(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
03 December 2020 (03.12.2020)

WIPO | PCT

(10) International Publication Number
WO 2020/237400 A1

(51) International Patent Classification:
A61B 34/00 (2016.01) *A61B 34/30* (2016.01)
A61B 17/29 (2006.01)

(21) International Application Number:
PCT/CA2020/050755

(22) International Filing Date:
01 June 2020 (01.06.2020)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
16/427,164 30 May 2019 (30.05.2019) US

(71) Applicant: **TITAN MEDICAL INC.** [CA/CA]; 750-155 University Avenue, Toronto, Ontario M5H 3B7 (CA).

(72) Inventors: **GENOVA, Perry A.**; 8226 Glynmorgan Way, Chapel Hill, North Carolina 27516 (US). **LAAKSO, Aki Hannu Einari**; 614 E Franklin St., Raleigh, North Carolina 27604 (US).

(74) Agent: **SMART & BIGGAR LLP**; 2300-1055 West Georgia Street, Vancouver, British Columbia V6E 3P3 (CA).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA,

(54) Title: SURGICAL INSTRUMENT APPARATUS, ACTUATOR, AND DRIVE

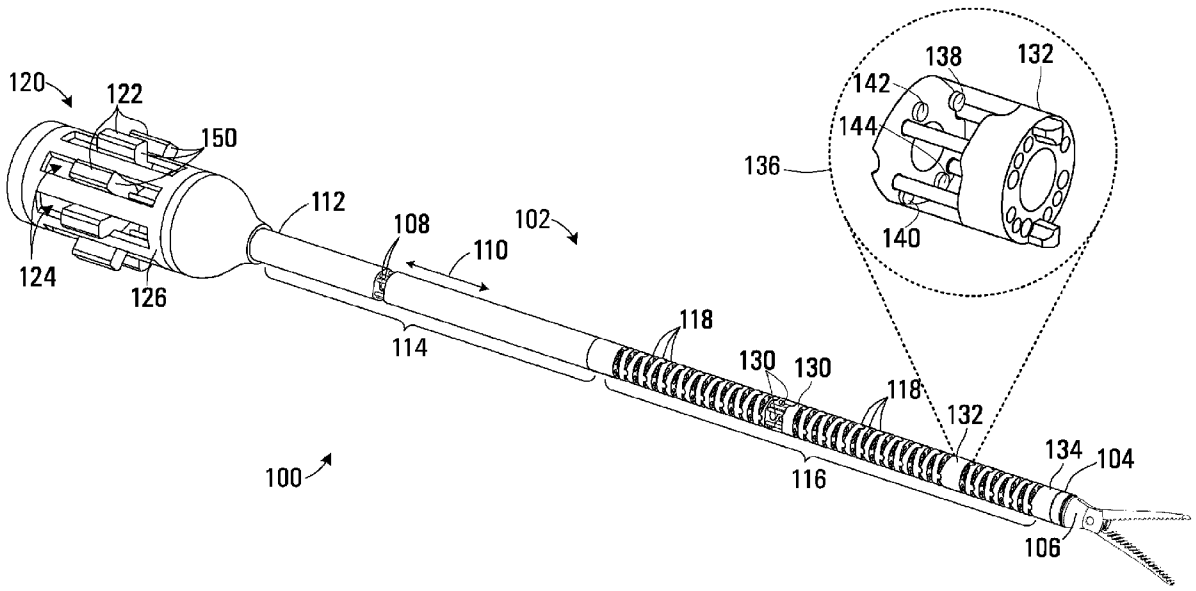

FIG. 1

(57) **Abstract:** A surgical instrument apparatus for performing a surgical procedure within a body cavity of a patient is disclosed and includes an elongate manipulator having a distal end for receiving an end effector and including a plurality of control links extending through the manipulator operable to cause movement of the distal end in response to movement of the control links in a longitudinal direction. An actuator chassis is disposed at a proximal end of the manipulator and includes a plurality of actuators slidingly mounted within the actuator chassis for linear movement in the longitudinal direction. Each actuator is coupled to a control link and adjacently disposed about a curved periphery of the actuator chassis. An outwardly oriented portion couples a drive force to the actuator to cause movement of the control link. A proximate end of the manipulator may be laterally offset to facilitate location of the surgical instrument apparatus closely adjacent to another surgical instrument apparatus. The manipulator may include an unactuated articulated portion

WO 2020/237400 A1

[Continued on next page]

SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

disposed between the rigid portion and the chassis.

