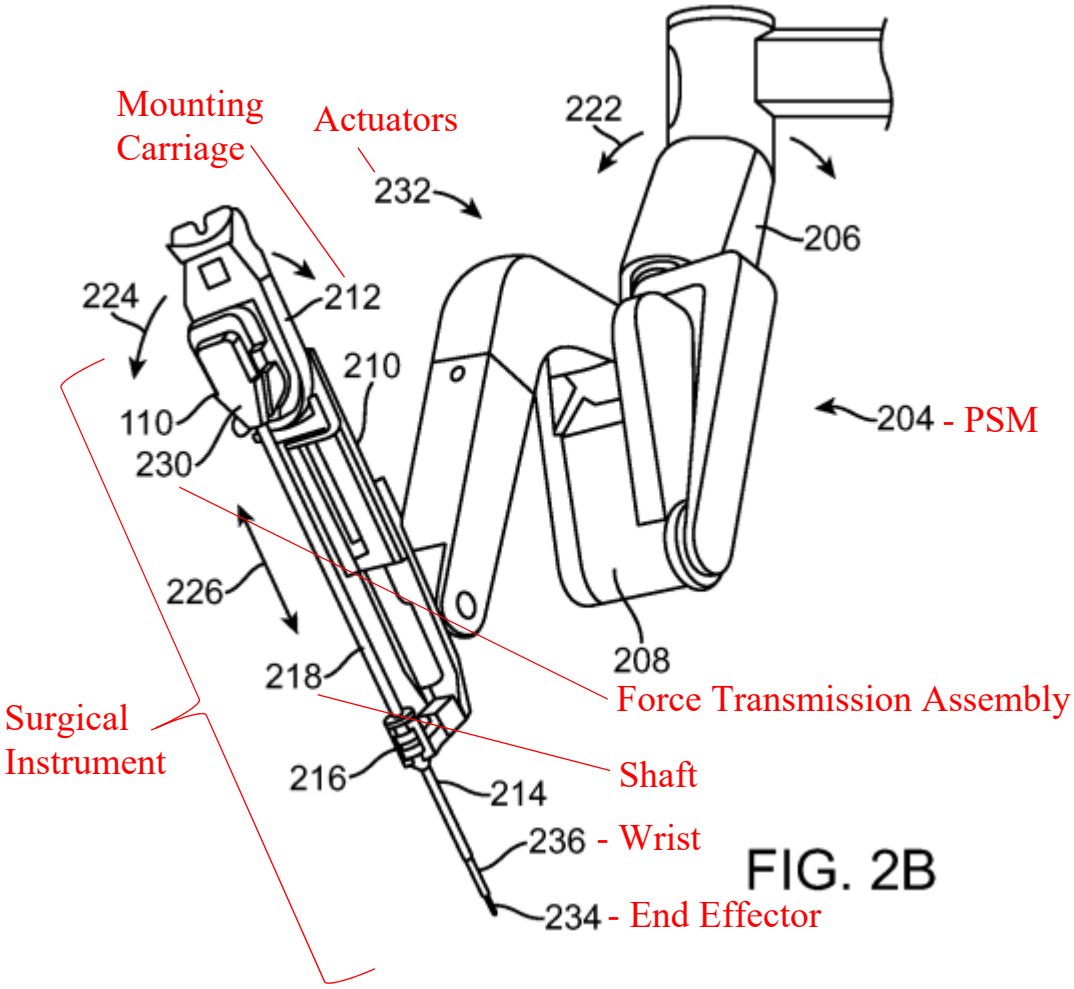


FIG. 2B

PSM (patient side manipulator) 204 transmits rotary motion to the removable surgical instrument via "force transmission disks." A driving set of force transmission disks is mounted on "mounting carriage 212" of PSM 204 and a driven set of force transmission disks is mounted on the "force transmission assembly 230" of the surgical instrument (which is the "tool mounting portion" of Prisco). Prisco explains:

> Matching force transmission disks in mounting carriage 212 and force transmission assembly 230 couple actuation forces from actuators 232 in PSM 204 to move various

> parts of instrument 110 in order to position, orient, and operate instrument end effector 234. Such actuation forces may typically roll instrument shaft 218 (thus providing another DOF [degree of freedom] through the remote center), operate a wrist 236 that provides yaw and pitch DOFs, and operate a movable piece or grasping jaws of various end effectors. . . .

IS1006, 8:34-44.

Figure 4A of Prisco provides another view of the mounted surgical instrument, this time with a flexible shaft for use in a curved cannula. In this figure, the interface disks 414a "couple actuation forces from servo actuators in PSM 204a to move instrument 402a components" (*e.g.*, to open and close end effector 408a):

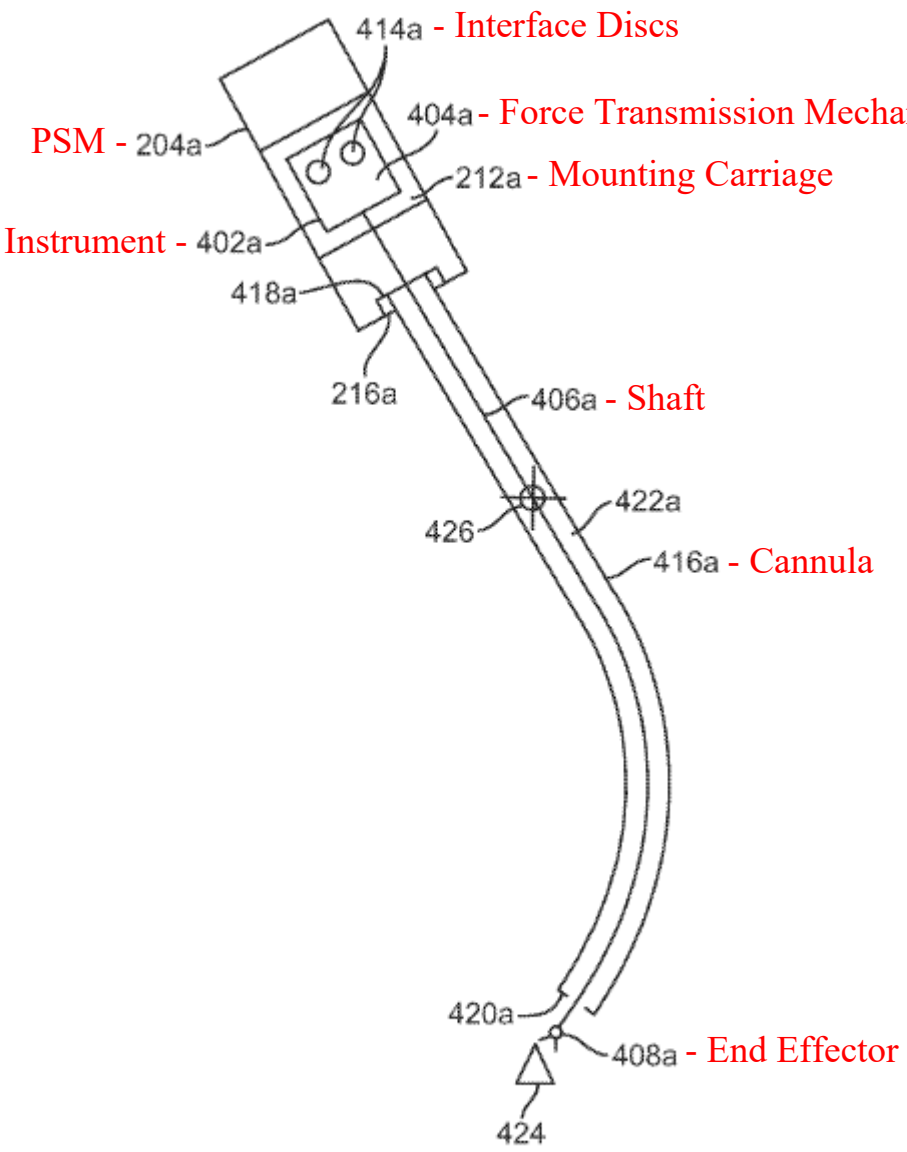


FIG. 4A

IS1006, 10:31-41, FIG. 4A. Prisco explains:

> FIG. 4A is a schematic view of a portion of a patient side robotic manipulator [(PSM)] that supports and moves a combination of a curved cannula [416a] and a passively flexible surgical instrument [402a]. As depicted in FIG.

> 4A, a telerobotically operated surgical instrument 402a includes a force transmission mechanism 404a, a passively flexible shaft 406a, and an end effector 408a. Instrument 402a is mounted on [a mounting carriage] 212a of a PSM 204a (previously described components are schematically depicted for clarity). Interface discs 414a couple actuation forces from servo actuators in PSM 204a to move instrument 402a components.

IS1006, 10:31-41, FIG. 4A.

Figures 5 and 6 of Prisco illustrate a surgical instrument with a flexible shaft in both curved and straight positions, respectively. "FIG. 5 is a diagrammatic view of an illustrative flexible instrument 500 used with a curved cannula. Instrument 500 includes a proximal end force transmission mechanism 502, a distal end surgical end effector 504, and a shaft 506 that couples force transmission mechanism 502 and end effector 504." IS1006, 12:8-13, FIG. 5.

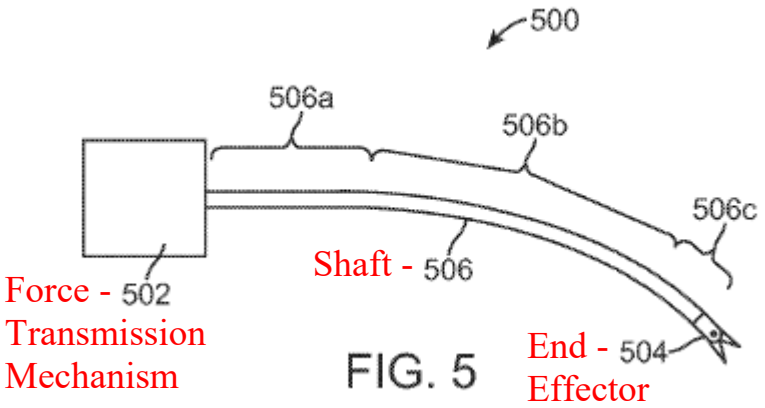


FIG. 5

"FIG. 6B is a diagrammatic view that illustrates aspects of a push/pull

[surgical] instrument design. As shown in FIG. 6B, a force transmission mechanism 620 is coupled to a grip type end effector 622 by a flexible shaft body 624." IS1006, 14:29-32, FIG. 6B.

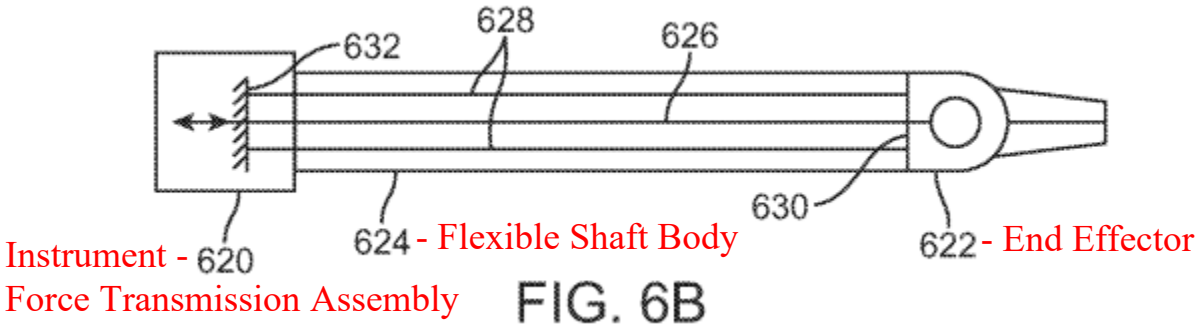


FIG. 6B

Figure 9E provides a close up view of one of Prisco's end effectors. In particular, "FIG. 9E is a diagrammatic view that illustrates a push/pull type end effector that may be at the distal end of the flexible shaft instruments (an illustrative clip applier end effector is shown)." IS1006, 19:42-45, FIG. 9E.

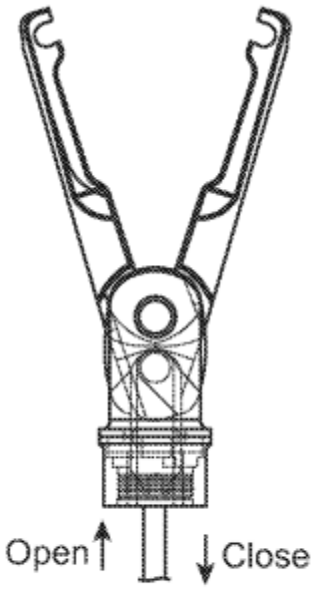


FIG. 9E

It is typically necessary to rotate the shaft of a surgical instrument to reposition the end effector. Like the '969 Patent, Prisco uses a tube gear to rotate the shaft. Prisco specifically discloses that the shaft is rotated by a "helical drive gear" that drives a tube gear called the "shaft roll gear," as shown in FIG. 7C:

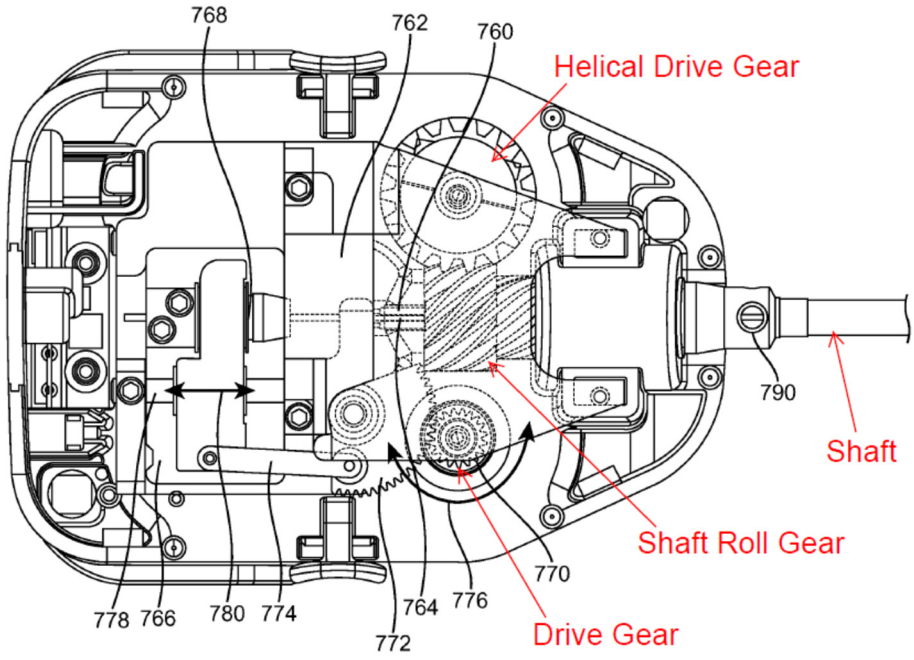


FIG. 7C

IS1006, FIG. 7C; 15:36-16:7.

Prisco also discloses articulation of the end effector via a "wrist" of the surgical instrument. For the wrist mechanism, Prisco incorporates Cooper, which is another surgical robotic reference: "A wrist to provide one or more end effector DOF's [Degrees of Freedom] (*e.g.*, pitch, yaw; *see e.g.*, U.S. Pat. No. 6,817,974 (filed Jun. 28, 2002) (disclosing 'Surgical Tool Having Positively Positionable Tendon-Actuated Multi-Disk Wrist Joint'), which is incorporated herein by reference) is optional and is not shown." IS1006, 10:43-48. This statement incorporates at least Cooper's wrist mechanism as if it were set out expressly rather than through incorporation. IS1003, ¶42.

Finally, Prisco discloses gear-driven actuation of the end effector. For

example, Prisco discloses a "rack gear 784" that operates the grasping jaws of various end effectors. Pinion drive gears 782 cause rack gear 784 to move back and forth along the shaft's longitudinal axis, thus pushing and pulling a drive rod that runs through the shaft and is coupled to the end effector jaws. IS1006, 16:13-23; FIG. 7D.

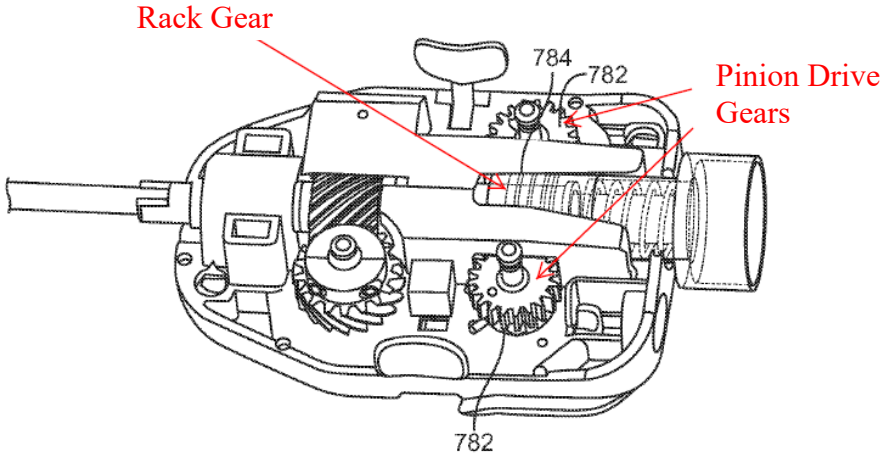


FIG. 7D

B. Cooper

As noted above, Prisco incorporates by reference at least the wrist mechanism disclosed in Cooper. Much like Prisco, Cooper discloses "a surgical instrument 400 having an elongate shaft" configured to releasably couple to "a robotic arm or system." IS1007, 17:26-50. As shown in FIG. 36, the instrument 400 includes an end effector 406 and a base 410, which couples the instrument to a robotic system. A shaft connects the end effector to the base and the shaft rotates in either direction to rotate the end effector, "as indicated by arrows H."

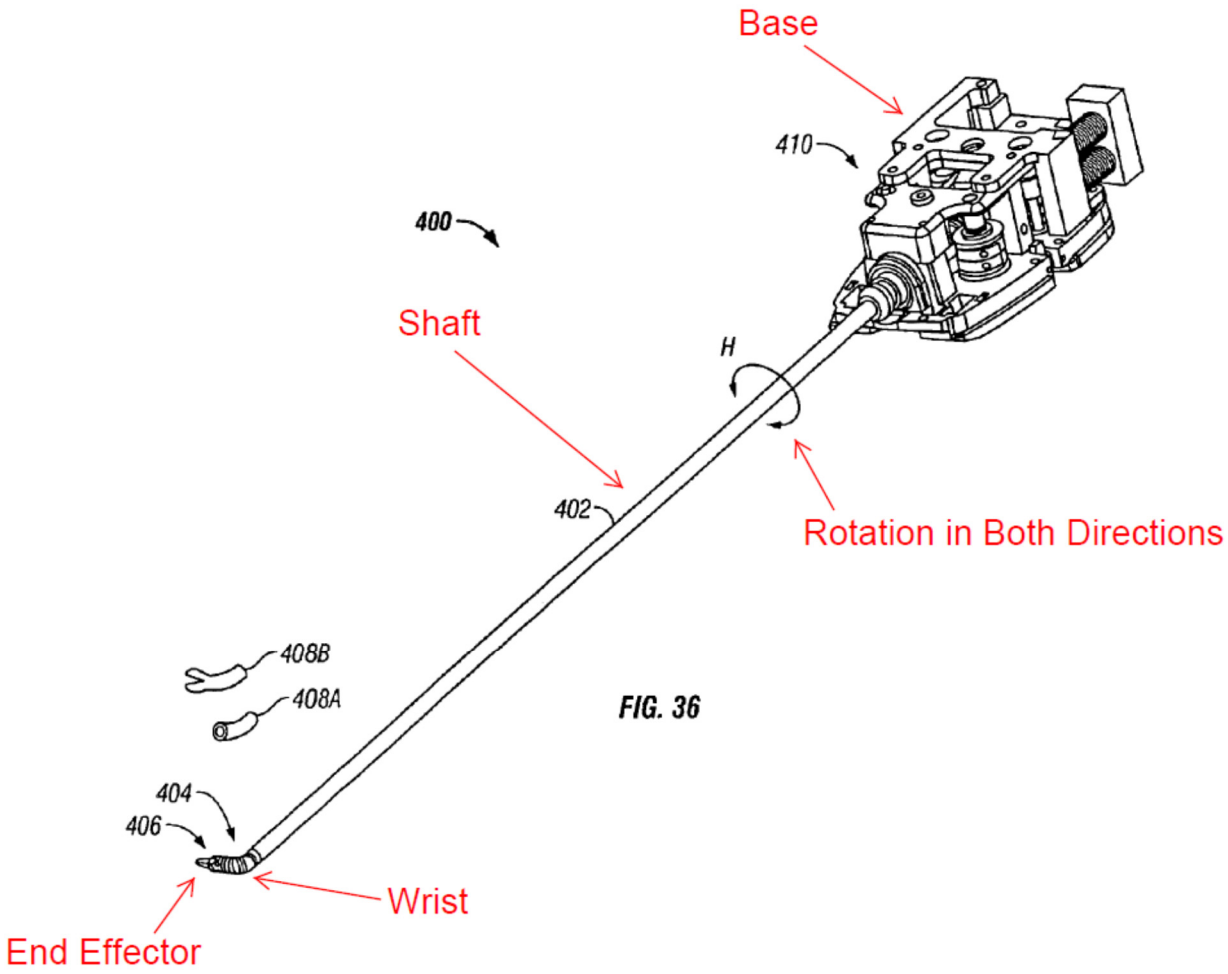


FIG. 36

IS1007, FIG. 36; 17:35-50; *see also* FIG. 64; 24:1-23.