SURGICAL INSTRUMENT APPARATUS, ACTUATOR, AND DRIVE

Technical Field

This disclosure relates generally to a surgical instrument apparatus for performing a surgical procedure within a body cavity of a patient.

Description of Related Art

Surgical instruments used in laparoscopic and/or robotic surgery generally have a proximally located actuator that may be used to actuate a distal end effector for performing a surgical task within a body cavity of a patient. Such instruments may be used in applications where there is an area of limited access for an operator. The distal end of the instrument may be inserted into the area of limited access and the operator may remotely manipulate the instrument via the actuator. The actuator may be located outside the area of limited access, but there may still be constraints placed on the extents of the actuator. There remains a need for actuators and drivers that are suitable for laparoscopic and/or robotic instruments.

SUMMARY

In accordance with one disclosed aspect there is provided a surgical instrument apparatus for performing a surgical procedure within a body cavity of a patient. The apparatus can include an elongate manipulator with a distal end configured to receive an end effector and including a plurality of control links extending through the manipulator and configured to cause movement of the distal end of the manipulator in response to movement of the control links in a longitudinal direction generally aligned with a length of the manipulator. The apparatus can also include an actuator chassis disposed at a proximal end of the manipulator, the actuator chassis including a plurality of actuators slidingly mounted within the actuator chassis and configured to move linearly in a direction aligned with the longitudinal direction, each actuator being coupled to one of the control links. The actuators are adjacently disposed about a curved periphery of the actuator chassis and including an outwardly oriented portion configured to couple a drive force to the actuator to cause movement of the control link.

The curved periphery of the actuator chassis may be cylindrically shaped and the plurality of actuators may be mounted within slots extending longitudinally along the periphery and radially arranged about the periphery.

The actuator chassis periphery may include a curved portion and a flat portion and the plurality of actuators may be mounted within slots extending longitudinally along the curved portion and radially arranged about the curved portion, the flat portion facilitating location of the surgical instrument apparatus adjacent (for example, closely adjacent) to another apparatus including a corresponding flat portion.

The another apparatus including the corresponding flat portion may include another of the surgical instrument apparatus and the respective flat portions may facilitate location of the respective elongate manipulators in proximity (for example, close proximity) for insertion through a common access port inserted or positioned to provide access to the body cavity of the patient.

The outwardly oriented portions of the plurality of actuators may be each shaped to engage a corresponding drive coupler configured to couple the drive force to the actuator.

The actuator coupling portion of the actuator may include a protrusion that extends outwardly beyond the curved periphery of the actuator chassis.

The apparatus may include a drive chassis including a respective plurality of drive couplers configured to couple drive forces to the plurality of actuators, the drive couplers arranged about the periphery of the actuator chassis, each drive coupler may include an open channel portion configured to receive the respective actuator protrusions when the actuator chassis is inserted into the drive chassis, and a retaining portion configured to receive and retain the respective actuator protrusions when the drive chassis and the actuator chassis are rotated thorough an angle to cause the retaining portions to engage the respective actuator protrusions.

The drive chassis may be configured to permit the manipulator to be inserted through the drive chassis to cause the open channel portions to receive the respective actuator protrusions.

The actuator chassis may include a transition portion between the manipulator and the actuator chassis, the transition portion configured to laterally displace the control links for coupling to the respective actuators.

The manipulator may include at least one end effector control link configured to couple to an end effector and the actuator chassis may include at least one end effector actuator coupled to the end effector control link to actuate movements of the end effector.

The at least one end effector actuator may be mounted within the actuator chassis to permit at least one of longitudinal movement configured to actuate opening or closing of an end effector, or rotational movement configured to cause a corresponding rotation of the end effector.

The at least one end effector actuator may include a single end effector actuator configured to perform both the longitudinal movement and the rotational movement.

The at least one end effector control link may be routed along a central bore of the actuator chassis and the end effector actuator may be mounted at a distal portion of the actuator chassis.

The manipulator may include a rigid portion connected to the actuator chassis, and an actuatable articulated portion configured to cause the movement of the distal end of the manipulator in response to the longitudinal movement of the control links.

The apparatus may include an unactuated articulated portion disposed between the rigid portion and the chassis, the unactuated articulated portion configured to permit the manipulator to be bent to reduce an overall length of the manipulator and actuator chassis during cleaning and sanitizing of the apparatus.

In accordance with another disclosed aspect there is provided a surgical instrument apparatus for performing a surgical procedure within a body cavity of a patient. The apparatus can include an elongate manipulator with a distal end configured to receive an end effector and including a plurality of control links extending through the manipulator and configured to cause movement of a distal end of the manipulator in response to movement of the control links in a longitudinal direction generally aligned with a length of the manipulator. The apparatus can also include an actuator chassis disposed at a proximal end of the manipulator, the actuator chassis including a plurality of actuators mounted within the actuator chassis, each actuator being coupled to one of the control links configured to couple a drive force to the actuator to cause movement of the control link. The proximate end of the manipulator can be laterally offset to facilitate location or positioning of the surgical instrument apparatus adjacent (such as, closely adjacent) to

another surgical instrument apparatus for insertion or positioning through a common access port inserted to provide access to the body cavity of the patient.

The manipulator may include a rigid portion connected to the actuator chassis, and an actuatable articulated portion configured to cause the movement of the distal end of the manipulator in response to longitudinal movement of the control links.

The apparatus may include an unactuated articulated portion disposed between the rigid portion and the actuator chassis, the unactuated articulated portion configured to permit the manipulator to be bent to reduce an overall length of the manipulator and actuator chassis during cleaning and sanitizing of the apparatus.

The proximate end of the manipulator can be laterally offset to facilitate positioning of the surgical instrument adjacent to the another surgical instrument apparatus so that spacing between the manipulator and another manipulator of the another surgical instrument is between about 10 millimeters and about 35 millimeters.

In accordance with another disclosed aspect there is provided a surgical instrument apparatus for performing a surgical procedure within a body cavity of a patient. The apparatus can include an elongate manipulator with a distal end configured to receive an end effector and including a plurality of control links extending through the manipulator and configured to cause movement of a distal end of the manipulator in response to movement of the control links in a longitudinal direction generally aligned with a length of the manipulator. The apparatus can also include an actuator chassis disposed at a proximal end of the manipulator, the actuator chassis including a plurality of actuators mounted within the actuator chassis, each of the plurality of actuators being coupled to one of the control links configured to couple a drive force to the actuator to cause movement of the control link. The manipulator can include a rigid portion connected to the actuator chassis, and an actuatable articulated portion configured to cause the movement of the distal end of the manipulator in response to longitudinal movement of the control links. The apparatus can further include an unactuated articulated portion disposed between the rigid portion and the chassis, the unactuated articulated portion configured to permit the manipulator to be bent to reduce an overall length of the manipulator and actuator chassis during cleaning and sanitizing of the apparatus.

Other aspects and features will become apparent to those ordinarily skilled in the art upon review of the following description of specific disclosed embodiments in conjunction with the accompanying figures.

BRIEF DESCRIPTION OF THE DRAWINGS

In drawings which illustrate disclosed embodiments,

Figure **1** is a perspective view of a surgical instrument apparatus for performing a surgical procedure within a body cavity of a patient;

Figure **2** is a partially cut away perspective view of an actuator chassis of the surgical instrument apparatus shown in Figure **1**;

Figure **3**A is a perspective view of an actuator of the actuator chassis shown in partial engagement with a drive coupler;

Figure **3**B is a perspective view of the actuator shown in full engagement with the drive coupler;

Figure **4**A is a perspective view of a drive chassis including a plurality of the drive couplers shown in Figures **3**A and **3**B and the actuator chassis of Figure **2** being inserted into the drive chassis;

Figure **4**B is a perspective view of the drive chassis of Figure **4**A showing the actuator chassis in partial engagement with the drive chassis;

Figure **4**C is a perspective view of the drive chassis of Figure **4**B showing the actuator chassis in full engagement with the drive chassis;

Figure **5**A is a perspective view of a surgical instrument apparatus in accordance with another embodiment;

Figure **5**B is a perspective view of a pair of the surgical instrument apparatus shown in Figure **5**A disposed adjacently for insertion through a common access port;

Figure **6** is a perspective view of a pair of surgical instruments disposed adjacently for insertion through a common access port operation in accordance with another embodiment; and

Figure **7** is a perspective view a surgical instrument apparatus in accordance with another embodiment.