Furthermore, Cooper's surgical instrument includes an articulation system comprising a proximal disk 412 and a distal disk 416 coupled via grip support 420 to an end effector 406. IS1003, ¶45. As shown in FIG 37, there are several pivot points between the proximal disk 412 and the distal disk 416 that supports end effector 406. Together these form an articulation joint (a wrist):

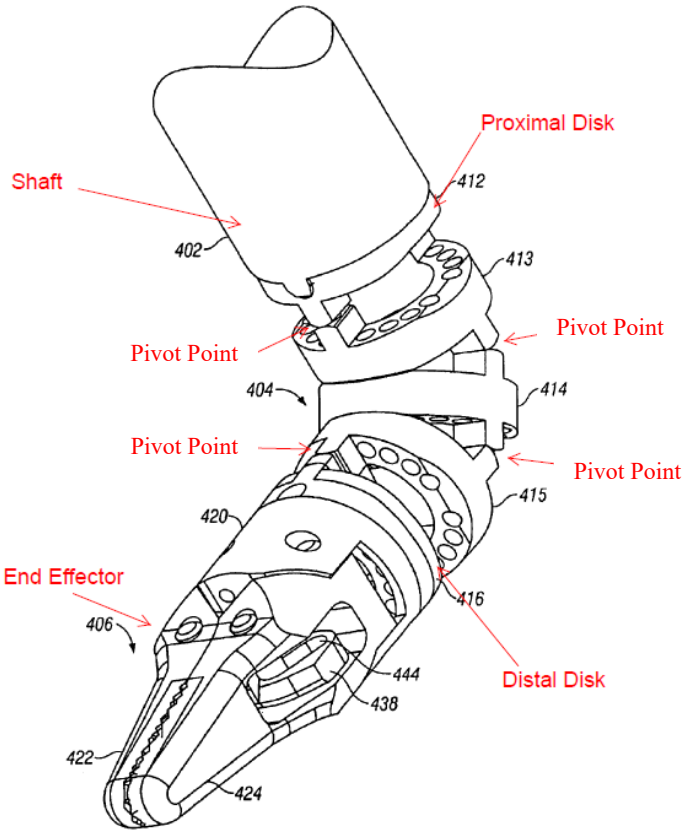


FIG. 37

IS1007, 5:54-6:3; 13:22-49, 17:25-64; FIGs. 14-21, 36-39, 51-56; *see also* 14:14-59 ("hinge mechanisms disposed on opposite sides of the disks guide the disks in pitch and yaw rotations to produce, for instance, the 90° pitch of the wrist 140"), 21:49-22:41, FIGS. 17-21 (disclosing another embodiment having proximal and distal disks).

C. Wallace

Wallace discloses "a robotic surgical tool for use in a robotic surgical system" that, much like the surgical instrument of Prisco, includes a shaft for supporting a surgical end effector, the shaft supported by a "tool base 62 [that]

includes an interface 64 which mechanically and electrically couples the tool 50 to a manipulator on the robotic arm cart" as shown in FIGs. 1 and 2A:

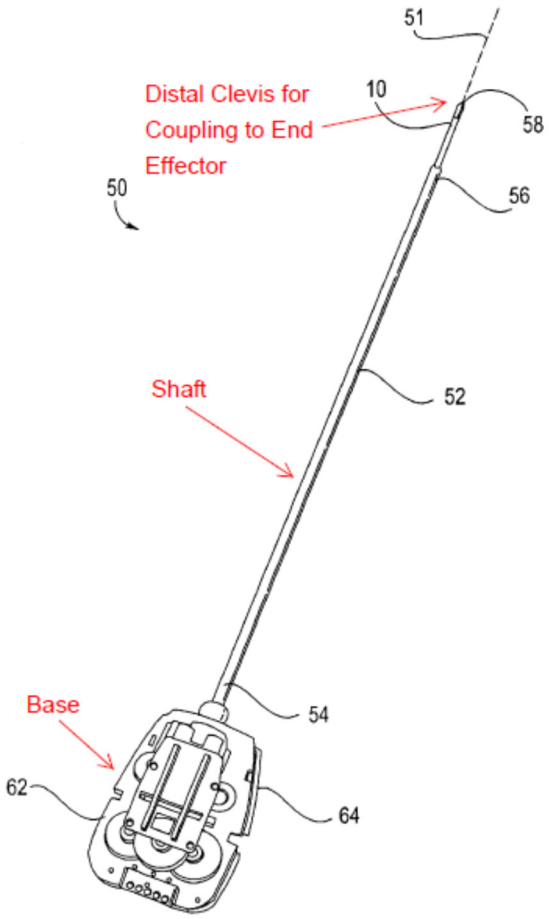


Fig. 1

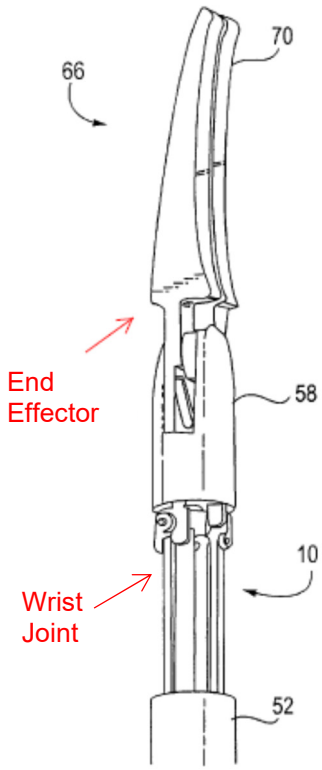
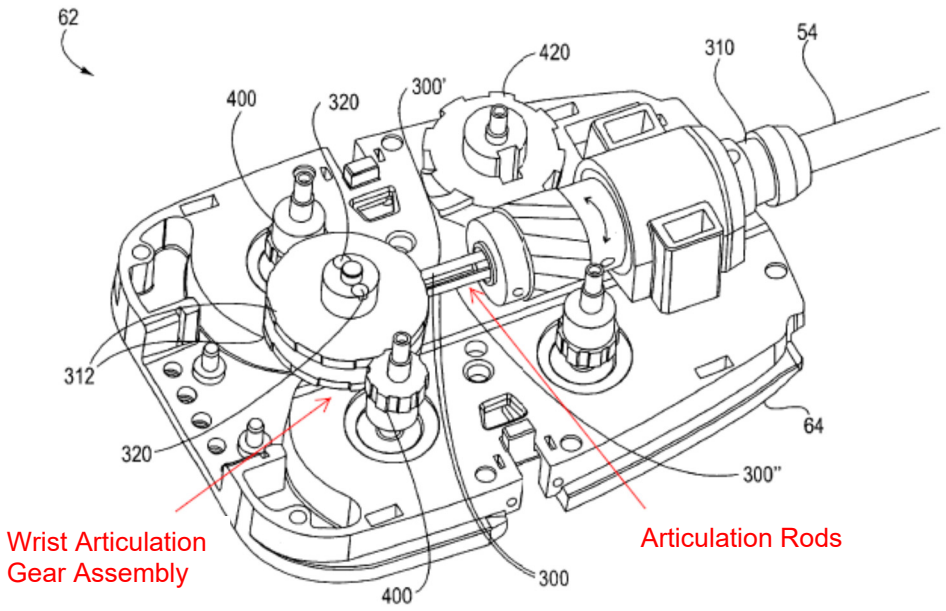


Fig. 2A

IS1008, FIGs. 1, 2A; Abstract; 7:33-56; IS1003, ¶46. Wallace further discloses an articulation assembly comprising a "wrist joint or mechanism" that is actuated by "a plurality of rods" that are driven by a gear assembly including "sector gears 312" and "gears 400" to advance and retract rods to cause articulation of the articulation wrist joint. IS1008, 7:57-65; 13:6-14:15, FIG. 30; IS1003, ¶47.



D. Tierney

Prisco broadly and unequivocally incorporates Tierney by reference. IS1006, 15:17-20, IS1009. This incorporates all of Tierney into Prisco as if it were set out expressly rather than through incorporation. *Harari v. Lee*, 656 F.3d 1331, 1335 (Fed. Cir. 2011) (holding that "the broad and unequivocal language" stating that "[t]he disclosures of the two applications are hereby incorporate[d] by reference" incorporated the entire disclosures of the two applications);[2] *Advanced*

[2] *See also Biscotti Inc. v. Microsoft Corp.*, No. 2:13-CV-01015-JRG-RSP, 2017 U.S. Dist. LEXIS 144164, at *12 (E.D. Tex. May 11, 2017) (confirming that *Harari*, which addressed incorporation by reference in the context of written description, also applies to anticipation because "[t]he incorporation by reference doctrine . . . does not vary across different applications of the doctrine.").

Display Sys., Inc. v. Kent State Univ., 212 F.3d 1272, 1282 (Fed. Cir. 2000) ("Material not explicitly contained in [a] single, prior art document may still be considered for purposes of anticipation if that material is incorporated by reference into the document."); IS1003, ¶48. As noted above, the robotic surgical system described in the '969 Patent appears to be the prior art robotic surgical system described in Petitioner's Tierney patent. *See* Section I.

VII. PROSECUTION HISTORY

During prosecution, the USPTO issued a single office action rejecting the broad independent claims, but indicating that two independent picture claims and a variety of dependent claims contained allowable subject matter. IS1002, 280-284. The broad claims were rejected over Petitioner's Tierney patent. IS1002, 280-284. The applicant subsequently amended the independent claims to include subject matter deemed allowable and added new dependent claims containing the allowable subject matter of original dependent claim 7 (issued claim 19), claim 9 (issued claim 21), claim 12 (issued claim 23), and claim 14 (issued claim 24). IS1002, 311; 304-310. The examiner then issued a notice of allowance. Rather than allowing the patent to issue, the applicant filed an RCE and submitted an IDS listing over 2,000 references. IS1002 at 328-333; 357-483. A notice of allowance promptly followed, and the '969 Patent issued on July 9, 2013. IS1002, 547-552; IS1001, Face.

VIII. PRIORITY DATE

The '969 Patent issued from U.S. Application No. 13/369,609, which is a continuation of U.S. Application No. 13/118,259, filed on May 27, 2011, which is a continuation-in-part of U.S. Application No. 11/651,807, which issued as U.S. Patent No. 8,459,520. The grandparent '807 application (IS1014) does not provide support for any of the challenged claims and therefore the '969 Patent is entitled only to the priority date of the '259 application: May 27, 2011. For example, each of the challenged independent claims (23-24) recites "[a] surgical tool for use with a ***robotic system that has a tool drive assembly that is operatively coupled to a control unit of the robotic system***." Each of the challenged independent claims further recites that the surgical tool has a tool mounting portion "being configured to operably interface with ***the tool drive assembly***" that has at least one "rotatable body portion." IS1001, claims 23-24. The grandparent '807 application provides no support for these recitations. IS1003, ¶¶29-31. Rather, the '807 application is directed toward handheld "endoscopic surgical instrument[s]" with only a passing reference to "robotic-assisted surgery." IS1014, ¶¶15, 89, FIGs. 1-2.

IX. CLAIM CONSTRUCTION UNDER 37 C.F.R. § 42.104(B)(3)

For the purposes of IPR only, Petitioner submits that the terms of the '969 Patent are to be given their broadest reasonable interpretation as understood by a

POSITA in view of the specification ("BRI").[3] 37 CFR § 42.100(b).

X. THERE IS A REASONABLE LIKELIHOOD THAT AT LEAST ONE CLAIM OF THE '969 PATENT IS UNPATENTABLE

As detailed below, claims 23-26 of the '969 Patent are anticipated by Prisco or obvious over Prisco in view of Cooper, Tierney, and/or Wallace.

A. Ground 1: Claims 23-26 are Anticipated under § 102(e) by Prisco

[23.P] A surgical tool for use with a robotic system that has a tool drive assembly that is operatively coupled to a control unit of the robotic system that is operable by inputs from an operator and is configured to provide at least one rotary output motion to at least one rotatable body portion supported on the tool drive assembly, said surgical tool comprising:

If the preamble of claim [23] is deemed to be limiting, then Prisco discloses it. IS1003, ¶¶52-59. In addition, Prisco incorporates Tierney, which the PTO has already found discloses the preamble of claim 23. IS1006, 15:16-20; IS1002, 282-83 (rejecting original claim 1 as anticipated by Tierney).

[3] Petitioner acknowledges that the Office has proposed to change from the BRI standard to the standard applied in District Courts. *See* 83 Fed. Reg. 21221 (proposed May 9, 2018). Petitioner submits that the prior art discussed herein invalidates the challenged claims under either standard. If the Office changes the rule after the filing of the Petition and applies the new standard to this proceeding, then due process requires the Office afford Petitioner an opportunity to provide additional argument and evidence on that issue.

"A surgical tool for use with a robotic system"

Prisco discloses a surgical tool (*e.g.*, surgical instruments 402a, 500) for use with a robotic system (Petitioner's prior art da Vinci® Surgical System). IS1003, ¶¶52- 53; IS1006, 6:14-15, 6:26-28, 6:38-42, 10:31-41, FIGs., 1A, 1C, 4A, 5. For example, FIG. 4A depicts surgical instrument 402a mounted to the PSM (patient side manipulator) 204a portion of an instrument arm via carriage 212a:

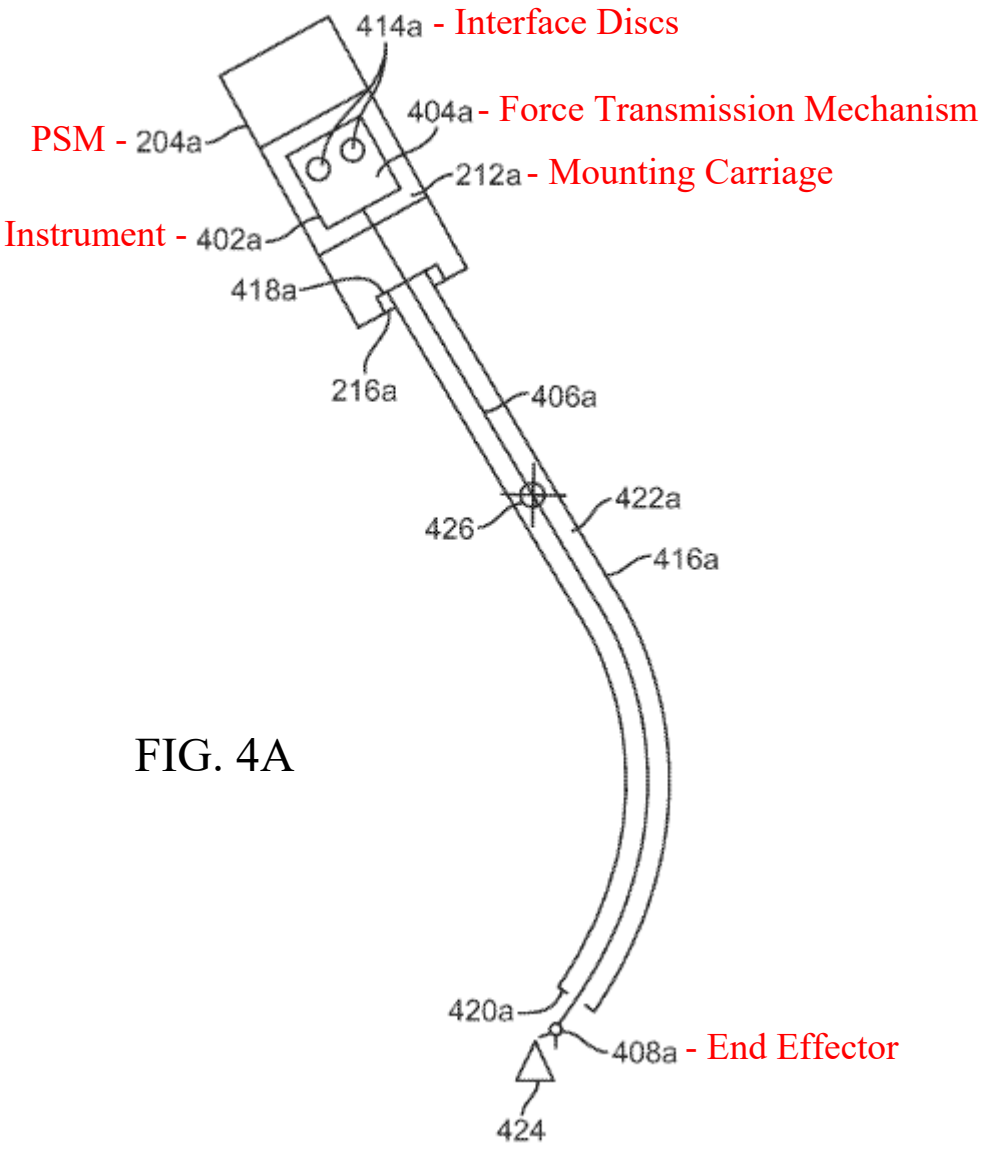


FIG. 4A

FIGs. 1A and 1B depict the robotic system on which the instrument is mounted. FIG. 1A shows the patient side cart 100 to which the surgical instruments are mounted, and FIG. 1B shows the surgeon's console 120 used to control movement of the surgical instruments:

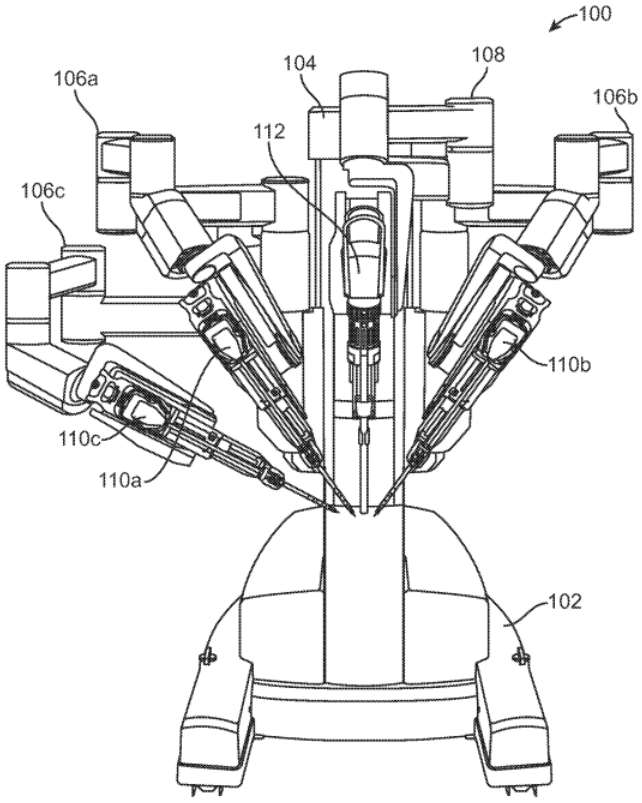


FIG. 1A

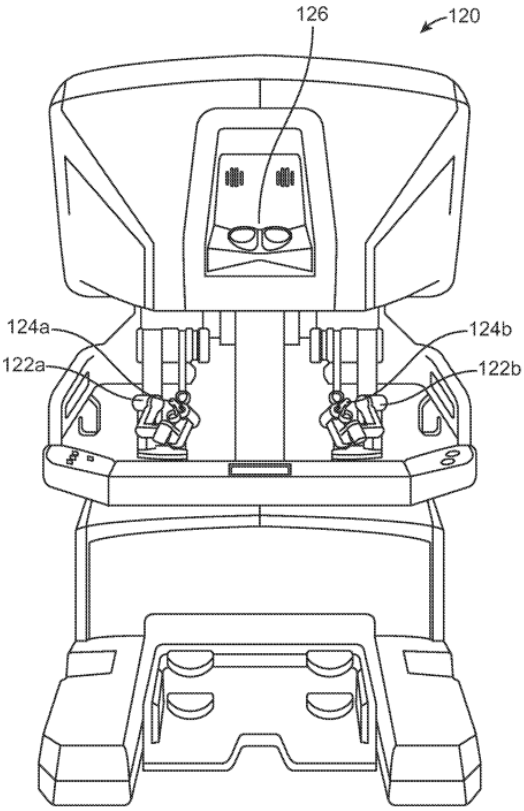


FIG. 1B

IS1006, 6:14-15 ("FIG. 1A is a front elevation view of the patient side cart component 100 of the da Vinci ® Surgical System."), 6:38-39 ("FIG.1B is a front elevation view of a surgeon's console 120 component of the da Vinci ® Surgical System."), Fig. 1A, 1B.

The robotic system "has a tool drive assembly"

Prisco's robotic system contains a tool drive assembly (*e.g.*, the combination of "actuators 232" and "mounting carriage 212"). "An illustrative surgical instrument 110 is shown mounted at an instrument mounting carriage 212" in FIG. 2B of Prisco. IS1006, 8:15-17, FIG. 2B; IS1003, ¶¶54-55.