DETAILED DESCRIPTION

Referring to Figure **1**, a surgical instrument apparatus for performing a surgical procedure within a body cavity of a patient is shown generally at **100**. The apparatus **100** includes an elongate manipulator **102** having a distal end **104** for receiving an end effector **106**. The manipulator **102** includes a plurality of control links **108** extending through the manipulator. The plurality of control links **108** are operable to cause movement of the distal end **104** of the manipulator in response to movement of the control links in a longitudinal direction **110** generally aligned with a length of the manipulator. The apparatus **100** also includes an actuator chassis **120** disposed at a proximal end **112** of the manipulator **102**. The actuator chassis **120** includes a plurality of actuators **122** slidingly mounted within the actuator chassis for linear movement in a direction aligned with the longitudinal direction **110**. In the embodiment shown, the actuators **122** are adjacently mounted within respective slots **124** disposed on a curved periphery **126** of the actuator chassis **120**.

In the embodiment shown, the manipulator **102** includes a rigid portion **114** connected to the actuator chassis **120** and an articulated portion **116** that is actuatable to cause the movement of the distal end **104** of the manipulator in response to the longitudinal movement of the control links **108**. The articulated portion **116** includes a plurality of coupled guides **118** mounted end-to-end and operable to move in response to pulling or pushing of the plurality of control links **108** as described in commonly owned PCT patent publication WO2014/201538 entitled "ARTICULATED TOOL POSITIONER AND SYSTEM EMPLOYING SAME" filed on December **20**, **2013** and incorporated herein by reference in its entirety. In other embodiments, the manipulator **102** may include structures other than the coupled guides **118** for causing movement of the distal end **104** of the manipulator.

Referring to Figure **2**, the proximal end **112** of the manipulator **102** and the actuator chassis **120** are shown with the actuator chassis partially cut away. In one embodiment, the plurality of control links **108** are implemented as wires routed through respective bores **200** extending through the manipulator **102**. The

actuator chassis **120** has a transition portion **202** between the proximal end **112** of the manipulator **102** and the actuator chassis. In this embodiment the transition portion **202** includes a bulkhead **204** having openings **206** that cause the respective control links **108** to be laterally displaced toward the curved periphery **126** of the actuator chassis **120**. The transition portion **202** facilitates the movement of the control links **108** along their respective axes while preventing drift of the control links **108**. In one embodiment, the transition portion **202** may include curved conduit (not shown) extending between the proximal end **112** of the manipulator **102** and the bulkhead **204** for receiving and guiding control links **108** through the transition portion. Each actuator **122** is coupled to one of the control links **108**. The control links **108** may be implemented using nitinol wire, which is capable of bending through an arc while still transmitting force in tension or compression. Nitinol is an alloy of nickel and titanium having shape memory and superelasticity and is capable of transmitting forces of about **200**N. In other embodiments, the control links **108** may be implemented using other commonly used wires such as stranded cables used in laparoscopic instruments.

One actuator **208** of the plurality of actuators **122** is shown displaced longitudinally within the slot **124**. The longitudinal displacement of the actuator **208** causes the coupled control link **108** to be correspondingly pulled rearwardly within the actuator chassis **120**. Other actuators **122** such as the adjacent actuators **210** and **212** are similarly moveable within the respective slots **124** to push or pull the associated control link **108**. In the embodiment shown, the curved periphery **126** of the actuator chassis **120** is cylindrically shaped and the slots **124** are radially arranged about the curved periphery.

Referring back to Figure **1**, in one embodiment pairs of the control links **108** are coupled to coupler segments **130**, **132**, and **134**. Actuation of the control links **108** by the actuators **122** causes the coupled guides **118** between each of the coupler segments to be displaced laterally to cause the distal end **104** and the end effector **106** to be moved into a desired position and orientation. A portion of the coupler segment **132** is shown cut away in an insert **136**. In this embodiment a first pair **138**, **140** of the plurality of control links **108** terminate within the coupler segment **132** and when the control link **138** is pushed by advancing the associated actuator **122** while the control link **140** is pulled by rearwardly retracting the associated actuator **122** within its slot, the coupler segment **132** is moved laterally. Similarly, a second pair **142**, **144** of the plurality of control links **108** terminate within the coupler segment **132** and when the control link **142** is pushed by advancing the associated actuator **122** within its slot while the control link **144** is pulled by rearwardly retracting the associated actuator **122** within its slot, the coupler segment **132** is moved

vertically upward. Reversal of the pushing and pulling of the respective actuators **122** causes a respective lateral movement to the opposite side or downward movement.

In another embodiment, the first pair **138**, **140** of the plurality of control links **108** may be respectively used for pulling motions without a corresponding pushing motion. In this embodiment when the control link **140** is pulled by rearwardly retracting the associated actuator **122** within its slot (while the control link **138** is let out by a corresponding amount, such as, for example, by advancing the associated actuator **122** or by allowing the actuator **122** to feely float), the coupler segment **132** is moved laterally. Similarly, in another embodiment, for the second pair **142**, **144** of the plurality of control links **108** when the control link **144** is pulled by rearwardly retracting the associated actuator **122** within its slot (while the control link **142** is let out by a corresponding amount, such as, for example, by advancing the associated actuator **122** or by allowing the actuator **122** to freely float), the coupler segment **132** is moved vertically upward. Reversal of the pulling of the respective actuators **122** causes a respective lateral movement to the opposite side or downward movement.

Combinations of lateral and vertical movement will cause the **132** to move in any direction within a working volume of the manipulator **102**. The coupler segment **134** may be similarly moved via other pairs of control links **108** actuated by the respective actuators **122** to point in any direction within the working volume. Further as described in commonly owned PCT patent publication WO2014/201538, the coupled guides **118** between the rigid portion **114** and the coupler segment **130** and the coupled guides between the coupler segment **130** and the coupler segment **132** may be configured to maintain the orientation of the coupler segment **132** substantially the same as the rigid portion **114**. In this case, the guides **118** within these portions of the articulated portion **116** are constrained to move as a two-dimensional parallelogram by a set of wire links extending between the rigid portion **114** and the coupler segment **132**.

Still referring to Figure **1**, each of the actuators **122** includes an outwardly oriented portion **150** that facilitates coupling a drive force to the actuator to cause movement of the coupled control link. In this embodiment, the outwardly oriented portions **150** also protrude outwardly with respect to the curved periphery **126**. Referring to Figure **3**A, one of the actuators **122** is shown in isolation in engagement with a drive coupler **300**. The drive coupler **300** may be part of an instrument drive of a robotic surgery system (not shown). The drive coupler **300** includes a curved outer wall **302** and a first end wall **304** extending radially inwardly from the curved outer wall and defining an open channel **306** in the drive coupler. The

open channel **306** is sized to receive the protruding portion **150** of the actuator **122** when slid into the drive coupler **300** in the direction indicated by the arrow **308** in Figure **3**A. Once received within the opening **306**, the drive coupler **300** is rotated in the direction of the arrow **310** to engage the outwardly oriented portion **150** of the actuator **122** as shown in Figure **3**B.

Referring to Figure **3**B, the drive coupler **300** further includes a second end wall **312** extending over the full length of the curved outer wall **302**. The outwardly oriented portion **150** of the actuator **122** is engaged between the first end wall **304** and the second end wall, which define a retaining portion for receiving and retaining the actuator protrusion **150** when the drive coupler **300** is rotated thorough an angle to cause the retaining portions to engage the actuator protrusion. Once the drive coupler **300** is engaged, a force *F* applied to the drive coupler **300** is transmitted to the outwardly oriented portion **150** to cause longitudinal motion of the actuator **122** within the associated slot **124**.

Referring to Figure **4**A, in the embodiment shown a plurality of the drive couplers **300** shown in Figure **3**A and **3**B are arranged to provide a drive chassis **400**. The drive couplers **300** are annularly arranged about the periphery **126** of the actuator chassis **120** with the open channels **306** aligned with the outwardly oriented portions **150** of the actuators **122**. The drive chassis **400** is configured to permit the manipulator **102** to be inserted through the drive chassis when loading the surgical instrument apparatus **100**. The open channels **306** of the drive couplers **300** receive the respective actuator protrusions **150** as shown in Figure **4**B. Referring to Figure **4**B, the drive chassis **400** and/or actuator chassis **120** is then rotated thorough an angle in a direction indicated by the arrow **402** to cause the retaining portions (i.e. first and second end walls **304** and **312**, shown in Figures **3**A and **3**B) to engage the respective actuator protrusions **150** as shown in Figure **4**C. Referring to Figure **4**C, once the drive couplers **300** are engaged, each drive coupler is able to independently move back and forward in the longitudinal direction **110** to couple drive forces to the respective actuators **122**. In one embodiment the drive chassis **400** is part of an instrument drive (not shown) that generates and couples individual drive forces to the respective drive couplers **300**. The instrument drive may be implemented as part of a robotic surgery system in which operator input received at an input device is used to generate drive signals, which are used to control the instrument drive for causing manipulation of the manipulator **102** via the drive chassis **400** and actuator chassis **120**.