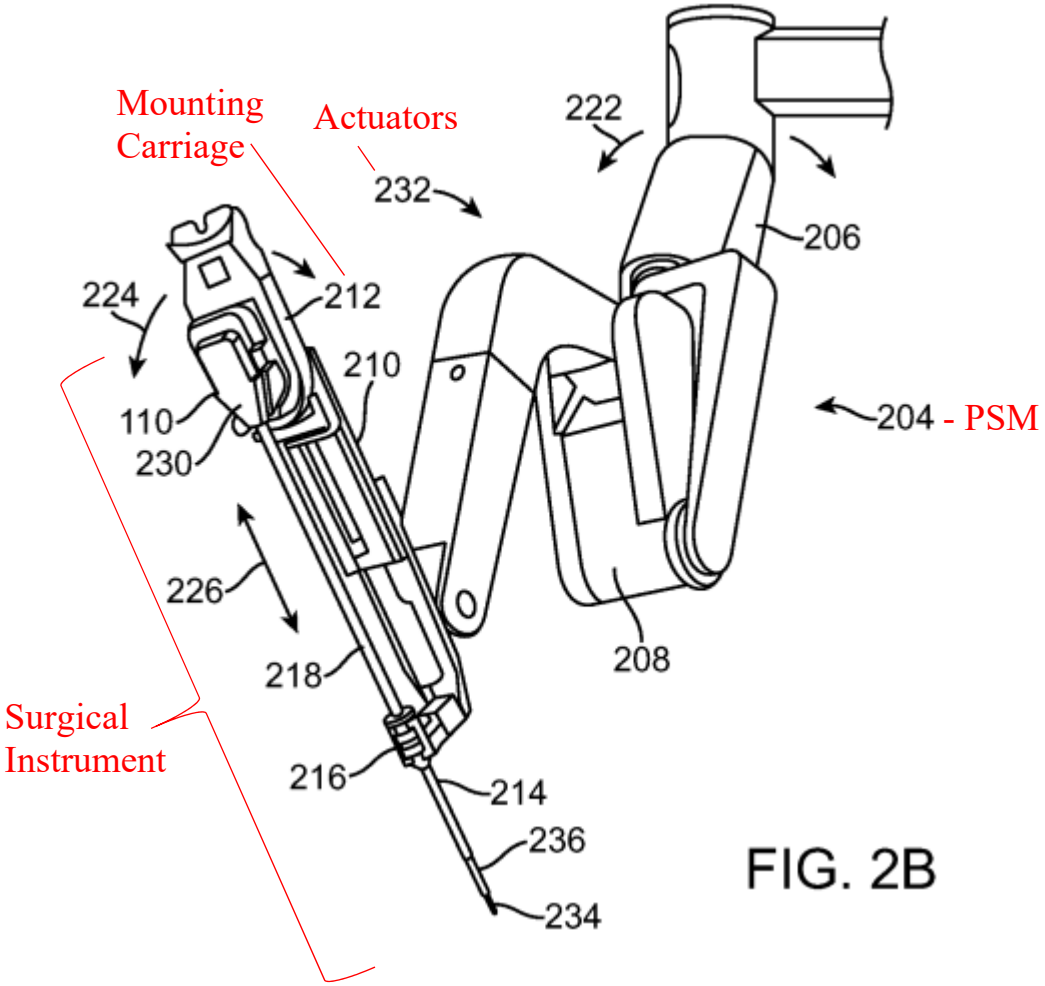
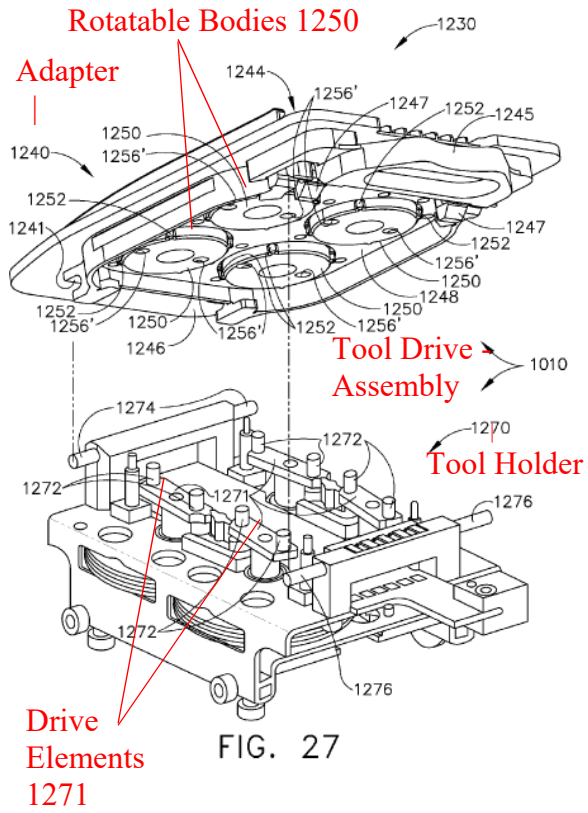
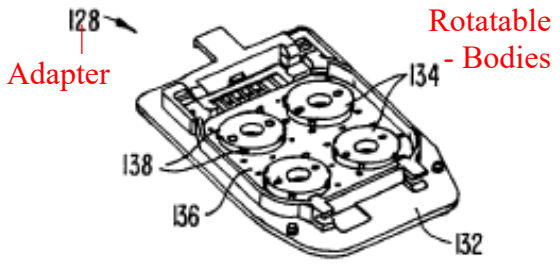
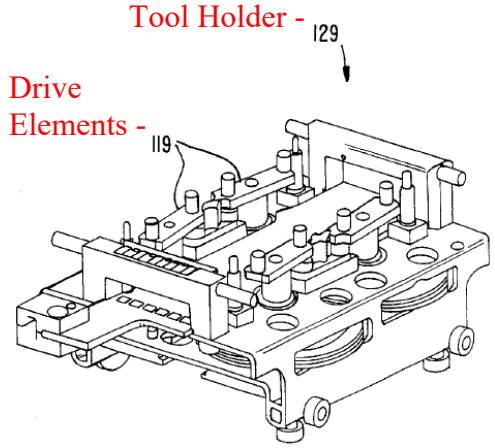


FIG. 2B

Prisco explains that "actuators 232 in PSM [(patient side manipulator)] 204 . . . move various parts of instrument 110 in order to position, orient, and operate instrument end effector 234." IS1006, 8:34-38; *see also* 10:37-41 ("Instrument

402a is mounted on [a mounting carriage] 212a of a PSM 204a . . . . Interface discs 414a couple actuation forces from servo actuators in PSM 204a to move instrument 402a components.").

In addition, Prisco's incorporation of Tierney discloses the same tool drive assembly as the '969 Patent:

'969 Patent	**Tierney**
 FIG. 27	 FIG. 7A.  FIG. 7J.

Compare IS1001, FIG. 27 *with* IS1009, FIG. 7A, 7J, 7F; IS1003, ¶50; *see also* IS1009, 11:33-35, 4:33-35, 7:65-8:7, 10:12-15, 11:3-6, FIGs. 3A, 8A, 8B, 9FIGs. 7F-7M.

The tool drive assembly "is operably coupled to a control unit"

Prisco's tool drive assembly (the combination of "actuators 232" and "mounting carriage 212") is operably coupled to a control unit ("surgeon's console 120" alone or in combination with "patient side cart 100"). IS1003, ¶56. "The surgeon's console [120] is equipped with . . . master tool manipulators (MTMs) 122a, 122b . . . that are used to control the surgical tools . . . ." IS1006, 6:38-43. And "each MTM 122 is coupled to control a corresponding instrument arm 106 for the patient side cart 100. For example, . . . right MTM 122b may be coupled to control instrument arm 106b and instrument 110b." IS1006, 6:47-52; *see also* 6:7-12 (explaining that the main components of the robotic surgical system, including the patient side cart 100 "are interconnected"). As shown in FIG. 2B of Prisco (above), actuators 232 and mounting carriage 212 are in the PSM (patient side manipulator) 204 of instrument arm 106 of patient side cart 100. *See also* IS1006, FIG. 23; IS1003, ¶54.

The control unit "is operable by inputs from an operator"

Prisco's control unit ("surgeon's console 120" alone or in combination with "patient side cart 100") is operable by inputs from an operator (*e.g.*, a surgeon). IS1003, ¶57. "The Surgeon grasps a pincher assembly 124a, 124b on each MTM 122 [of the surgeon's console 120] and can move the pincher assembly to various positions and orientations." IS1006, 6:3-46; *see also* 2:53-57.

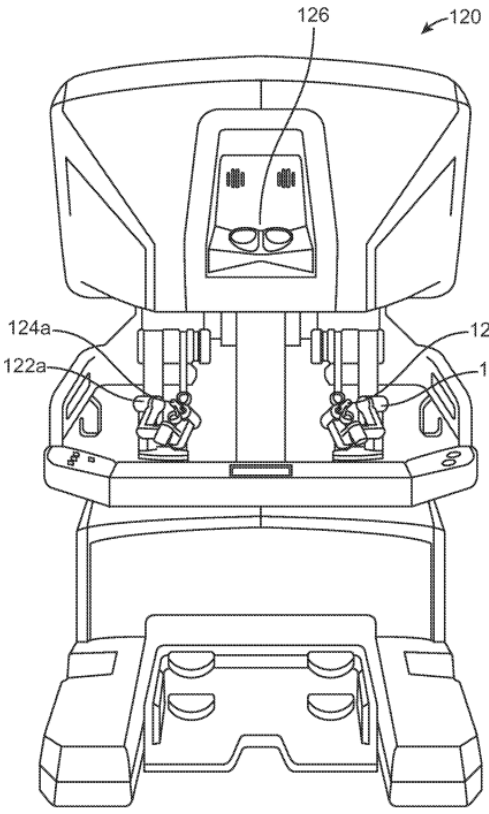


FIG. 1B

The tool drive assembly is "configured to provide at least one rotary output motion to at least one rotatable body portion supported on the tool drive assembly"

Prisco's tool drive assembly is configured to provide rotary output motions to rotatable body portions ("force transmission disks") supported on the "mounting carriage 212" portion of the tool drive assembly (*e.g.*, the combination of "actuators 232" and "mounting carriage 212"). IS1003, ¶58. Prisco explains that "***[m]atching force transmission disks*** in mounting carriage 212 and force transmission assembly 230 couple actuation forces from actuators 232 in PSM [(patient side manipulator)] 204 . . . ." IS1006, 8:34-38; *see also* 10:39-41

("Interface discs 414a [(the rotatable body portions)] couple actuation forces from servo actuators in PSM 204a"), FIG. 4a. The disks are "matching" force transmission disks because the disk on the mounting carriage 212 drives the "matching" disk on the surgical instrument.

Furthermore, Prisco's incorporation of Tierney provides additional details of the tool drive assembly. IS1003, ¶59. Specifically, Prisco's incorporation of Tierney discloses a rotatable body portion (rotatable bodies 134) supported on a tool drive assembly (the combination of adapter 128 and tool holder 129):

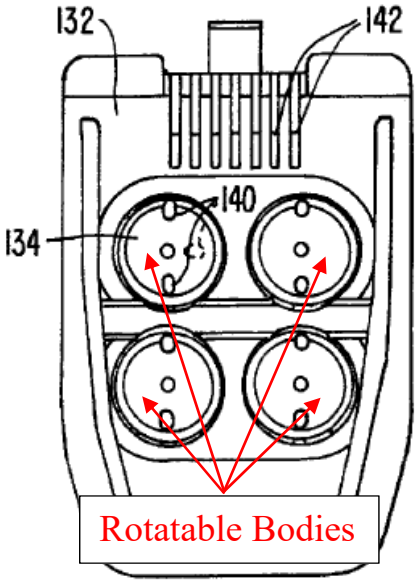


FIG. 7C.

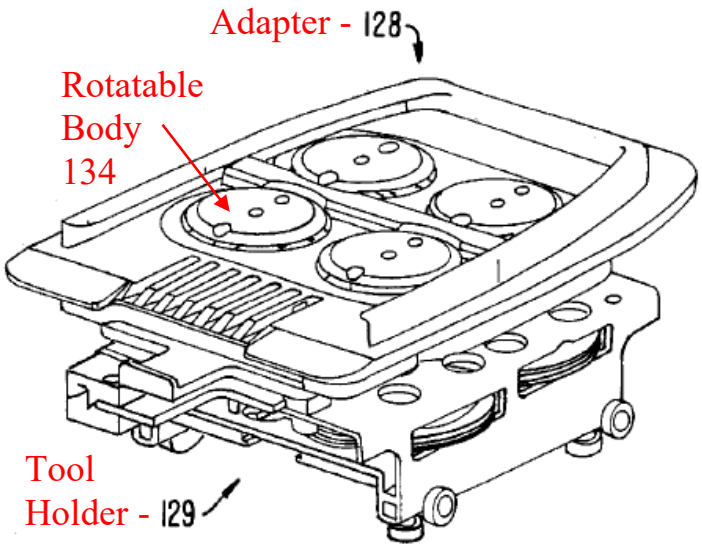


FIG. 7F.

IS1009, FIGs. 7C and 7F; *compare* to IS1001, FIGs. 29, 30. As shown above, adapter 128 is mounted to the tool holder 129 and includes a "plurality of rotatable bodies 134." IS1009, 10:46-51; 11:3-10 (emphasis added), Figs. 6-7L. A POSITA would have understood that Tierney's rotatable bodies 134 correspond to Prisco's

force transmission disks and that the combination of Tierney's adapter 128 and tool holder 129 correspond to Prisco's mounting carriage 212. IS1003, ¶¶49, 59. As also noted above, this structure is essentially identical to the tool drive assembly disclosed in the '969 Patent. *Id*.

[23.1] a surgical end effector comprising at least one component portion that is selectively movable between first and second positions relative to at least one other component portion thereof in response to control motions applied to said selectively movable component portion;

Prisco discloses element [23.1]. IS1003, ¶¶60-64.

"a surgical end effector"

Prisco's surgical tool (*e.g.*, instrument 500) includes "surgical end effector 504." IS1006, 12:9-11, FIGs. 5, 6B, 9E; IS1003, ¶60.

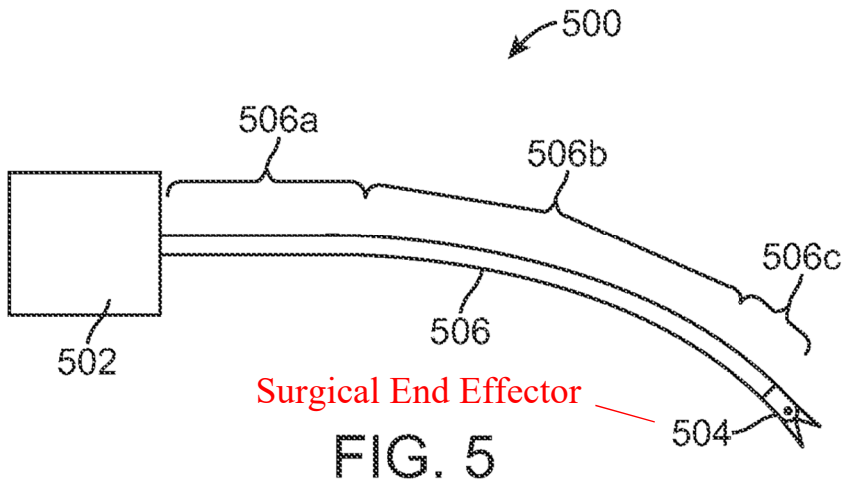


FIG. 5

IS1006, FIG. 5.

"FIG. 6B is a diagrammatic view that illustrates aspects of a push/pull instrument design [for instrument 500 that includes] . . . a grip type end effector 622 . . . ." IS1006, 14:29-32; *see also* 14:67-15:1.

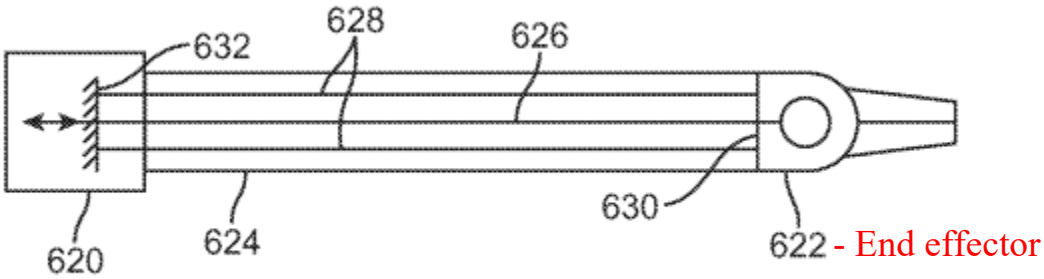


FIG. 6B

IS1006, FIG. 6B.

And "FIG. 9E is a diagrammatic view that illustrates a push/pull type end effector that may be at the distal end of the flexible shaft instrument [500]."

IS1006, 19:42-45.

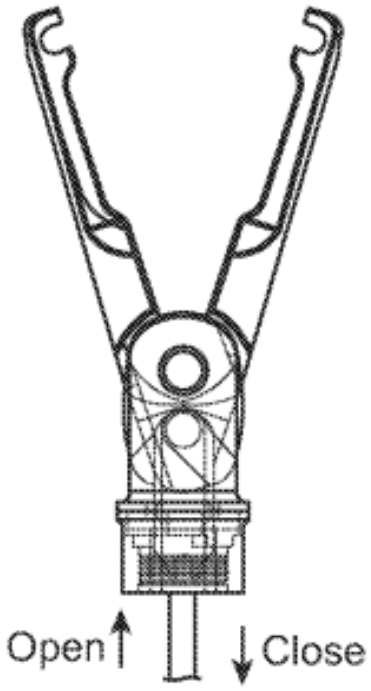


FIG. 9E

IS1006, FIG. 9E.

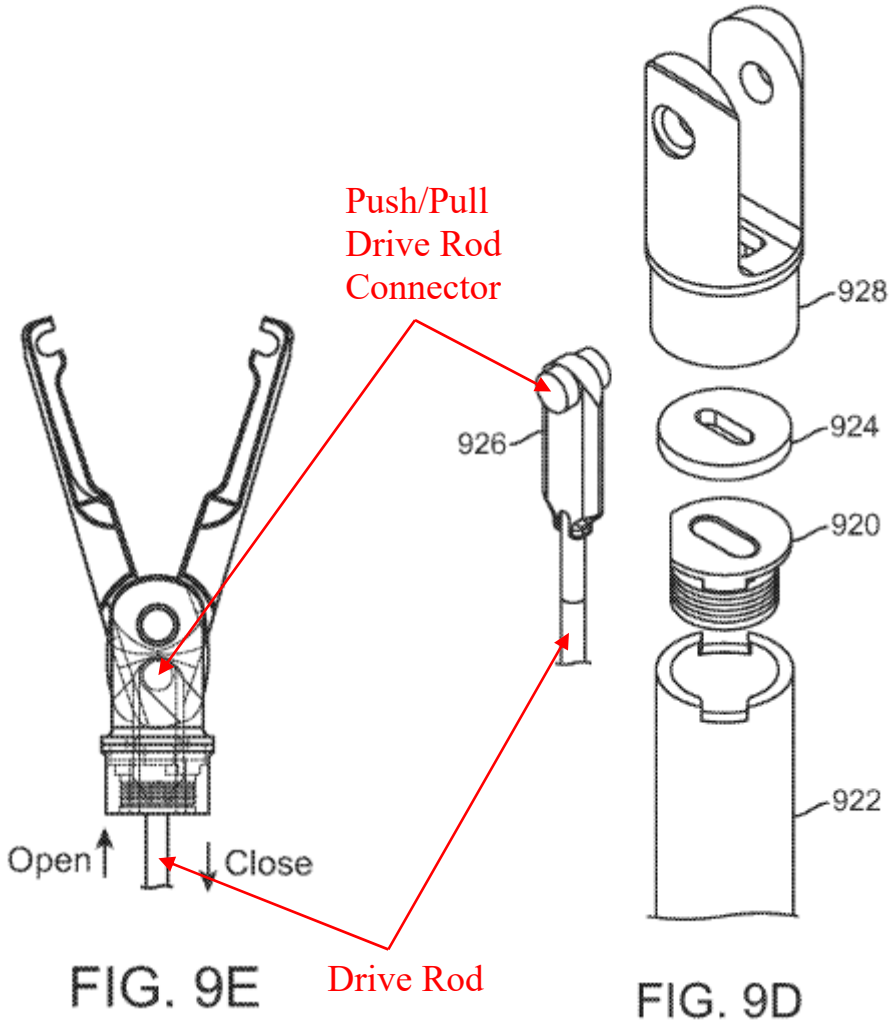
"at least one component portion that is selectively movable between first and second positions relative to at least one other component portion thereof"

As shown above in FIG. 9E, the jaws of Prisco's push/pull type end effector open and close. IS1006, 19:42-47, FIG. 9E; IS1003, ¶61. A POSITA would have understood that each jaw is at least one component portion of the end effector that is selectively movable between first (*e.g.*, open) and second (*e.g.*, closed) positions relative to the other jaw. IS1003, ¶61. Figures 5 and 6B, above, likewise show jaws that open and close and each have selectively movable component portions. IS1003, ¶61.

"in response to control motions applied to said selectively movable component portion"

The selective movements of Prisco's jaws in the "push/pull" implementation described above are in response to control motions (reciprocating motions of the drive element rod 764 and push/pull drive rod connector 926 connected to the jaws) that are applied to the jaws. IS1003, ¶62.

Prisco explains that the "drive rod" shown in FIG. 9E, opens and closes the end effector jaws. IS1006, 19:42-47, FIG. 9E; IS1003, ¶63.



IS1006, FIGS. 9D, 9E.

Prisco also explains that a "push/pull drive rod connector 926 . . . couple[s] with the movable component [(*e.g.*, jaw)] of the end effector." IS1006, 19:32-34, FIG. 9D. And Prisco further explains that pinion drive gears 782 impart control motions on drive element rod 764. IS1006, 16:17-29, FIG. 7D; *see also* 15:55-16:7, FIG. 7C.

A POSITA would have understood that the "drive rod" for actuating the end effector jaws discussed with respect to FIG. 9E is the "drive element rod 764" discussed with respect to FIGs. 7C and 7D. IS1003, ¶64.

[23.2] an elongated shaft assembly including a distal end operably coupled to said surgical end effector and defining a longitudinal tool axis, said elongated shaft assembly including a tube gear segment on a proximal end thereof; and

Prisco discloses element [23.2]. IS1003, ¶¶65-67.