In the embodiment shown in Figure **1**, eight actuators **122** and associated control links **108** are provided. Four of these actuators **122** cause movement of the coupler segment **132**, while the remaining four

actuators cause movement of the coupler segment **134**. Referring back to Figure **2**, the manipulator **102** further includes a central bore **220** that in this embodiment accommodates an end effector control link **222**. The end effector control link **222** is coupled to the end effector **106** for causing opening of the actuator jaws and/or causing rotation of the actuator about a longitudinal axis of the manipulator **102**. The end effector control link **222** is routed through the actuator chassis **120** and coupled to an end cap **224** at a distal end of the actuator chassis. In one embodiment, the end cap **224** is able to rotate in the direction of the arrow **226**, which rotates the end effector control link **222** causing corresponding rotation of the end effector at the distal end **104** of the manipulator **102**. Additionally, the end cap **224** may also be configured to move in the longitudinal direction **110** to actuate longitudinal back and forth movement of the end effector control link **222** for opening and closing the end effector. The single end effector control link **222** may thus be operable to actuate both rotation and opening/closing movements of the end effector **106**. In other embodiments, the end effector control link **222** may be configured as a hollow torque tube that provides the rotational actuation to the end effector **106**, while an additional control link may be routed through the central bore **220** to actuate the opening and closing movements of the end effector **106**.

Referring to Figure **5**A, an actuator chassis in accordance with another embodiment is shown generally at **500**. The periphery of the actuator chassis **500** includes a curved portion **502** and a flat portion **504**. The actuator chassis **500** includes a plurality of actuators **506** configured generally as described above. The plurality of actuators **506** are mounted in respective slots **508** extending longitudinally along the curved portion **502** of the actuator chassis **500**. The actuators **506** are radially arranged about the curved portion **502** and the actuator chassis **500** is coupled to a manipulator **102** (shown in part) as generally described above.

In many cases two or more of the surgical instrument apparatus **100** may be used during a surgical procedure performed through a single common access port (i.e. a single incision or opening to a body cavity of a patient). Referring to Figure **5**B, the flat portion **504** of the actuator chassis **500** facilitates closely spacing the actuator adjacent to a second actuator chassis **510** having a corresponding flat portion **512**. The close spacing has the advantage of spacing the manipulator **102** and a manipulator **514** coupled to the actuator chassis **510** in relatively close proximity for insertion through a common access port and/or trocar (not shown). The spacing *D* between the manipulators may be less than about 10 millimeters, about 10 millimeters, about 20 millimeters, about 21.5 millimeters, about 35 millimeters, about 40 millimeters, or greater than about 35 millimeters or 40 millimeters, such as about 50 millimeters or 60 millimeters. The

spacing *D* between the manipulators may be between about 10 millimeters (or less) and about 20 millimeters (or more), between about 10 millimeters (or less) and about 35 millimeters (or more), between about 10 millimeters (or less) and about 40 millimeters (or more), between about 20 millimeters (or less) and about 35 millimeters (or more), or between about 20 millimeters (or less) and about 40 millimeters (or more). The further off-center the manipulator **102** and the manipulator **514** are from the respective actuator chassis **500** and **510** such that the spacing *D* is reduced, the smaller the diameter of the common access port/trocar. Each of the actuator chassis **500** and the actuator chassis **510** would be received within a drive chassis (not shown) configured to accommodate and provide drive forces for operating the side-by-side surgical instruments.

Referring to Figure **6**, an alternative arrangement for side-by-side surgical instrument operation includes a first actuator chassis **600** disposed spaced apart from a second actuator chassis **602**. Each actuator chassis **600**, **602** has a respective manipulator **604** and **606** coupled to the chassis. The manipulators **604** and **606** have respective actuatable articulated portions **608** and **610** configured generally as described above in connection with the Figure **1** embodiment. The manipulators **604** and **606** each have respective rigid portions **612** and **614**. The rigid portion **612** of the manipulator **604** has a leftward laterally offset portion **620** while the manipulator **606** has a rightward laterally offset portion **622**. The left and right laterally offset portions **620** and **622** facilitate closely adjacent location of the respective articulated portions **608** and **610** of the manipulators **604** and **606** for insertion through a common access port.