"an elongated shaft assembly including a distal end operably coupled to said surgical end effector"

Prisco discloses an elongated shaft assembly (the combination of shaft body 624, drive element 626, and force isolation components 628) including a distal end operably coupled to the surgical end effector (grip-type end effector 622):

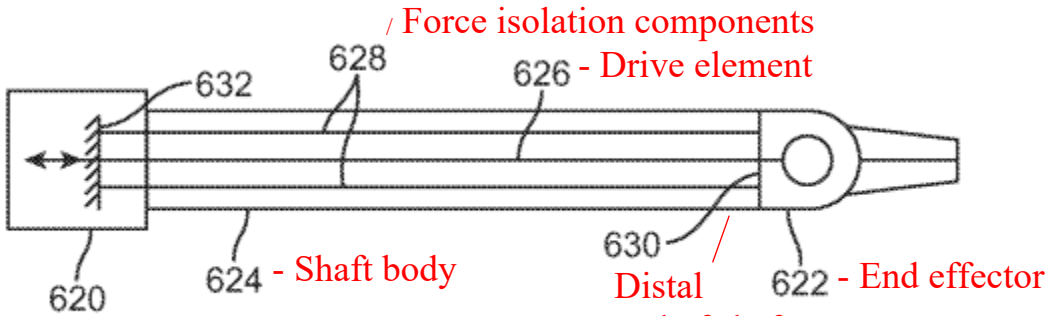


FIG. 6B

IS1003, ¶65; IS1006, FIG. 6B; 14:29-57. FIG. 8A depicts "a cutaway perspective view of a portion of an instrument shaft [506]" and shows the numerous components of that exemplary shaft assembly:

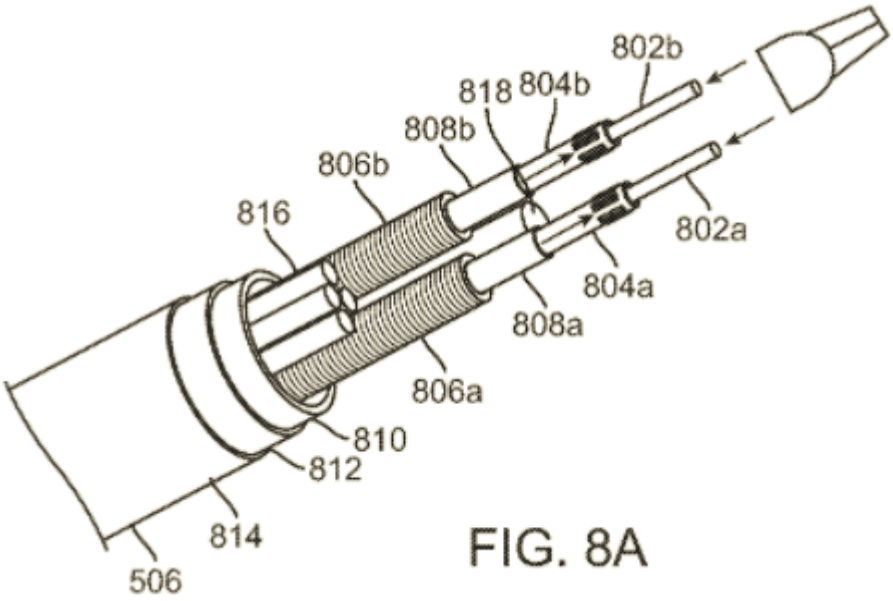


FIG. 8A

IS1006, FIG. 8A, 3:35-36; *see also* 17:5-56.

"defining a longitudinal tool axis"

As shown below, Prisco's elongated shaft assembly defines a longitudinal axis:

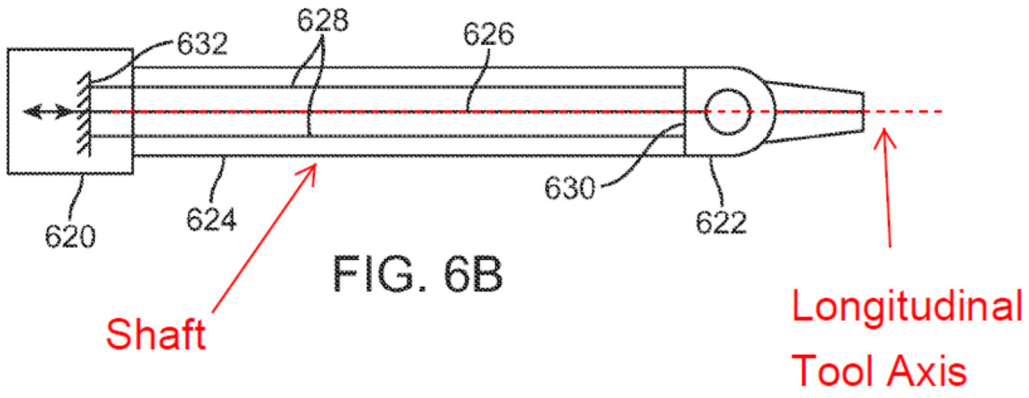
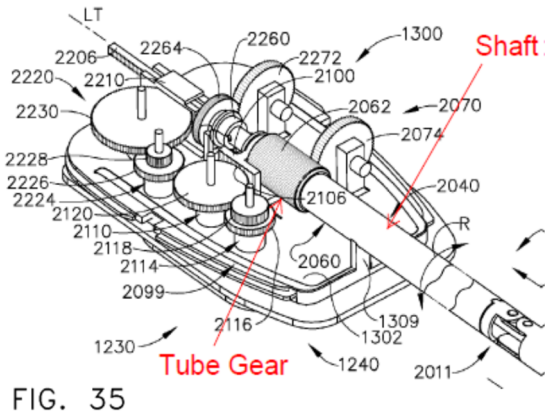
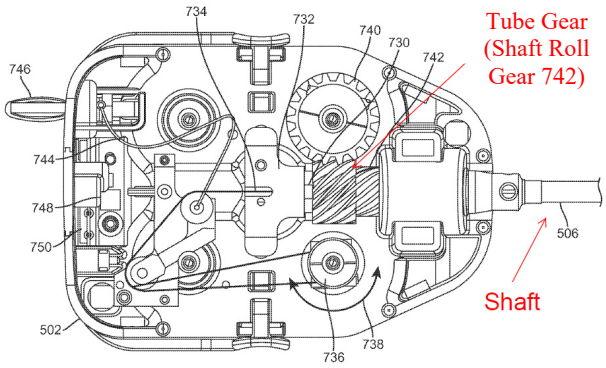


FIG. 6B

IS1003, ¶66; IS1006, FIG. 6B; *see also* 14:53-57 (referring to the instrument shaft's "***longitudinal axis***") (emphasis added), 5:48-51 (same).

"said elongated shaft assembly including a tube gear segment on a proximal end thereof"

Prisco's elongated shaft assembly includes a tube gear ("shaft roll gear 742") on the proximal end of the shaft 506 component of the elongated shaft assembly. IS1003, ¶67; IS1006, FIGs. 7B-7C. Specifically, "[r]oll gear 742 is coupled (*e.g.*, laser welded) to a stainless steel adaptor swaged over the proximal end of the flexible shaft's body tube." IS1006, 15:36-47. As shown below, Prisco's tube gear is very similar to the tube gear disclosed in the '969 Patent:

'969 Patent	**Prisco**
 FIG. 35	 FIG. 7B

IS1001, FIG. 35; 27:61-28:25; IS1006, FIG. 7B; IS1003, ¶67. Although FIG. 7B relates to a "pull/pull instrument design," and FIG. 7C relates to a "push/pull instrument design," both use the same tube gear structure for shaft rotation. IS1006, 15:36-38, 55-57. Indeed, Prisco confirms that the "FIG. 7C shaft implementation is substantially similar to the implementation described above with reference to FIG. 7B." IS1006, 16:5-7; FIG. 7C.

[23.3] a tool mounting portion operably coupled to said elongated shaft assembly, said tool mounting portion being configured to operably interface with the tool drive assembly when coupled thereto,

Prisco discloses element [23.3]. IS1003, ¶¶68-70. In addition, Prisco incorporates Tierney, which the PTO has already found discloses element [23.3]. IS1006, 15:16-20; IS1002, 282-83 (Aug. 30, 2012 Non-Final Rejection) (rejecting original claim 1 as anticipated by Tierney). Prisco discloses various "tool mounting portions" (*e.g.*, "force transmission mechanism 502", "force transmission mechanism 620", "transmission mechanism 602", and "force transmission assembly 230"). *E.g.*, IS1006, FIGs. 2B, 5, 6A; IS1003, ¶68. Each operatively couples to the elongated shaft assembly and each operatively interfaces with the tool drive assembly (the combination of "actuators 232" and "mounting carriage 212") when coupled thereto. IS1006, FIGs. 2B, 4A, 5, 6A, 6B, and 7A; 12:8-13; 13:64-66; 14:30-32; IS1003, ¶68.

As shown for illustrative surgical instrument 110 in FIG. 2B and as described in the accompanying text, the tool mounting portion ("force transmission assembly 230") interfaces with the tool drive assembly (the combination of "actuators 232" and "mounting carriage 212") via matching "force transmission disks":

> Matching ***force transmission disks*** in mounting carriage 212 and force transmission assembly 230 couple actuation forces from actuators 232 in PSM [(patient side

manipulator)] 204 to move various parts of instrument 110 in order to position, orient, and operate instrument end effector 234. Such actuation forces may typically roll instrument shaft 218 . . . .

IS1006, 8:34-44; IS1003, ¶69.

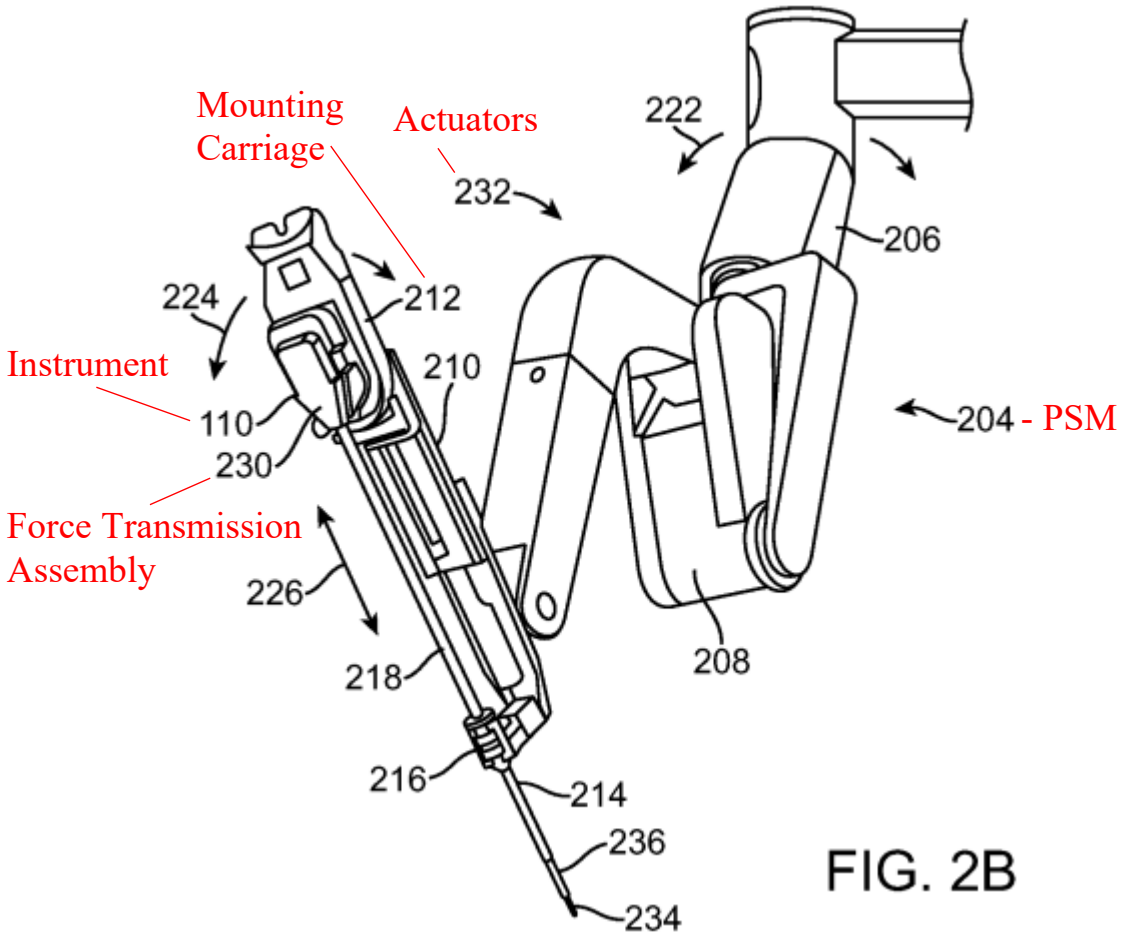


FIG. 2B

IS1006, FIG. 2B.

Similarly, "[i]nstrument 402a is mounted on [a mounting carriage] 212a of a PSM [(patient side manipulator)] 204a . . . . Interface discs 414a couple actuation forces from servo actuators [232] in PSM 204a to move instrument 402a components:"

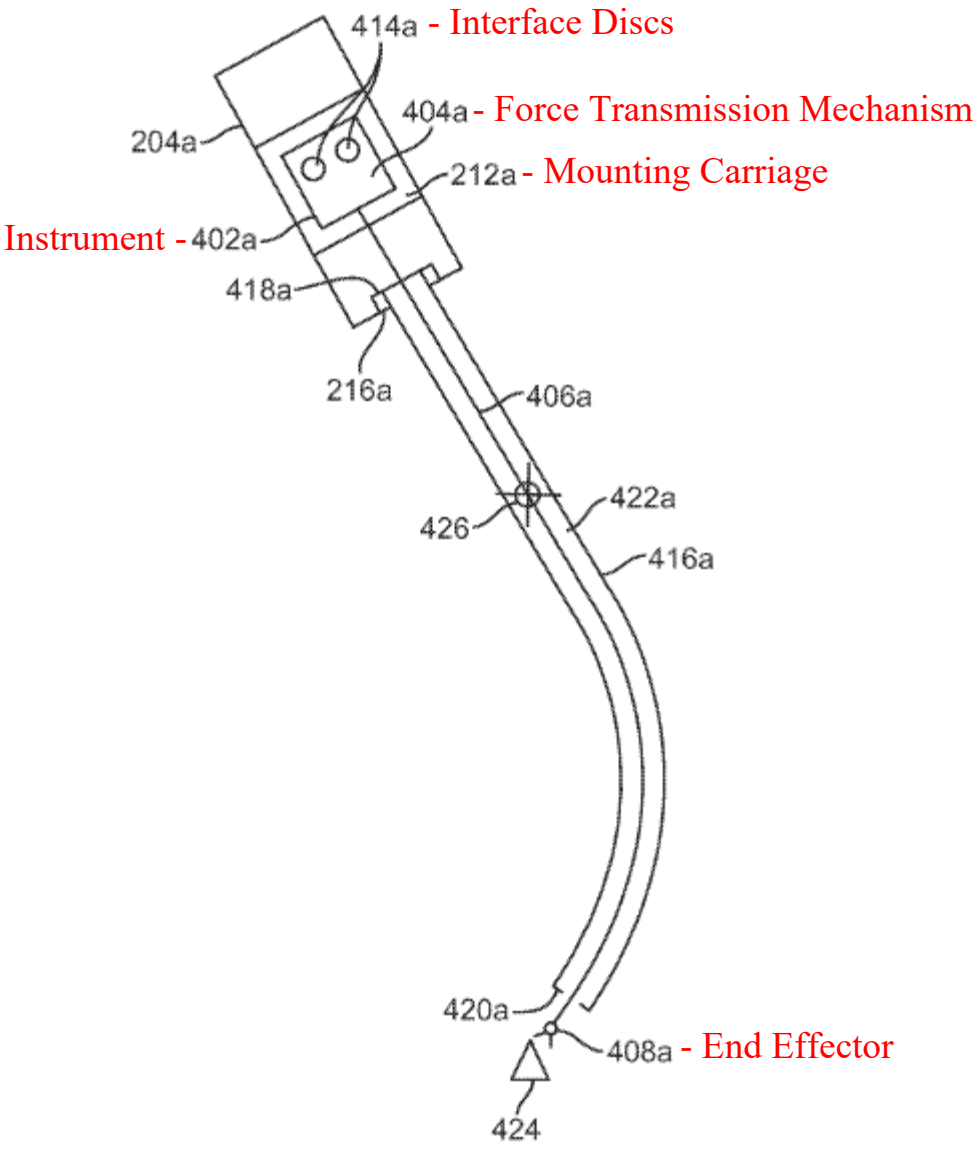


FIG. 4A

IS1006, 10:37-41, FIG. 4A; *see also* 15:4-6 ("Force transmission mechanism 502 may be coupled to PSM 204 without any mechanical modifications required to the PSM . . . ."); IS1003, ¶70. In addition, FIG. 7A depicts "interface disk 702a [which] rolls shaft 506 so as to provide a roll DOF [degree of freedom] for end effector 504 . . . ." IS1006, 14:64-66, FIGs. 7A, 7D; IS1003, ¶70.

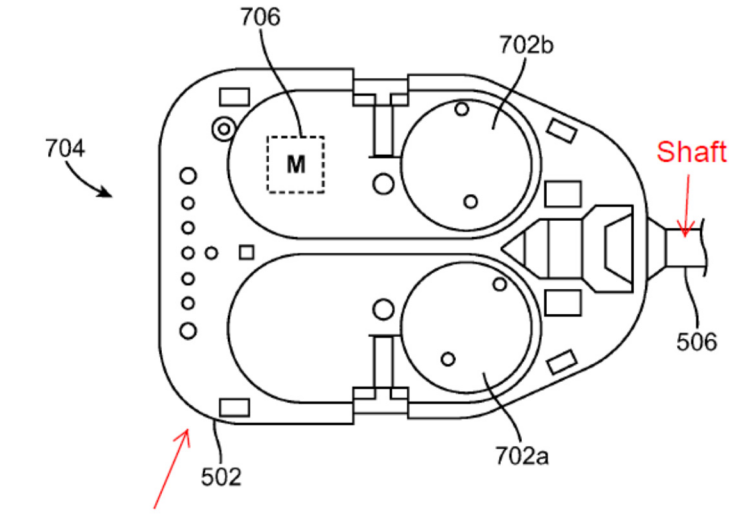


FIG. 7A

Finally, "two extra drive elements and associated interface disks (not shown; *see e.g.*, FIG. 7A) [are] positioned towards the rear of the force transmission mechanism [502], and the drive elements rotate in opposite directions to actuate the end effector's jaw mechanism. IS1006, 16:17-37, FIG. 7D; IS1003, ¶70.

[23.4] said tool mounting portion comprising a rotational transmission assembly comprising a rotational gear assembly in meshing engagement with the tube gear segment and operably coupled to one of the at least one rotatable body portions supported on the tool drive assembly

Prisco discloses element [23.4]. IS1003, ¶¶71-72.

"said tool mounting portion comprising a rotational transmission assembly comprising a rotational gear assembly in meshing engagement with the tube gear segment"

Prisco's tool mounting portion (force transmission mechanisms/assemblies) comprise a rotational transmission assembly (*e.g.*, "helical drive gear 740", its drive shaft, and "interface disk 702a"), as shown in the exemplary drawing of force transmission mechanism 520 of FIG. 7B. IS1006, FIG. 7B; IS1003, ¶71. The interface disk 702a on the robot-side of the tool mounting portion turns the drive shaft for helical drive gear 740, which is in meshing engagement with the shaft roll gear 742. *Id*. Thus, the rotational transmission assembly comprises a rotational gear assembly (*e.g.*, helical drive gear 740, its drive shaft, and interface disk 702a) in meshing engagement with a tube gear segment ("shaft roll gear 742"):

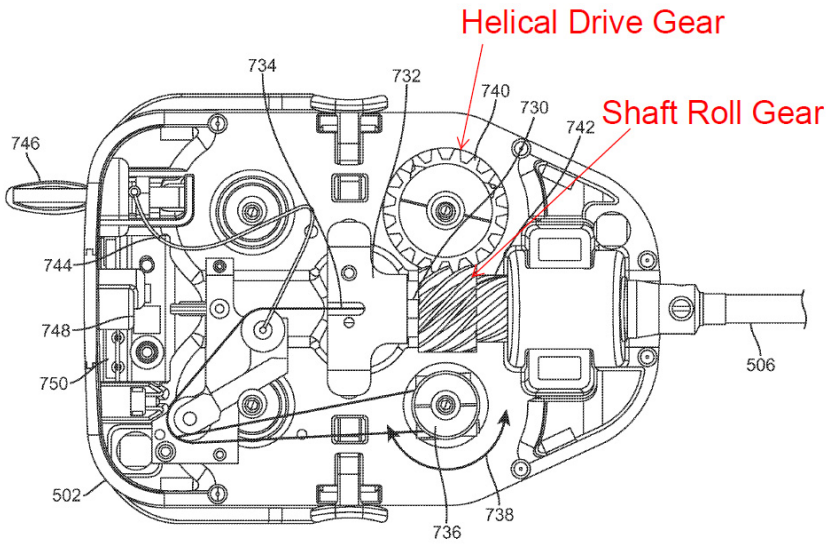


FIG. 7B

IS1006, FIG. 7B; 15:36-54; 16:5-7; *see also* 14:58-15:8; IS1003, ¶71. FIG. 7A shows roll interface disk 702a:

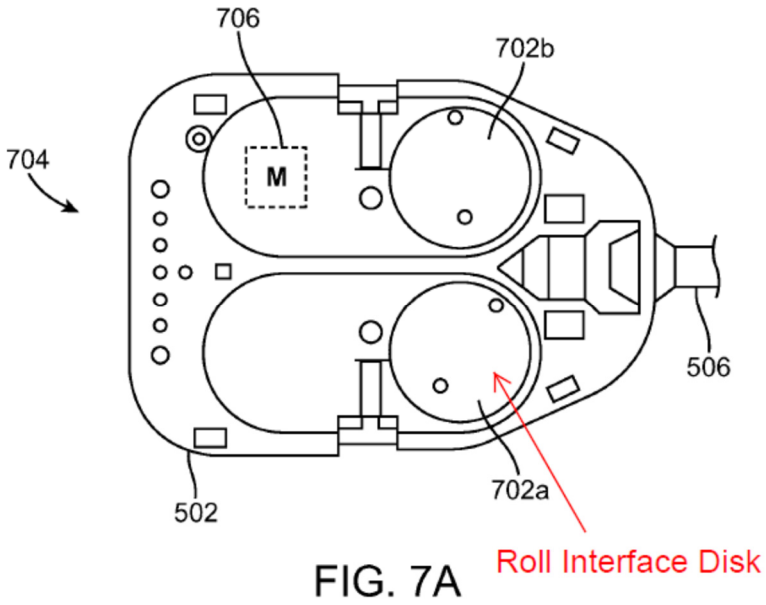


FIG. 7A

IS1006, FIG. 7A. FIG. 7D shows another view of the helical drive gear 740 in meshing engagement with the shaft roll gear 742:

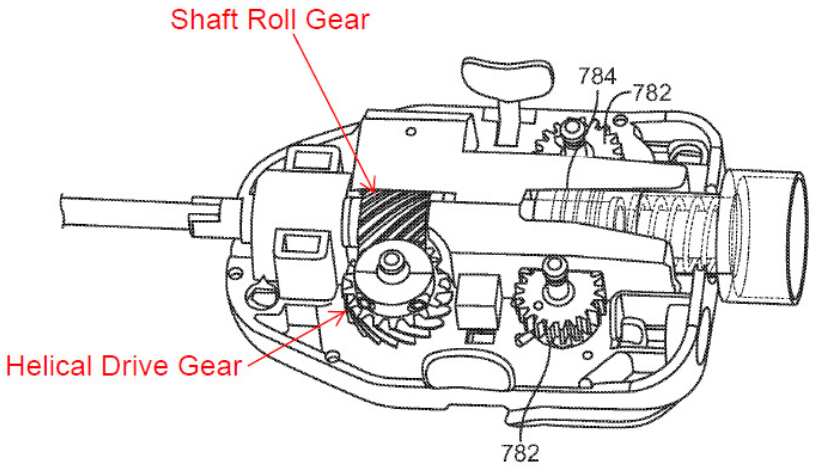


FIG. 7D

IS1006, FIG. 7D; IS1003, ¶71.

"operably coupled to one of the at least one rotatable body portions supported on the tool drive assembly"

As discussed above, interface disk 702a of the rotational gear assembly is operably coupled to a matching force transmission disk on the instrument arm mounting carriage (the recited "one of the at least one rotatable body portions supported on the tool drive assembly"). IS1006, 8:34-40; *see also* Ground 1, element [23.P]; IS1003, ¶72.

> ***[23.5] such that upon application of a rotary output motion in a first direction to said rotational gear assembly by said at least one rotatable body portion, said rotational gear assembly rotates said elongated shaft assembly and said surgical end effector in a first rotary direction about said longitudinal tool axis and upon application of said rotary output motion in a second direction to said rotational gear assembly, said rotational gear assembly rotates said elongated shaft assembly and said surgical end effector about said longitudinal tool axis in a second rotary direction relative to the tool mounting portion.***

Prisco discloses element [23.5]. IS1003, ¶¶73-77. Application of a rotary output motion in first and second directions to the rotational gear assembly (*e.g.*, "helical drive gear 740," its drive shaft, and "interface disk 702a") by the at least one rotatable body portion (the corresponding "force transmission disk") would necessarily cause the helical drive gear 740 assembly to rotate the elongated shaft and the surgical end effector in first and second rotary directions about the longitudinal tool axis. *Id*. As explained in Prisco, rotation of "interface disk 702a rolls shaft 506" using "cross-connected helical drive gear 740 and shaft roll gear

742." IS1006, 14:64-15:8, 15:43-47, 15:55-16:7, 8:34-40, 12:45-49, 18:47-49, claim 13.

Furthermore, Prisco states that rolling the instrument shaft provides "another DOF through the remote center." IS1006, 8:34-40. A POSITA would have understood that a roll degree of freedom allows rolling in both directions (clockwise and counterclockwise). IS1003, ¶74. Moreover, a POSITA would have expected the instrument shaft of Prisco's surgical instrument to roll in both directions, and a POSITA reading the Prisco disclosure would have understood that the tube gear could be driven to rotate the instrument shaft in both directions. IS1003, ¶¶75-76 (noting that the Cooper reference, incorporated by reference into Prisco, confirms that the tube gear structure in Prisco would be understood by a POSITA to roll in both directions); IS1007, FIGs. 36, 64, 65; 17:35-50.

[24.P] A surgical tool for use with a robotic system that has a tool drive assembly that is operatively coupled to a control unit of the robotic system that is operable by inputs from an operator and is configured to provide at least one rotary output motion to at least one rotatable body portion supported on the tool drive assembly, said surgical tool comprising:

If the preamble of claim [24] is deemed to be limiting, then Prisco discloses it. *See* Ground 1, element [23.P]; IS1003, ¶78. In addition, Prisco incorporates Tierney, which the PTO has already found discloses the preamble of claim 24. IS1006, 15:16-20; IS1002, 282-83 (Aug. 30, 2012 Non-Final Rejection) (rejecting original claim 1 as anticipated by Tierney).

[24.1] a surgical end effector comprising at least one component portion that is selectively movable between first and second positions relative to at least one other component portion thereof in response to control motions applied to said selectively movable component portion;

Prisco discloses element [24.1]. *See* Ground 1, element [23.1]; IS1003, ¶79. In addition, Prisco incorporates Tierney, which the PTO has already found discloses element [24.1]. IS1006, 15:16-20; IS1002, 282-83 (Aug. 30, 2012 Non-Final Rejection) (rejecting original claim 1 as anticipated by Tierney).

[24.2] an elongated shaft assembly defining a longitudinal tool axis and comprising: a distal spine portion operably coupled to said end effector; and a proximal spine portion pivotally coupled to said distal spine portion at an articulation joint to facilitate articulation of said surgical end effector about an articulation axis that is substantially transverse to said longitudinal tool axis; and

Prisco discloses element [24.2]. IS1003, ¶¶80-85.

"an elongated shaft assembly defining a longitudinal tool axis,"

See Ground 1, element [23.2], *supra*.

"a distal spine portion operably coupled to said end effector"

Prisco's surgical instrument "may be adapted for use in instruments that include a movable wrist mechanism or other mechanism at the distal end of the instrument shaft." IS1006, 16:38-53. Prisco states that the wrist mechanism disclosed by Cooper (incorporated by reference in Prisco) can be used with Prisco's surgical instrument. *Id.*, 10:31-55.

Prisco's incorporation of Cooper discloses a distal spine portion (*e.g.*, "distal disk 416") operably coupled via "grip support 420" to end effector 406 as shown in FIG. 37 of Cooper:

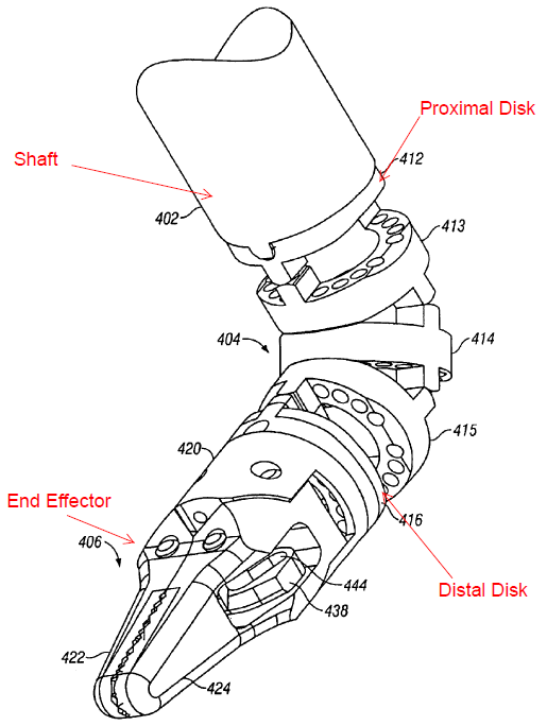


FIG. 37

IS1003, ¶¶81-82; IS1007, 17:25-64; FIGs. 36-39; *see also* 14:14-59; 21:49-22:41; FIGs.14-21; 51-56. Another example of a distal spine portion is distal disk 166, shown in FIG. 20 of Cooper:

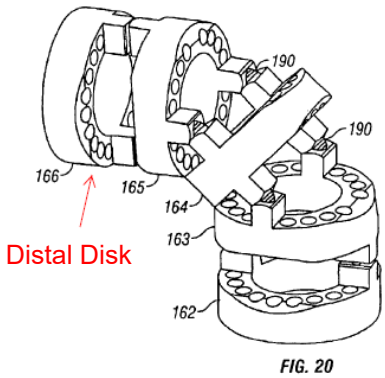


FIG. 20

IS1007, FIG. 20 (excerpt); IS1003, ¶82. "Note that the most distal disk (*e.g.*, disk 166 in FIGS. 17-21) may serve as a mounting base for various kinds of single-element and multi-element end effectors…." IS1007, 17:1-3.

"a proximal spine portion pivotally coupled to said distal spine portion at an articulation joint to facilitate articulation of said surgical end effector about an articulation axis that is substantially transverse to said longitudinal tool axis"

Prisco's incorporation of Cooper discloses a proximal spine portion (*e.g.*, Prisco's "shaft 506") pivotally coupled to the distal spine portion (*e.g.*, Cooper's "distal disk 416") at an articulation joint (the pivot points between the proximal disk 412 and the distal disk 416 that together form a "Multi-Disk Wrist Joint") to facilitate articulation of end effector 406:

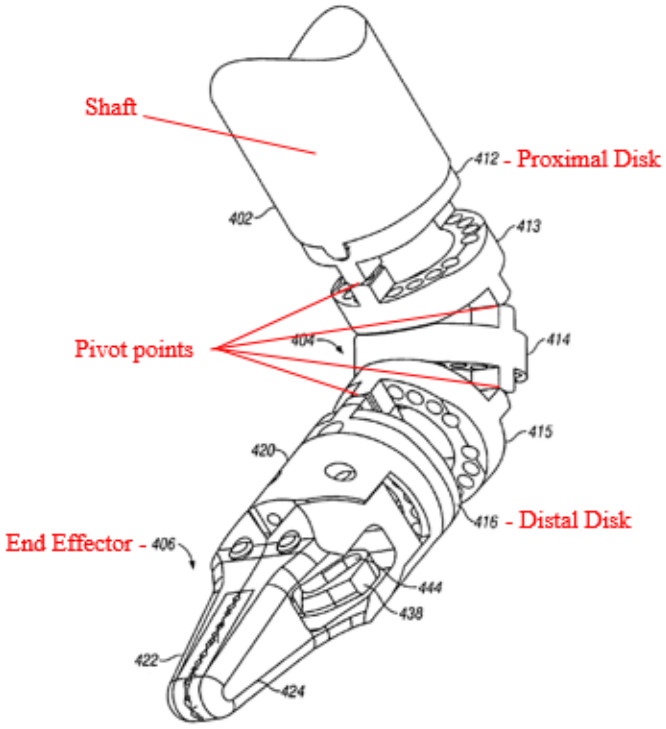


FIG. 37

IS1003, ¶83; IS1007, Title, 17:25-64; FIGs. 36-39; *see also* 14:14-59; 21:49-22:41; FIGs.14-21; 51-56; *see also* FIGS. 17-21 (disclosing another embodiment having proximal and distal disks). The proximal and distal spine portions (including proximal and distal disks, respectively) are structural components that support the end effector. IS1003, ¶83. Indeed, they resemble the vertebra (structural components) of a human spine. *Id*. The proximal and distal spine portions are also within the elongated shaft assembly (which includes both the shaft and the wrist) because they are part of the elongated shaft assembly and/or because Cooper discloses enclosing the entire wrist (and thus the spine portions) within a sheath portion of the elongated shaft assembly to maintain sterility. IS1003, ¶83; IS1007, 17:30-34.

As shown in FIG. 36 and 37 of Cooper, the pivoting of wrist 404 is about an axis substantially transverse to the longitudinal tool axis of shaft 402:

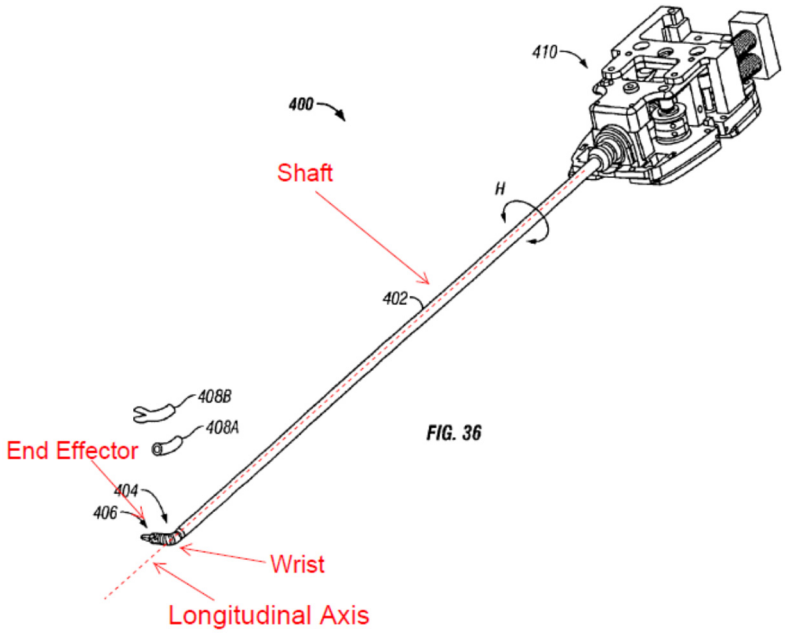


FIG. 36

IS1007, FIGs. 36-39; IS1003, ¶84.

When the Cooper wrist is used with Prisco's flexible shaft, the wrist would likewise bend about an axis transverse to the longitudinal axis of the shaft. IS1003, ¶85. For example, when the shaft is straight, then the longitudinal axis runs down the length of the shaft:

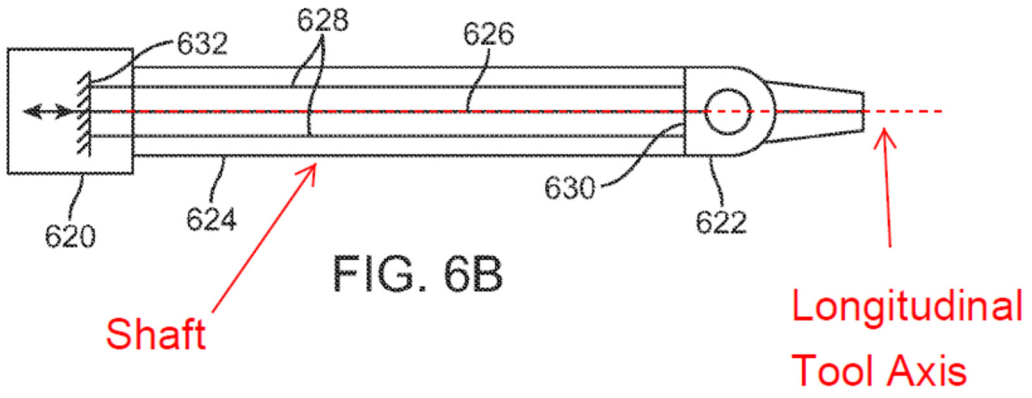


FIG. 6B

IS1006, FIG. 6B; 14:29-57; IS1003, ¶85. If the flexible shaft is bent through a curved cannula, then the wrist would bend about an axis transverse to "an insertion and withdrawal axis 2112 [] defined to include a center-line that extends along longitudinal axis 2110 in a straight line from the distal end of the curved cannula." IS1006, 33:64-67; IS1003, ¶85. Figure 21 depicts the cannula without the shaft and end effector:

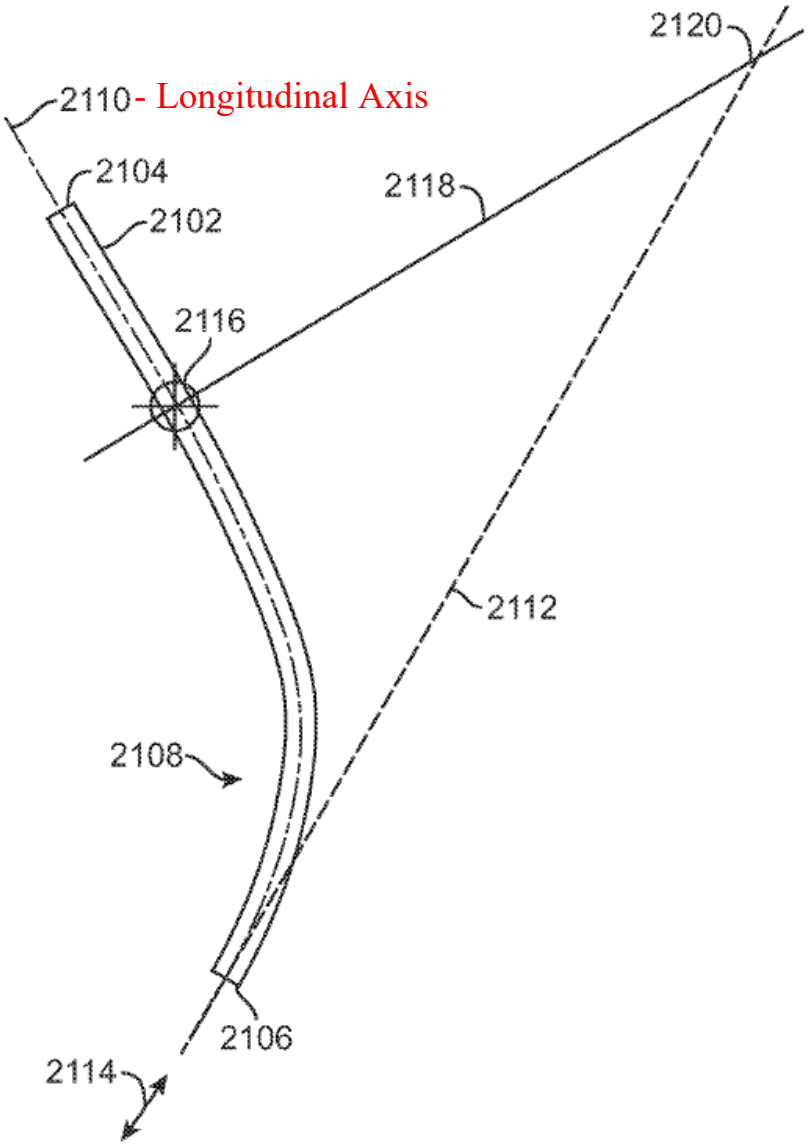


FIG. 21

IS1007, FIG. 21; IS1003, ¶85. Figure 22 depicts the shaft and end effector that has passed through the curved cannula. IS1007, FIG. 22; IS1003, ¶85. The longitudinal axis of the distal end of the shaft is the same as that of the cannula:

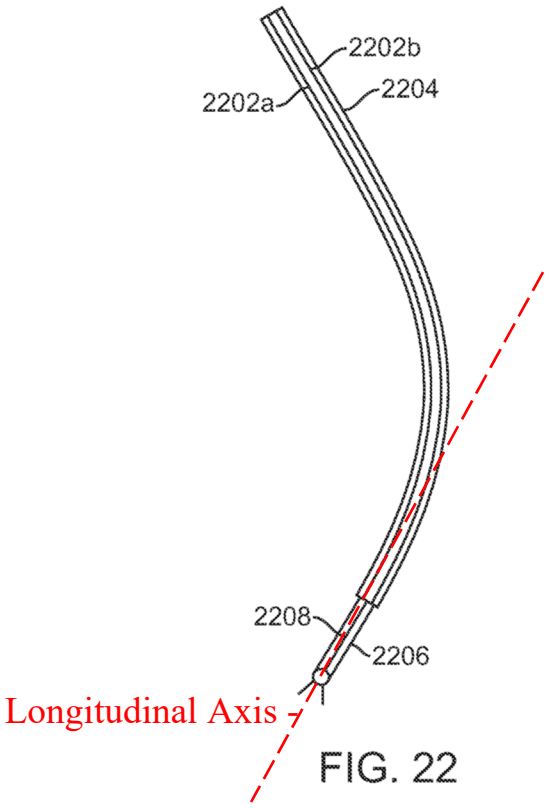


FIG. 22

IS1006, FIG. 22; IS1003, ¶85. When the wrist mechanism from Cooper is added to the distal end of the shaft of Prisco, the wrist will articulate about an axis transverse to the longitudinal axis of the shaft at the distal end emerging from the curve cannula. IS1003, ¶85.

[24.3] at least one gear-driven portion that is in operable communication with said at least one selectively movable component portion of said surgical end effector and wherein said surgical tool further comprises:

Prisco discloses element [24.3]. IS1003, ¶¶86-89. In addition, Prisco incorporates Tierney, which the PTO has already found discloses element [24.3]. IS1006, 15:16-20; IS1002, 282-83 (Aug. 30, 2012 Non-Final Rejection) (rejecting original claim 1 as anticipated by Tierney). Prisco discloses at least one gear

driven portion (*e.g.*, "rack gear 784"). IS1003, ¶86; IS1006, 16:17-37, FIG. 7D. As shown in FIG. 7D, "two pinion drive gears 782 engage a rack gear 784 between them . . . to move [(push and pull)] the rack along the instrument shaft's longitudinal axis." IS1006, 16:17-37, FIG. 7D.

Furthermore, rack gear 784 is in operable communication with the at least one selectively movable component portion of the surgical end effector (*e.g.*, the jaws) such that movement of the rack opens and closes the jaws: "The push/pull drive element rod [764] is coupled to the rack (*e.g.*, with a free rolling bearing as described above)." IS1006, 16:22-23; *see also* 15:55-16:7, FIG. 7C; IS1003, ¶87. The "push/pull drive rod connector 926 [connected to the drive element rod 764] . . . couple[s] with the movable component [(jaw)] of the end effector." IS1006, 19:29-34, FIGs. 9D, 9E.