Referring to Figure **7**, a surgical instrument apparatus in accordance with another embodiment is shown generally at **700**. The surgical instrument apparatus **700** includes an actuator chassis **702** configured generally as disclosed above. The actuator chassis **702** is coupled to a manipulator **704** including a rigid portion **706** and an actuatable articulated portion **708** also configured generally as disclosed above. In this embodiment, the surgical instrument apparatus **700** further includes an articulated portion **712** disposed between the rigid portion **706** and the actuator chassis **702**. The articulated portion **712** permits the manipulator to be bent as shown in Figure **7** to reduce an overall length of the instrument (i.e. manipulator and actuator chassis). The articulated portion **712** may be actuated during a surgical procedure or may be a passive portion that is not actuated during the procedure.

In many cases the surgical instrument apparatus **700** may be reusable and cleaning and sanitization following use in a surgical procedure is thus required. The overall length of the surgical instrument

apparatus **100** shown in Figure **1** may prohibit its accommodation within the conventional sanitization equipment. The articulated portion **712** facilitates bending of the instrument to reduce the overall dimensions that may make the instrument more readily accommodated in a decontamination sink or a chamber of a washer/disinfector commonly used for cleaning and sanitization in surgical environments. Additional bending to accommodate limited space constraints during cleaning and sanitization may be enabled by having the actuatable articulated portion **708** at least partially bendable/flexible during cleaning and sanitization (i.e. when not in surgical use). This additional bending and/or the bending of articulated portion **712** may be facilitated by may allowing the control links extending through the manipulator **704** to move into a relaxed state, for example by maneuvering the actuators (such as actuators **506** shown in Figure **5**A).

Language of degree used herein, such as the terms "approximately," "about," "generally," and "substantially" as used herein represent a value, amount, or characteristic close to the stated value, amount, or characteristic that still performs a desired function or achieves a desired result. For example, the terms "approximately", "about", "generally," and "substantially" may refer to an amount that is within less than 10% of, within less than 5% of, within less than 1% of, within less than 0.1% of, or within less than 0.01% of the stated value.

While specific embodiments have been described and illustrated, such embodiments should be considered illustrative only and not as limiting the disclosed embodiments as construed in accordance with the accompanying claims.

What is claimed is:

1. A surgical instrument apparatus for performing a surgical procedure within a body cavity of a patient, the apparatus comprising:

an elongate manipulator comprising a distal end configured to receive an end effector and including a plurality of control links extending through the manipulator and configured to cause movement of the distal end of the manipulator in response to movement of the control links in a longitudinal direction generally aligned with a length of the manipulator; and

an actuator chassis disposed at a proximal end of the manipulator, the actuator chassis including a plurality of actuators slidingly mounted within the actuator chassis and configured to move linearly in a direction aligned with the longitudinal direction, each actuator being coupled to one of the control links, the actuators being adjacently disposed about a curved periphery of the actuator chassis and including an outwardly oriented portion configured to couple a drive force to the actuator to cause movement of the control link.

2. The apparatus of claim **1** wherein the curved periphery of the actuator chassis is cylindrically shaped, and wherein the plurality of actuators are mounted within slots extending longitudinally along the periphery and radially arranged about the periphery.

3. The apparatus of claim **1** wherein the actuator chassis periphery includes a curved portion and a flat portion, and wherein the plurality of actuators are mounted within slots extending longitudinally along the curved portion and radially arranged about the curved portion, the flat portion facilitating location of the surgical instrument apparatus adjacent to another apparatus including a corresponding flat portion.

4. The apparatus of claim **3** wherein the another apparatus including the corresponding flat portion comprises another of the surgical instrument apparatus, and wherein the respective flat portions facilitate location of the respective elongate manipulators in proximity for insertion through a common access port positioned to provide access to the body cavity of the patient.

5. The apparatus of claim **1** wherein the outwardly oriented portions of the plurality of actuators are each shaped to engage a corresponding drive coupling configured to couple the drive force to the actuator.

6. The apparatus of claim **5** wherein the actuator coupling portion of the actuator comprises a protrusion that extends outwardly beyond the curved periphery of the actuator chassis.

7. The apparatus of claim **6** further comprising a drive chassis including a respective plurality of drive couplers configured to couple drive forces to the plurality of actuators, the drive couplers arranged about the periphery of the actuator chassis, each drive coupler comprising:

an open channel portion configured to receive the respective actuator protrusions when the actuator chassis is inserted into the drive chassis; and

a retaining portion configured to receive and retain the respective actuator protrusions when the drive chassis and the actuator chassis are rotated thorough an angle to cause the retaining portions to engage the respective actuator protrusions.