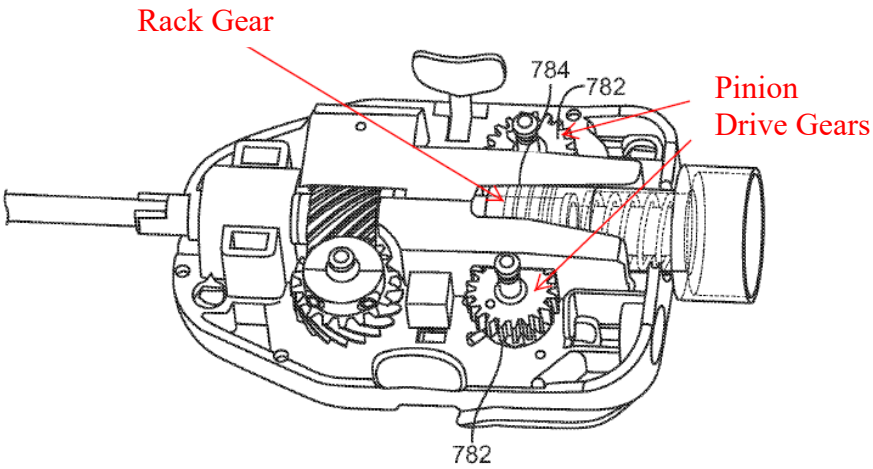


FIG. 7D

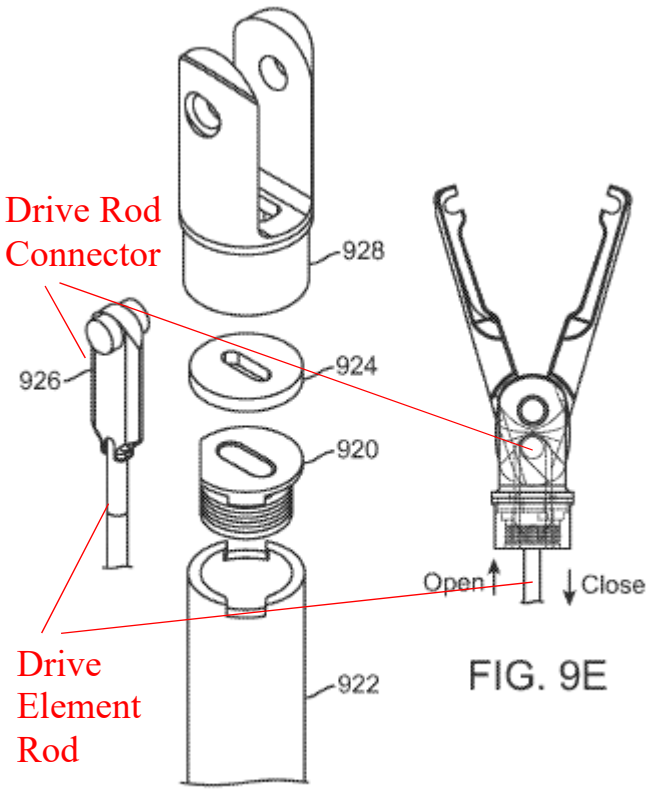


FIG. 9D

FIG. 9E

IS1006, 16:17-43, FIG. 7D; *see also* 15:55-16:7, 16:17-37, 19:28-47, FIGs. 9D, 9E. Alternatively, the combination of push/pull drive rod connector 926, drive element rod 764, and rack gear 784 is a gear-driven portion that operably communicates with the end effector jaws. IS1003, ¶88. Under either read, Prisco discloses a gear-driven portion that is in operative communication with a selectively movable component, namely, a jaw of the end effector. *Id.*

Moreover, as explained in Ground 1, element [23.2], Prisco includes a tube gear ("shaft roll gear 742") "to provide a roll DOF [degree of freedom] for end effector 504." IS1006, 14:64-15:1, 15:43-47, FIG. 7B; *see also* IS1006, 15:45-47, FIGs. 7B, 7D, 19:34-36, FIG. 9D, 9E; IS1003, ¶89.

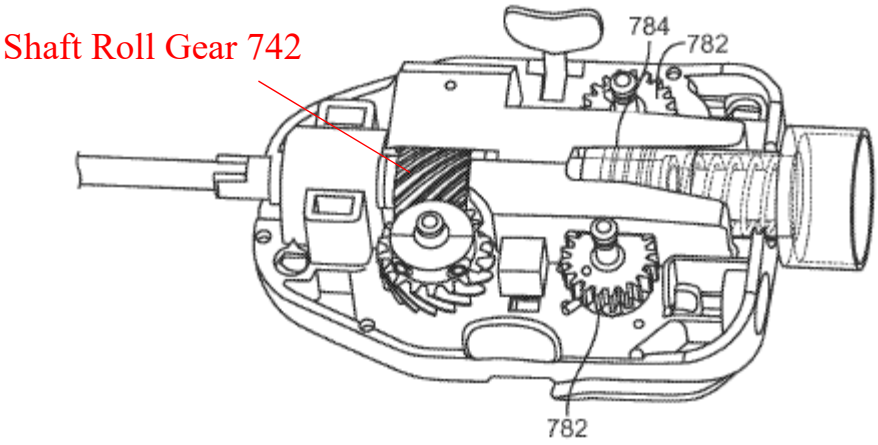


FIG. 7D

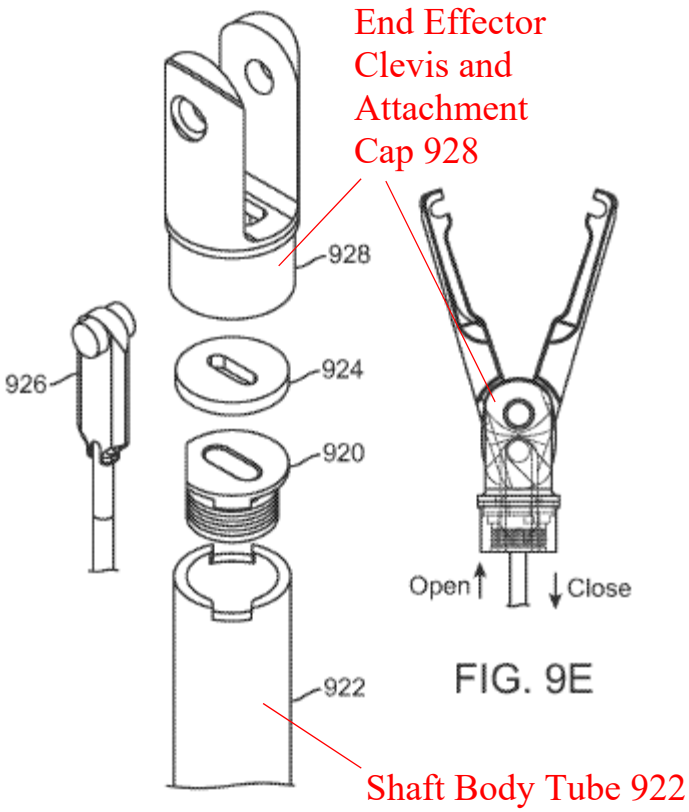


FIG. 9E

FIG. 9D

Thus, shaft roll gear 742 is also a gear-driven portion that operably communicates (via shaft body tube 922 and end effector clevis and attachment cap 928) with the end effector jaws. IS1003, ¶89. Alternatively, the combination of end effector

clevis and attachment cap 928, shaft body tube 922, and shaft roll gear 742 is a gear-driven portion that operably communicates with the end effector jaws. *Id*.

[24.4] a tool mounting portion operably coupled to a [proximal/distal][4] end of said proximal spine portion, said tool mounting portion being configured to operably interface with the tool drive assembly when coupled thereto,

Prisco discloses element [24.4]. IS1003, ¶¶90-91. In addition, Prisco incorporates Tierney, which the PTO has already found discloses element [24.4]. IS1006, 15:16-20; IS1002, 282-83 (Aug. 30, 2012 Non-Final Rejection) (rejecting original claim 1 as anticipated by Tierney).

"a tool mounting portion operably coupled to a proximal end of said proximal spine portion"

Prisco discloses a tool mounting portion (*e.g.*, "proximal force transmission mechanism 502") operably coupled to a proximal end of the proximal spine portion (*e.g.*, "proximal section 506a" of "shaft 506"), as illustrated in FIGs. 5 and 6A. In this example, the operable coupling is via a direct connection:

[4] On January 23, 2018, the PTO entered a Certificate of Correction replacing the word "distal" with the word "proximal" in element [24.4]. IS1002, 686. Petitioner contends the Certificate was not effective, and applies the claim both with and without the Certificate.

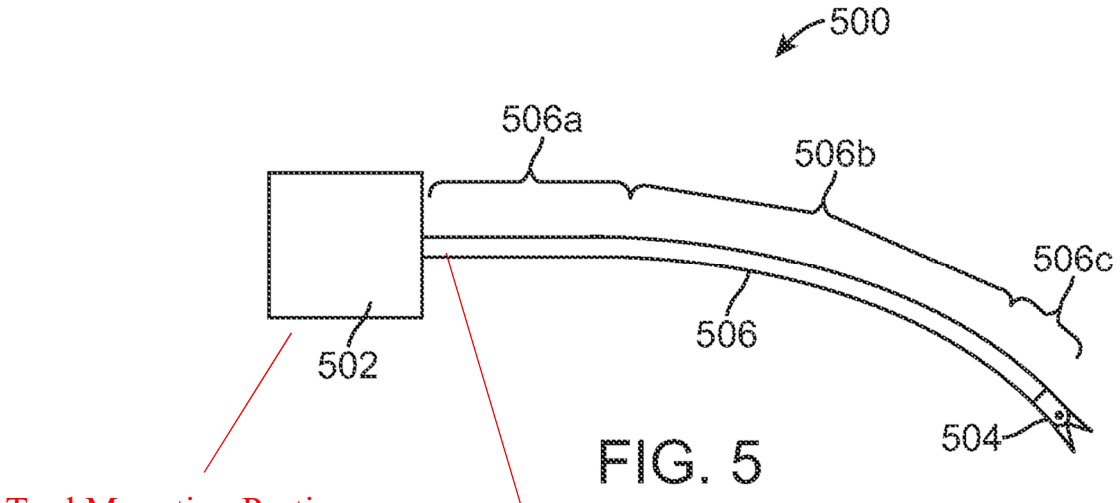


FIG. 5

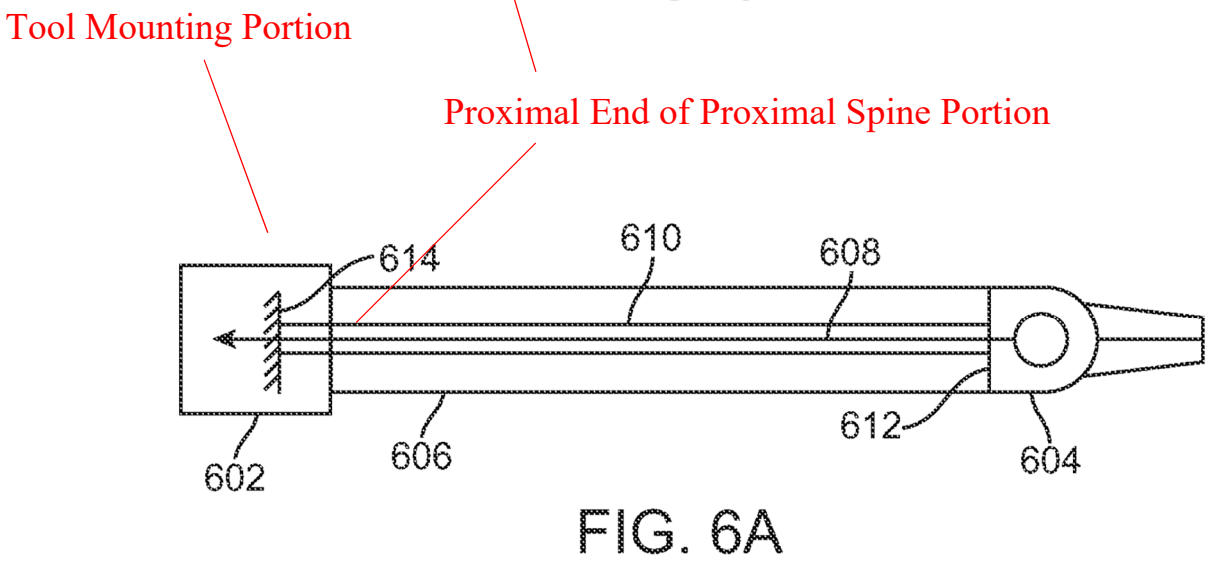


FIG. 6A

IS1006, 12:8-17; 13:62-14:18, FIGs. 5, 6A; IS1003, ¶90.

If the January 23, 2018 Certificate of Correction is deemed to be not effective, then Prisco still discloses this limitation. IS1003, ¶90. Specifically, Prisco discloses a tool mounting portion (*e.g.*, "proximal force transmission mechanism 502") operably coupled via the elongated shaft assembly to a distal end of the proximal spine portion (*e.g.*, "distal section 506c" of "shaft 506"), as illustrated in FIGs. 5 and 6A:

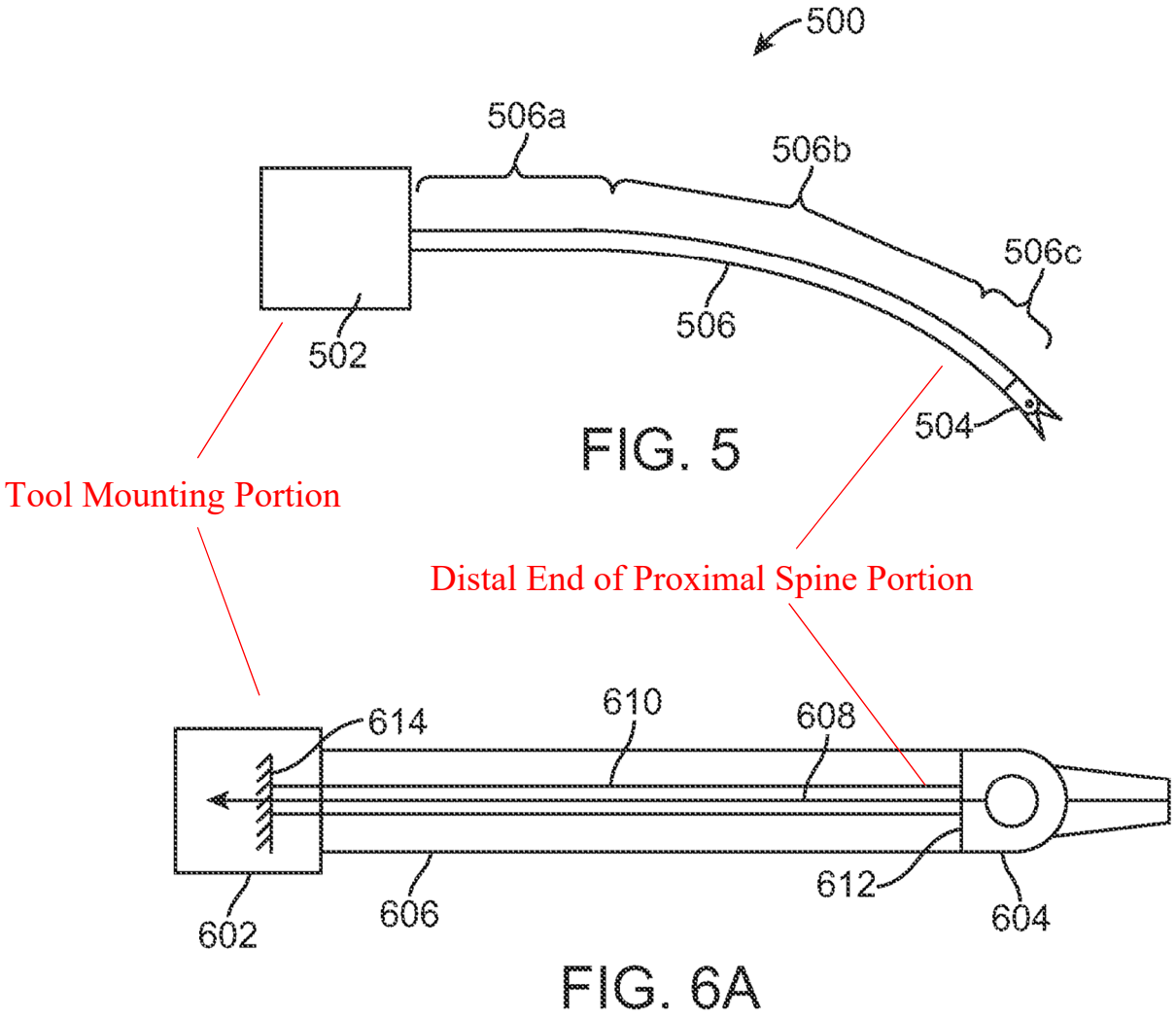


FIG. 5

FIG. 6A

IS1006, 12:8-17; 13:62-14:18, FIGs. 5, 6A; IS1003, ¶90.

"said tool mounting portion being configured to operably interface with the tool drive assembly when coupled thereto"

See Ground 1, element [23.3].

[24.5] said tool mounting portion comprising: a driven element rotatably supported on said tool mounting portion and configured for driving engagement with a corresponding one of the at least one rotatable body portions of the tool drive assembly to receive corresponding rotary output motions therefrom; and

Prisco discloses element [24.5]. IS1003, ¶¶92-94. In addition, Prisco incorporates Tierney, which the PTO has already found discloses element [24.5]. IS1006, 15:16-20; IS1002, 282-83 (Aug. 30, 2012 Non-Final Rejection) (rejecting original claim 1 as anticipated by Tierney).

"a driven element rotatably supported on said tool mounting portion"

Prisco's tool mounting portion (*e.g.*, "force transmission mechanism 502") includes at least two driven elements ("interface disks") rotatably supported on force transmission mechanism 502. IS1003, ¶92. For example, force transmission mechanism 502 includes "one interface disk 702a . . . and a second interface disk 702b . . . ." IS1006, 14:64-15:1, FIG. 7A.

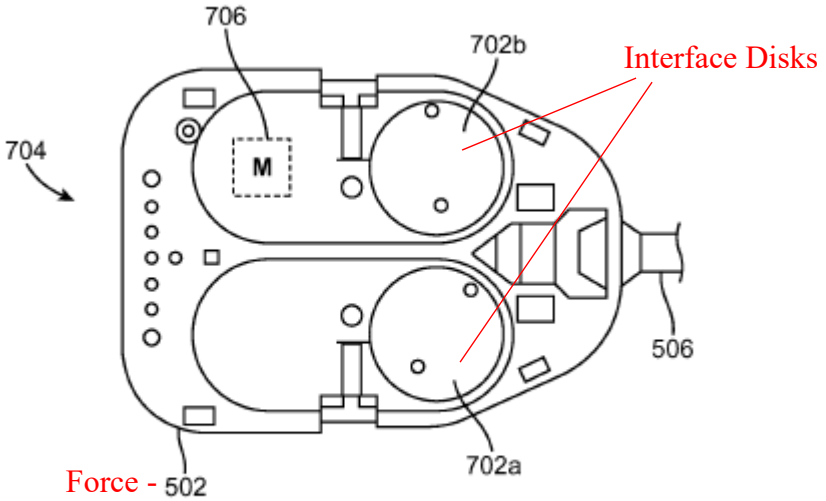


FIG. 7A

IS1006, FIG. 7A; 14:58-15:8; IS1003, ¶92. In addition, force transmission mechanism 502 can include "two extra . . . interface disks (not shown; *see e.g.*, FIG. 7A) positioned towards the rear of the force transmission mechanism [502]." IS1006, 16:17-44; FIG. 7D; IS1003, ¶92.

"configured for driving engagement with a corresponding one of the at least one rotatable body portions of the tool drive assembly to receive corresponding rotary output motions therefrom"

Prisco's driven elements ("interface disks") are driven by, and therefore configured for driving engagement with, the corresponding rotatable body portions (the "matching force transmission disks") of the tool drive assembly. IS1003, ¶93; IS1006, 8:34-44; 16:17-44; FIGs. 7A-7D. Specifically, "[m]atching force transmission disks in mounting carriage 212 and force transmission assembly 230 couple actuation forces from actuators 232 in PSM [(patient side manipulator)] 204 to move various parts of instrument 110 … [such as] grasping jaws of various end effectors…." IS1006, 8:34-44; *see also* IS1003, ¶¶49, 94 (noting that Tierney, which Prisco incorporates by reference (IS1006, 15:17-20), confirms that each interface disk receives rotational motion from its corresponding force transmission disk); IS1006, 10:39-41, 16:17-44; IS1009, 10:12-11:35, FIGs. 6-7M.

[24.6] a transmission assembly in operable engagement with said driven element and in meshing engagement with a corresponding one of said at least one gear-driven portions to apply actuation motions thereto to cause said corresponding one of said at least one gear-driven portions to apply at least one control motion to said selectively movable component.

Prisco discloses element [24.6]. IS1003, ¶¶95-97. In addition, Prisco incorporates Tierney, which the PTO has already found discloses element [24.6]. IS1006, 15:16-20; IS1002, 282-83 (Aug. 30, 2012 Non-Final Rejection) (rejecting original claim 1 as anticipated by Tierney).

"a transmission assembly in operable engagement with said driven element"

Prisco's tool mounting portion ("force transmission mechanism 502") includes a transmission assembly (*"*"pinion drive gears 782" and/or the "helical drive gear 740" assembly) in operable engagement with the driven element (the corresponding interface disk(s)). IS1003, ¶95. As explained above, pinion drive gears 782 and their "associated interface disks . . . rotate . . . to move the rack [gear 784 and drive element rod 764] along the instrument shaft's longitudinal axis." IS1006, 16:17-37, FIG. 7D; *see also* 15:55-16:7, FIG. 7A. Similarly, the helical drive gear 740 assembly and the associated "interface disk 702a rolls shaft 506 so as to provide a roll DOF [degree of freedom] for end effector 504 . . . ." IS1006, 14:64-15:1, FIG. 7A, 7D.

"and in meshing engagement with a corresponding one of said at least one gear-driven portions to apply actuation motions thereto to cause said corresponding one of said at least one gear-driven portions to apply at least one control motion to said selectively movable component"

The two pinion drive gears 782 in Prisco's transmission assembly are in meshing engagement with a gear-driven portion ("rack gear 784" or the combination of "push/pull drive rod connector 926," "drive element rod 764," and "rack gear 784"—*see* Ground 1, element [24.3]) to apply actuation motions (rotary motions) thereto. IS1006, FIG. 7D; 16:17-43, 19:42-48, 13:49-62; IS1003, ¶96.

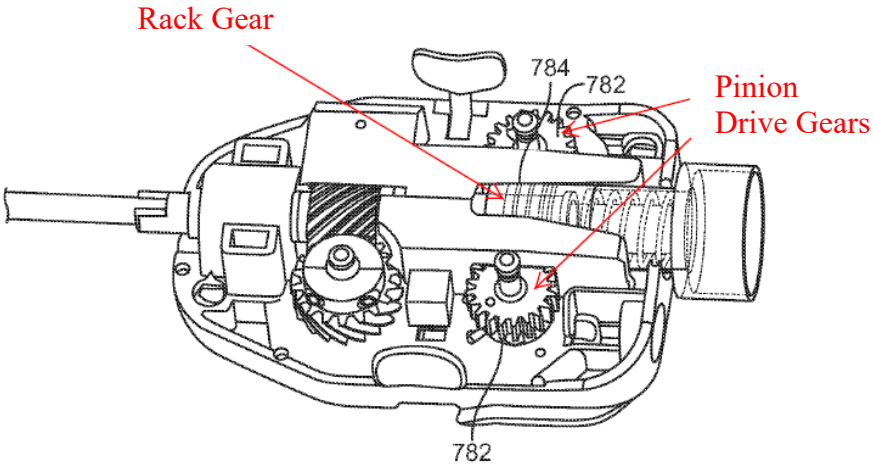


FIG. 7D

Application of this rotary motion to the gear-driven portion causes the gear-driven portion to apply at least one control motion (distal or proximal movement of the gear-driven portion) to the at least one selectively movable component of the end effector (the end effector jaws). *See* Ground 1, element [24.3].

Alternatively, the helical drive gear 740 in Prisco's transmission assembly is in meshing engagement with a corresponding gear-driven portion (shaft roll gear 742 or the combination of end effector clevis and attachment cap 928, shaft body tube 922, and shaft roll gear 742—*see* Ground 1, element [24.3]) to apply actuation motions (rotary motions) thereto. IS1006, 15:43-47, FIGs. 7B-7D; IS1003, ¶97.

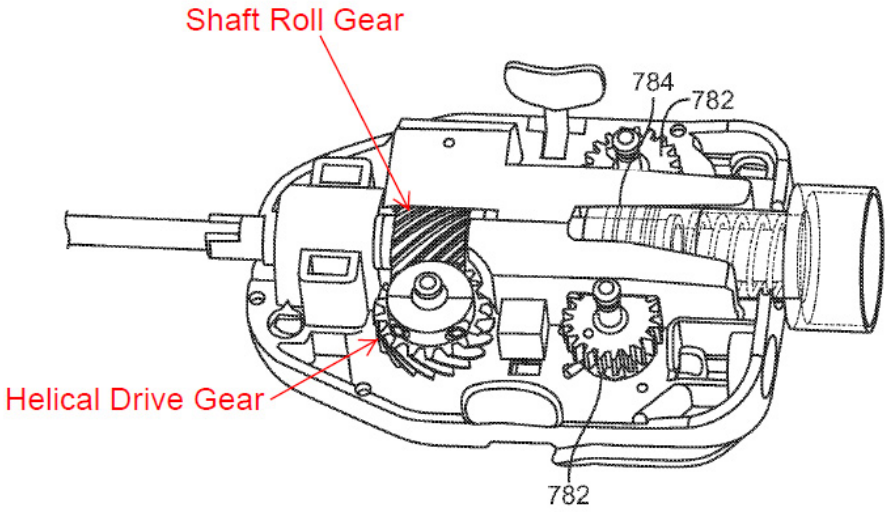


FIG. 7D

Application of this rotary motion to the gear-driven portion causes the gear-driven portion to apply at least one control motion (rotation of the gear-driven portion) to the at least one selectively movable component of the end effector (the end effector jaws). *See* Ground 1, elements [23.4]-[23.5], [24.3].

[25] The surgical tool of claim 24 wherein said at least one gear-driven portion comprises an articulation system interfacing with said distal spine portion and said transmission assembly.

Prisco discloses claim [25]. IS1003, ¶¶98-99. Prisco's incorporation of Cooper discloses that the gear-driven portion of the surgical tool can include an

articulation system (*e.g.*, "gimbaled cable actuator 300" and its corresponding cables). *Id.*; IS1007, 15:35-17:23, FIGs. 27-28.

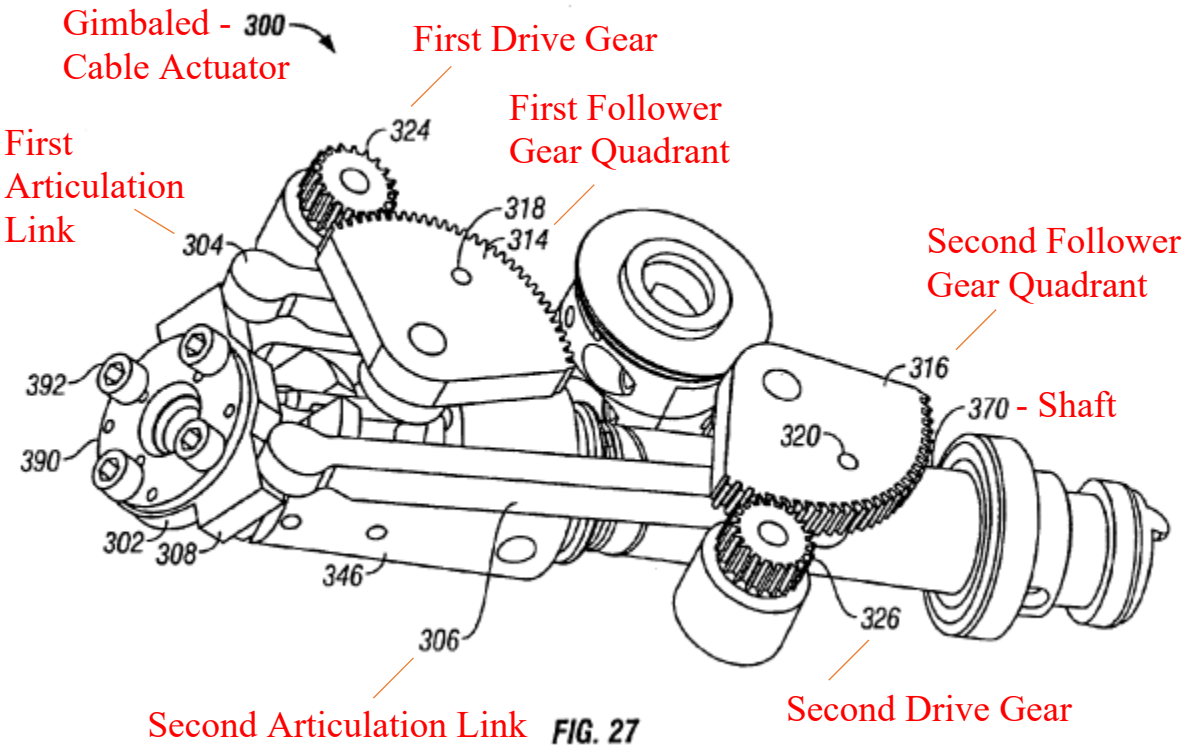


FIG. 27

As shown above, gimbaled cable actuator 300 of the articulation system is driven by first and second drive gears 324, 326. IS1003, ¶98. Thus, the articulation system is part of the surgical tool's gear driven portion. *Id.*

Furthermore, Prisco's incorporation of Cooper discloses that the articulation system interfaces with the distal spine portion (distal disk 166) and the transmission assembly. IS1003, ¶99. Specifically, the "distal actuation cables [of the articulation system] extend through . . . the hollow center of the shaft 370 . . . to the . . . distal disk . . . 166." IS1007, 16:56-60. And, as shown above, "gear quadrants 314, 316" of the articulation system interface with, and therefore "are

rotated by[,] first and second drive gears 324, 326" of the transmission assembly. IS1007, 16:27-30.

[26] The surgical tool of claim 25 wherein said transmission assembly comprises an articulation transmission and wherein said articulation system comprises: a first articulation bar having a distal end coupled to a proximal portion of said elongated shaft assembly at a first lateral point that is laterally offset in a first lateral direction from said articulation axis, said first articulation bar having a proximal end that operably interfaces with said articulation transmission; and a second articulation bar having a distal end coupled to said proximal portion of said elongated shaft assembly at a second lateral point that is laterally offset in a second lateral direction from said articulation axis, said second articulation bar having a proximal end that operably interfaces with said articulation transmission.

Prisco discloses claim [26]. IS1003, ¶¶100-102.

"transmission assembly comprises an articulation transmission"

As discussed in claim [25], Prisco's incorporation of Cooper discloses a transmission assembly that comprises an articulation transmission (*e.g.*, "first and second drive gears 324, 326") used to articulate the wrist of the surgical instrument. IS1007, 15:35-17:23; IS1003, ¶100.

"articulation system comprises: a [first/second] articulation bar having a distal end coupled to a proximal portion of said elongated shaft assembly at a [first/second] lateral point that is laterally offset in a [first/second] lateral direction from said articulation axis"

Prisco's incorporation of Cooper discloses that the articulation system ("gimbaled cable actuator 300" and its corresponding cables) comprises first and

second articulation bars (actuator links 304, 306). IS1003, ¶101; IS1007, 16:7-30, FIGs. 27-29.

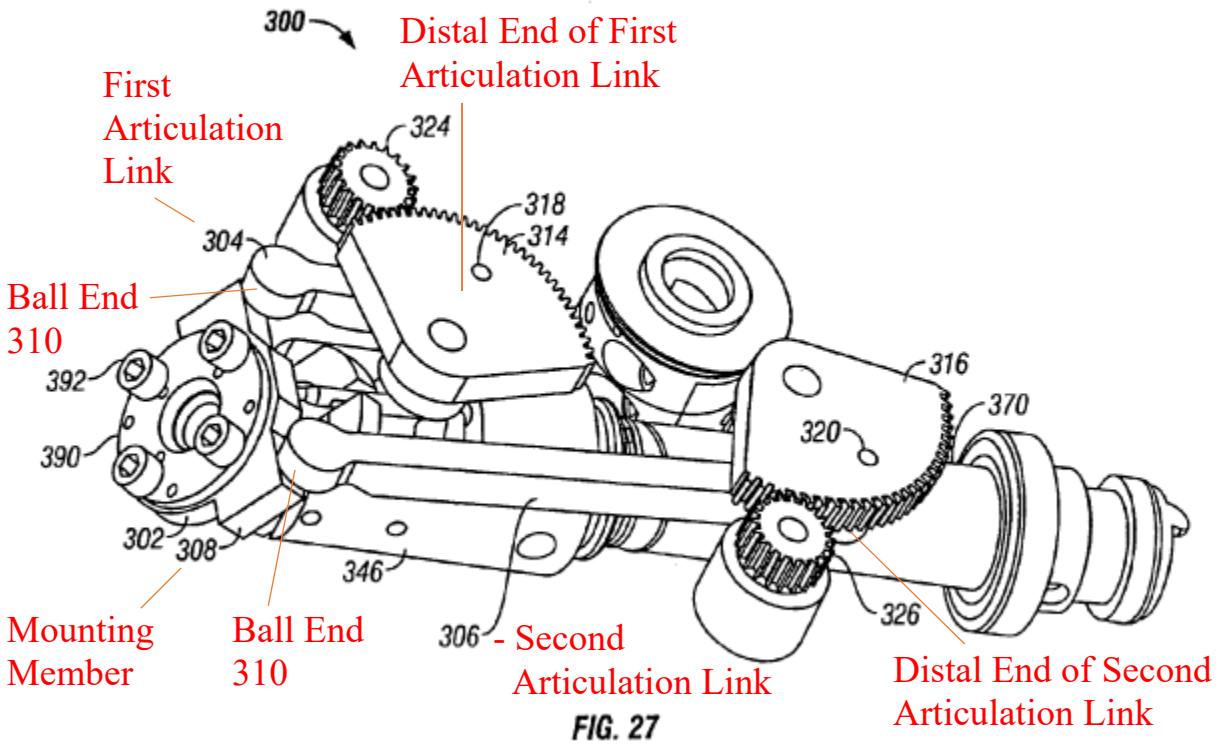
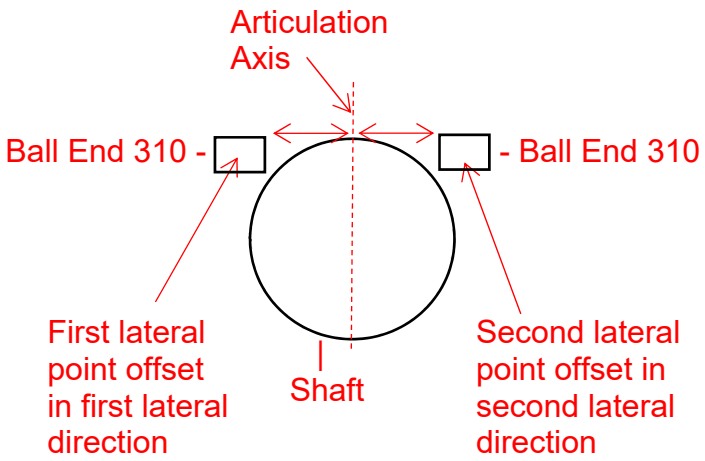


FIG. 27

As shown above, the articulation system also comprises first/second articulation bars ("actuator links 304, 306") having a distal end coupled by the actuator link to a proximal portion ("mounting member 308") of the elongated shaft assembly at first/second lateral points ("ball ends 310"). IS1003, ¶101; *see also* IS1007, 16:18-20 (confirming "ball ends 310 are used for coupling the actuator links 304, 306 with the mounting member 308"), FIGS, 27, 33. And, as shown below in a schematic layout of the shaft and the ball ends 310 looking down the shaft from the distal end of the surgical instrument, the first/second lateral points ("ball ends

310") are laterally offset in a first/second lateral direction from the articulation axis for yaw movement of the end effector. IS1003, ¶101.



"[first/second] articulation bar having a proximal end that operably interfaces with said articulation transmission"

The first and second articulation bars ("actuator links 304, 306") also have proximal ends that operably interface (via "actuator links 304, 306" and "gear quadrants 314, 316") with the articulation transmission ("drive gears 324, 326"). IS1003, ¶102; IS1007, 16:7-30, FIGs. 27-29. As explained in Cooper (incorporated by reference into Prisco), "first and second follower gear quadrants 314, 316 . . . [(1)] are rotatably coupled with the actuator links 304, 306, [and (2)] rotated by first and second drive gears 324, 326, respectively, which are in turn actuated by drive spools 334, 336." IS1007, 16:23-30, FIGs. 27-29.

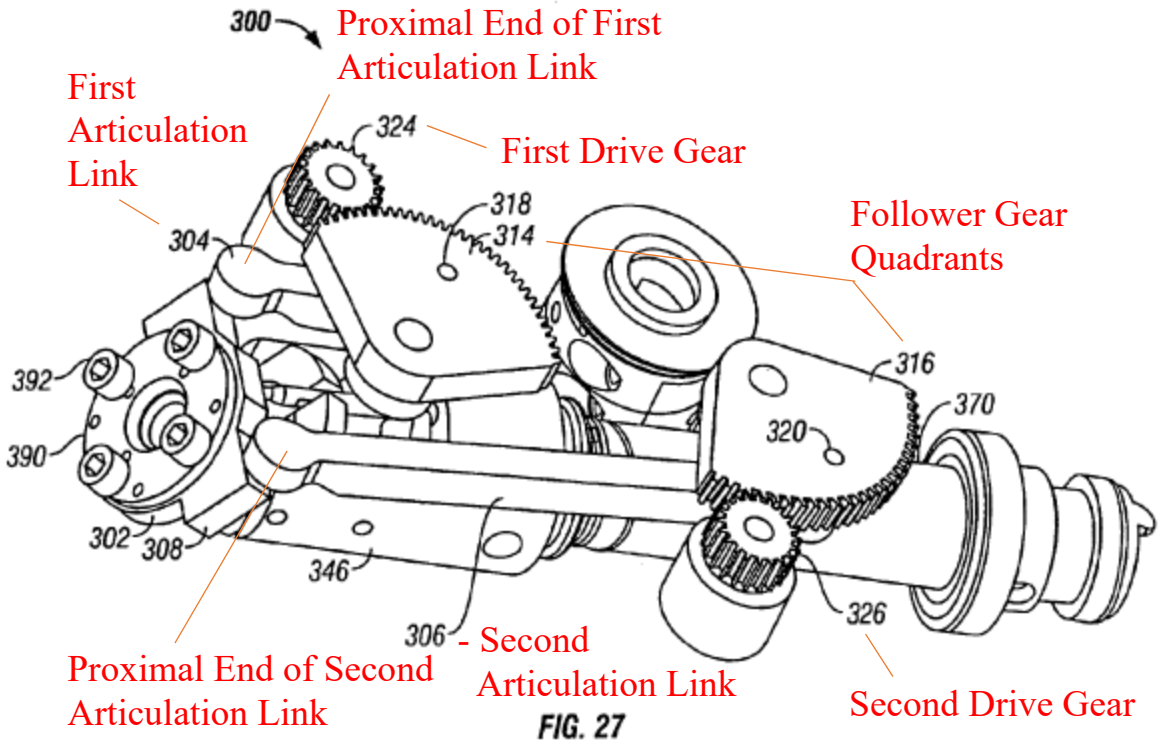


FIG. 27

B. Ground 2: Claims 23-26 Would Have Been Obvious Under § 103 Over Prisco in View of Cooper

To the extent that the Board concludes that Prisco does not disclose a surgical tool with Cooper's wrist mechanism, it would have been obvious to a POSITA to look to Cooper for further details on the articulation mechanism because Prisco directs the reader to Cooper for teachings of the wrist implementation. IS1003, ¶103; IS1006, 10:43-48. Moreover, a person of skill in the art would look to Cooper because it, like Prisco, is assigned to Petitioner, the industry leader in robotic surgical systems.

Similarly, to the extent that the Board concludes that Prisco does not disclose rotation of the elongated shaft assembly and end effector in both rotational

directions (Ground 1, element [23.5]), then it would have been obvious in view of Cooper to include such functionality. IS1003, ¶104. As explained above, Cooper confirms that surgical instruments using tube gears to rotate the end effector (via rotation of the shaft to which the end effector is coupled) in both rotational directions were well known in prior art systems:

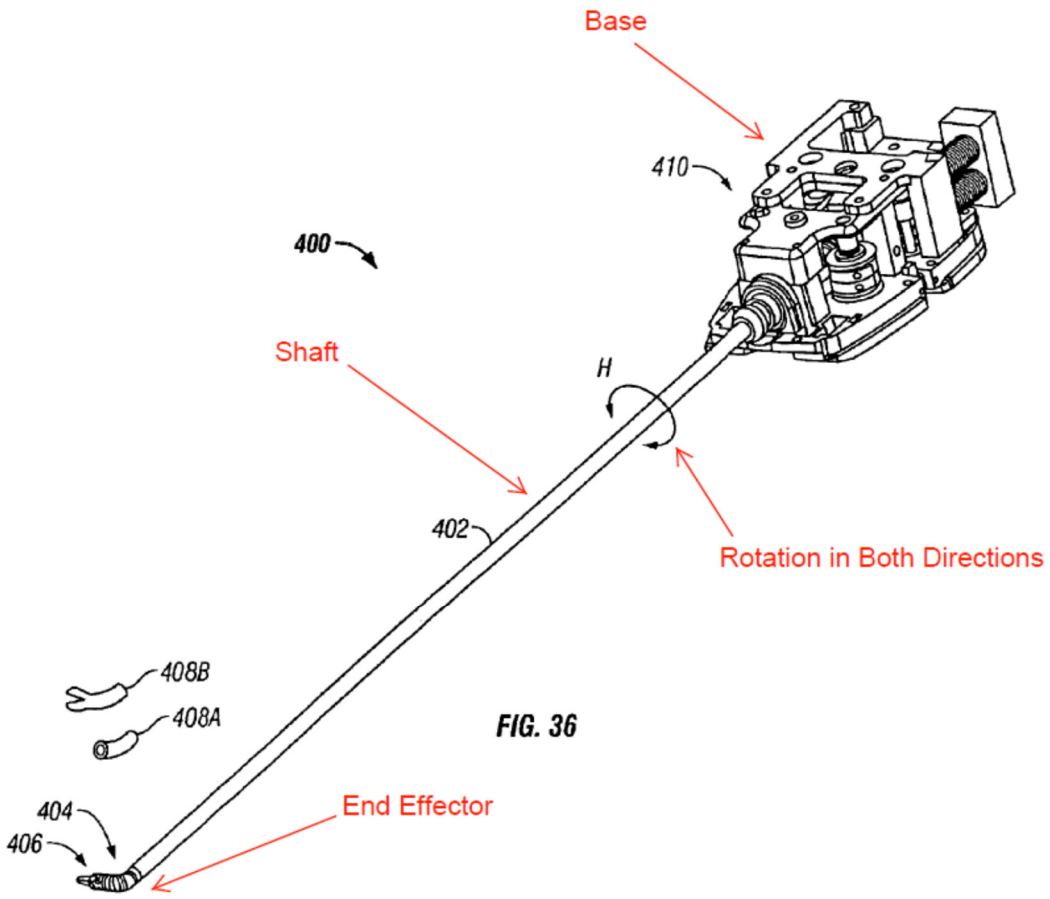


FIG. 36

IS1007, FIG. 36; 17:35-50; FIGs 64-67 (showing tube gear).

Multiple reasons would have prompted a POSITA to configure the surgical instrument of Prisco to rotate in both rotational directions (element [23.5]). **First**, a POSITA would have recognized that Prisco states that the purpose of providing

"actuation forces [to] roll [the] instrument shaft" is to increase the degrees of freedom. IS1006, 8:34-44; 5:18-60; IS1003, ¶105. A POSITA would have recognized that providing for rotation of the instrument shaft in both rotational directions would have increased the degrees of freedom of movement and therefore furthered the intended goal of Prisco's surgical instrument. IS1003, ¶105. The POSITA would certainly locate Tierney as it, like Prisco, is assigned to Petitioner, the industry leader in robotic surgical systems.

Second, a POSITA would have recognized that Prisco's helical drive gear and shaft roll gear are configured to provide rotation of the shaft assembly in both rotational directions in response to rotation of the helical drive gear in first and second rotational directions, as shown in FIG. 7B:

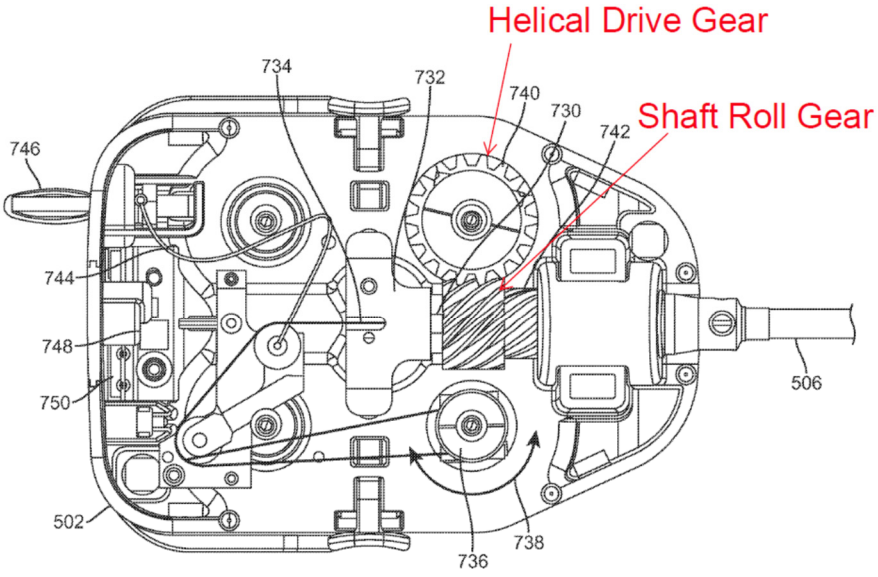


FIG. 7B

IS1006, FIG. 7B; 15:43-47; IS1003, ¶106. A POSITA would have recognized that

it would have been at least obvious that Prisco's surgical system allowed for rotation of the shaft in both rotational directions because the gear assembly is configured to rotate the shaft in both rotational directions, and nothing in Prisco would prevent rotation in both directions. IS1003, ¶106.

Third, a POSITA would have been prompted to provide rotation of Prisco's instrument shaft in both rotational directions because doing so would be merely the application of a known technique to a known device ready for improvement to yield predictable results. IS1003, ¶107; *KSR,* 550 U.S. at 416-17. Here, Prisco discloses rotation of the instrument shaft and Cooper expressly discloses rotation of the instrument shaft in both rotational directions, and a POSITA would have recognized that applying Cooper's disclosure of rotation in both directions to Prisco's surgical instrument would have led to predictable results without significantly altering or hindering the functions performed by Prisco's system. IS1003, ¶107.

Therefore, to the extent that Prisco (including the incorporated Cooper patent) does not expressly disclose claims 23-26 these claims would have been obvious over Prisco in view of Cooper, which taken together disclose each and every recited limitation of claims 23-26. IS1003, ¶108.

C. Ground 3: Claims 23-26 Would Have Been Obvious Under § 103 over Prisco in View of Cooper and Tierney

If Prisco is deemed not to disclose the Tierney subject matter incorporated

by reference, it would have been obvious to combine Prisco and Tierney to arrive at the same subject matter. IS1003, ¶¶109-112. A POSITA implementing the embodiments of Prisco would have been motivated to combine them with Tierney for at least two reasons. **First**, even if Prisco's incorporation of Tierney by reference were deemed insufficient, a POSITA would nonetheless have turned to a reference such as Tierney because Prisco leaves many details concerning surgical robots to prior art references and assumes that the reader is familiar with the cited prior art. IS1003, ¶110; *see also* IS1006, 1:35-38 (confirming that "the use of robotic surgical systems (*e.g.*, teleoperated robotic systems that provide telepresence), such as the da Vinci ® Surgical System manufactured by Intuitive Surgical, Inc. of Sunnyvale, Calif. [was] known."). Thus, a POSITA would seek out a reference such as Tierney for details concerning how to design and construct the robotic system on which Prisco is based. IS1003, ¶110.

Second, Prisco explicitly directs a POSITA to Tierney and thus a POSITA would naturally be motivated to look to Tierney for the information contained therein. IS1006, 15:17-20; IS1003, ¶111.

Thus, claims 23-26 would have been obvious over Prisco in view of Cooper and further in view Tierney as shown in Grounds 1 and 2. IS1003, ¶112.

D. Ground 4: Claims 25-26 Would Have Been Obvious Under § 103 Over Prisco in View of Cooper and Wallace, and, If Necessary, Tierney

[25] The surgical tool of claim 24 wherein said at least one gear-driven portion comprises an articulation system interfacing with said distal spine portion and said transmission assembly.

Prisco in view of Cooper and Wallace discloses claim [25]. IS1003, ¶¶113-122. If Prisco's incorporation of Cooper or the combination of Prisco and Cooper is deemed not to disclose the limitations of claim [25], then it would have been obvious to a POSITA in view of Wallace to modify the gear driven portion of the surgical tool to include an articulation system interfacing with said distal spine portion and said transmission assembly.

Wallace discloses "a robotic surgical tool for use in a robotic surgical system" that, much like the surgical instrument of Prisco, includes a shaft for supporting a surgical end effector, the shaft supported by a "tool base 62 [that] includes an interface 64 which mechanically and electrically couples the tool 50 to a manipulator on the robotic arm cart" as shown in FIGs. 1 and 2A:

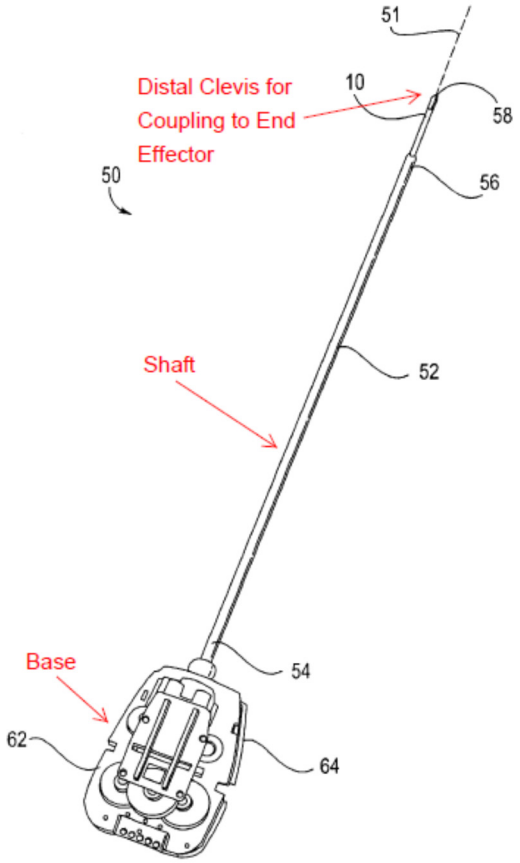


Fig. 1

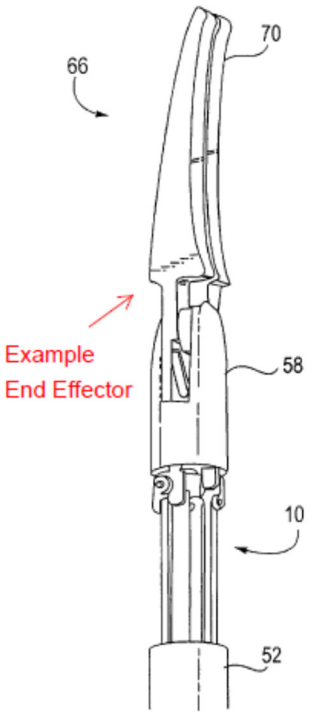


Fig. 2A

IS1008, FIGs. 1, 2A; Abstract; 7:33-56; IS1003, ¶115. More importantly, Wallace discloses that the gear driven portion of the surgical tool can include an articulation system (*e.g.,* the combination of "articulation rods 300" and "sector gears 312"). IS1008, 7:57-65; 13:6-14:15; IS1003, ¶115.

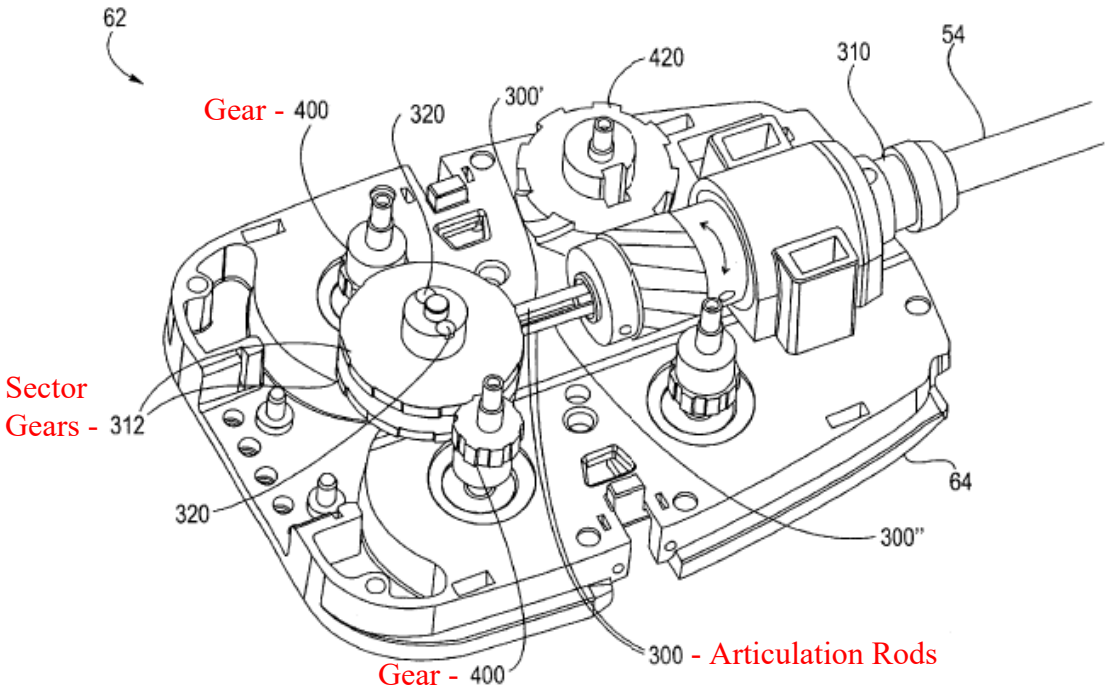


Fig. 30

IS1008, FIG. 30. As shown above, "sector gears 312" of the articulation system are driven by "gears 400." IS1008,13:6-14:15; IS1003, ¶115. Thus, the articulation system is part of the surgical tool's gear driven portion. IS1003, ¶115.

Wallace also discloses that the articulation system interfaces with a distal spine portion ("distal clevis") and the "gears 400" of the transmission assembly. IS1003, ¶116. Specifically, the distal ends of articulation rods 300 of the articulation system interface with the distal spine portion ("distal clevis") as shown in FIG. 2A of Wallace. IS1008, 7:40-46, FIG. 30. And the sector gears 312 of the articulation system interface with "gears 400" of the transmission assembly. IS1008, 13:44-54.

A POSITA would have understood that, in the combination of Prisco and Wallace, the Wallace articulation gears, articulation rods, distal member, and clevis would be the "movable wrist mechanism" of Prisco that provides the additional degrees of freedom, and the gears 400 of Wallace would be driven by Prisco's "interface disks" which receive rotary motion from the tool drive assembly. IS1006, 8:34-40; 14:58-15:1; 16:23-43; 10:39-48; IS1003, ¶117. For example, Prisco contemplates a surgical instrument having a force transmission mechanism with four interface disks. One interface disk would be used for end effector rotation, one would be used for opening and closing the end effector jaws, and two would be used for wrist articulation (one for each degree of freedom). Each of the two interface disks used to control articulation would control two reciprocating articulation rods. IS1003, ¶117; IS1006, 14:58-15:1; 16:23-25; FIGs. 7A-7D; IS1008, 13:44-14:15; 13:6-25.

Multiple reasons would have prompted a POSITA to modify Prisco's surgical tool to include Wallace's articulation assembly. **First**, Prisco identifies Cooper's wrist mechanism as one example of a pivoting mechanism for "provid[ing] one or more end effector [degrees of freedom]," but does not limit the suggested articulation mechanism to those disclosed by Cooper. IS1006, 10:39-48; 16:38-43; IS1003, ¶118. Accordingly, a POSITA would turn to other wrist mechanisms, such as that disclosed by Wallace for the advantages that each may

offer. IS1003, ¶118; IS1008, 13:6-14:15; IS1006, 16:38-43.

Second, a POSITA would have recognized that "[v]arious design aspects may be used" for the surgical instrument of Prisco so that it "may be adapted to instrument aspects that include a movable wrist mechanism" and Wallace provides the details necessary for implementing such an articulating surgical instrument for use with Prisco's robotic surgical system. IS1006, 16:38-53; IS1008, Abstract; 7:33-56; 13:6-14:15; IS1003, ¶119.

Third, a POSITA would have been motivated to modify Prisco's system to include a gear-driven articulation assembly (as suggested by Wallace) because Wallace's articulation wrist assembly "allows ease of assembly, reduction of parts and an increased range of motion." IS1008, 10:59-67; IS1003, ¶120. As Wallace states, the "simple" articulation design "reduce[s] possible points of failure." IS1008, 2:61-3:5.

Fourth, a POSITA would have been prompted to modify Prisco's surgical tool to include Wallace's articulation assembly because doing so would be merely the application of a known technique (using articulation bars and sector gears) to a known system (*e.g.*, Prisco's surgical tool) ready for improvement to yield predictable results, without significantly altering or hindering the functions performed by Prisco's surgical instrument. IS1003 at ¶121; *KSR,* 550 U.S. at 416-17. Indeed,

Prisco contemplates that "[v]arious design aspects may be used" including "a movable wrist mechanism" and Wallace suggests just such an improvement. IS1006 at 16:38-53; IS1003, ¶121.

Finally, if Prisco is deemed not to disclose the Tierney subject matter incorporated by reference, then it would have been obvious to combine Prisco and Tierney, both of which are assigned to Petitioner, the industry leader in robotic surgical systems, in the combination used for claim 24 to arrive at the same subject matter for claim 25 for the reasons explained above. *See* Ground 3; IS1003, ¶122.

[26] The surgical tool of claim 25 wherein said transmission assembly comprises an articulation transmission and wherein said articulation system comprises: a first articulation bar having a distal end coupled to a proximal portion of said elongated shaft assembly at a first lateral point that is laterally offset in a first lateral direction from said articulation axis, said first articulation bar having a proximal end that operably interfaces with said articulation transmission; and a second articulation bar having a distal end coupled to said proximal portion of said elongated shaft assembly at a second lateral point that is laterally offset in a second lateral direction from said articulation axis, said second articulation bar having a proximal end that operably interfaces with said articulation transmission.

Prisco in view of Wallace discloses claim [26]. IS1003, ¶¶123-125.

"transmission assembly comprises an articulation transmission"

As discussed in claim [25], the device resulting from the combination of Prisco and Wallace includes a transmission assembly comprising an articulation transmission ("gears 400") used to articulate the wrist of the surgical instrument. IS1008, FIG. 30; 13:6-14:14; IS1003, ¶123.

"articulation system comprises: first/second articulation bar having a distal end coupled to said proximal portion of said elongated shaft assembly at a first/second lateral point that is laterally offset in a first/second lateral direction from said articulation axis"

The articulation system disclosed in Wallace comprises first and second articulation bars ("articulation rods 14, 300") having a distal end (the ends of "articulation rods 14, 300" that terminate at "distal member 12") coupled to the proximal portion ("guide tube 20") of the elongated shaft assembly:

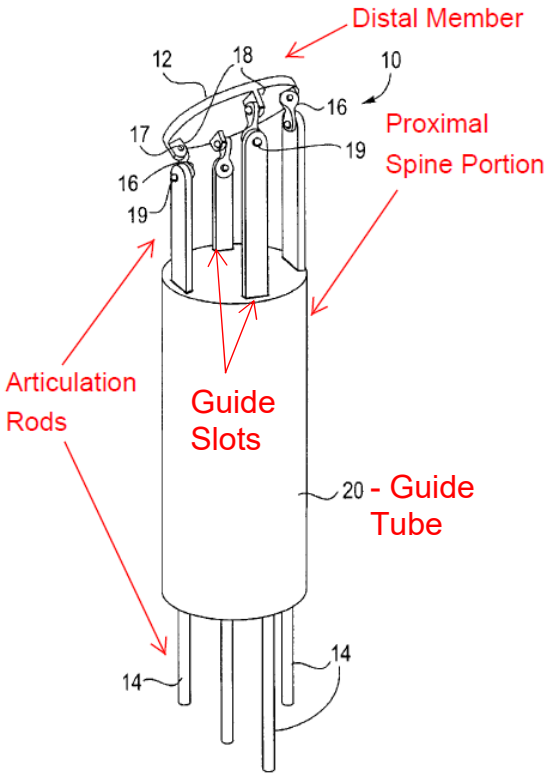
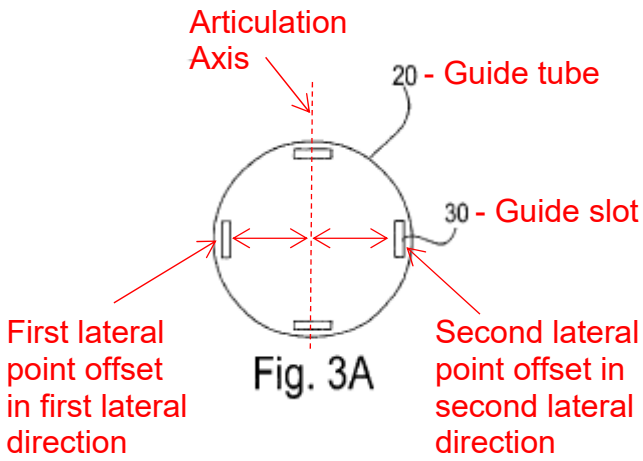


Fig. 3

IS1008, FIG. 3; 4:42-49, 7:57-8:24; IS1003, ¶124. As also shown in FIGs. 3A (below), two of the articulation rods 14, 300 are coupled to guide tube 20 at

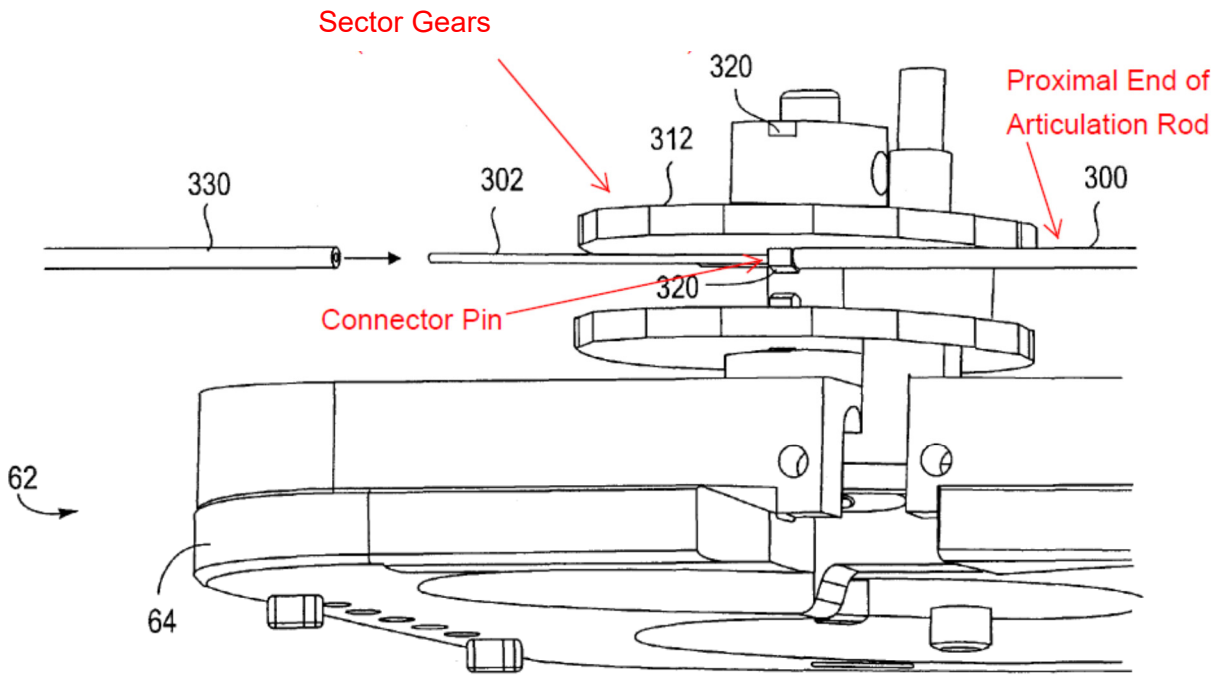
first/second lateral points that are laterally offset in a first/second lateral direction from the yaw articulation axis of Wallace's articulation system. IS1003, ¶124.



IS1008, FIG. 3A.

"[first/second] articulation bar having a proximal end that operably interfaces with said articulation transmission"

The proximal ends of the articulation bars ("articulation rods 14, 300") operably interface (via "sector gears 312") with the articulation transmission ("gears 400"). IS1003, ¶125. Specifically, pins 320 couple articulation rods 300 to the sector gears 312 and "sector gears 312 can be individually rotated clockwise or counterclockwise by action of gears 400." IS1008, 13:48-50, FIGs. 29-30. "[B]y rotating the sector gear 312 clockwise, rod 300′ is advanced while rod 300″ is retracted" and "[m]anipulation of the rods 300 actuates the wrist mechanism to position the distal clevis in a desired orientation" as shown by FIG. 29:



IS1008, FIGs. 29-30, 13:44-14:14; *see also* FIGs. 24-30.

XI. CONCLUSION

Claims 23-26 of the '969 Patent are invalid over the prior art pursuant to Grounds 1-4 set forth above. Accordingly, Petitioner request *inter partes* review of the challenged claims.

Respectfully submitted,

Dated: June 14, 2018

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(Trial No. IPR2018-01248)

CERTIFICATION UNDER 37 CFR § 42.24(d)

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for Inter Partes Review totals 11,434, which is less than the 14,000 allowed under 37 CFR § 42.24(a)(i).

Respectfully submitted,

Dated: June 14, 2018

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Attorney for Petitioner

CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§ 42.6(e)(4)(i) *et seq.* and 42.105(b), the undersigned certifies that on June 14, 2018, a complete and entire copy of this Petition for *Inter Partes* Review and all supporting exhibits were provided by Federal Express, cost prepaid, to the Patent Owner by serving the correspondence address of record as follows:

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