8. The apparatus of claim **7** wherein the drive chassis is configured to permit the manipulator to be inserted through the drive chassis to cause the open channel portions to receive the respective actuator protrusions.

9. The apparatus of claim **1** wherein the actuator chassis includes a transition portion between the manipulator and the actuator chassis, the transition portion configured to laterally displace the control links for coupling to the respective actuators.

10. The apparatus of claim **1** wherein the manipulator comprises at least one end effector control link configured to couple to an end effector, and wherein the actuator chassis comprises at least one end effector actuator coupled to the end effector control link to actuate movements of the end effector.

11. The apparatus of claim **10** wherein the at least one end effector actuator is mounted within the actuator chassis to permit at least one of:

longitudinal movement configured to actuate opening or closing of an end effector; or

rotational movement configured to cause a corresponding rotation of the end effector.

12. The apparatus of claim **11** wherein the at least one end effector actuator comprises a single end effector actuator configured to perform both the longitudinal movement and the rotational movement.

13. The apparatus of claim **10** wherein the at least one end effector control link is routed along a central bore of the actuator chassis and the end effector actuator is mounted at a distal portion of the actuator chassis.

14. The apparatus of claim **1** wherein the manipulator further comprises:

a rigid portion connected to the actuator chassis; and

an actuatable articulated portion configured to cause the movement of the distal end of the manipulator in response to the longitudinal movement of the control links.

15. The apparatus of claim **14** further comprising an unactuated articulated portion disposed between the rigid portion and the chassis, the unactuated articulated portion configured to permit the manipulator to be bent to reduce an overall length of the manipulator and actuator chassis during cleaning and sanitizing of the apparatus.

16. A surgical instrument apparatus for performing a surgical procedure within a body cavity of a patient, the apparatus comprising:

an elongate manipulator including a distal end configured to receive an end effector and including a plurality of control links extending through the manipulator and configured to cause movement of a distal end of the manipulator in response to movement of the control links in a longitudinal direction generally aligned with a length of the manipulator; and

an actuator chassis disposed at a proximal end of the manipulator, the actuator chassis including a plurality of actuators mounted within the actuator chassis, each actuator being coupled to one of the control links configured to couple a drive force to the actuator to cause movement of the control link,

wherein the proximate end of the manipulator is laterally offset to facilitate positioning of the surgical instrument apparatus adjacent to another surgical instrument apparatus for insertion through a common access port positioned to provide access to the body cavity of the patient.

17. The apparatus of claim **16** wherein the manipulator comprises:

a rigid portion connected to the actuator chassis; and

an actuatable articulated portion configured to cause the movement of the distal end of the manipulator in response to longitudinal movement of the control links.

18. The apparatus of claim **17** further comprising an unactuated articulated portion disposed between the rigid portion and the actuator chassis, the unactuated articulated portion configured to permit the manipulator to be bent to reduce an overall length of the manipulator and actuator chassis during cleaning and sanitizing of the apparatus.

19. The apparatus of claim **16** wherein the proximate end of the manipulator is laterally offset to facilitate positioning of the surgical instrument adjacent to the another surgical instrument apparatus so that spacing between the manipulator and another manipulator of the another surgical instrument is between 10 millimeters and 35 millimeters.

20. A surgical instrument apparatus for performing a surgical procedure within a body cavity of a patient, the apparatus comprising:

an elongate manipulator including a distal end configured to receive an end effector and including a plurality of control links extending through the manipulator and configured to cause movement of a distal end of the manipulator in response to movement of the control links in a longitudinal direction generally aligned with a length of the manipulator;

an actuator chassis disposed at a proximal end of the manipulator, the actuator chassis including a plurality of actuators mounted within the actuator chassis, each of the plurality of actuators being coupled to one of the control links configured to couple a drive force to the actuator to cause movement of the control link;

wherein the manipulator comprises:

a rigid portion connected to the actuator chassis; and

an actuatable articulated portion configured to cause the movement of the distal end of the manipulator in response to longitudinal movement of the control links; and

an unactuated articulated portion disposed between the rigid portion and the chassis, the unactuated articulated portion configured to permit the manipulator to be bent to reduce an overall length of the manipulator and actuator chassis during cleaning and sanitizing of the apparatus.

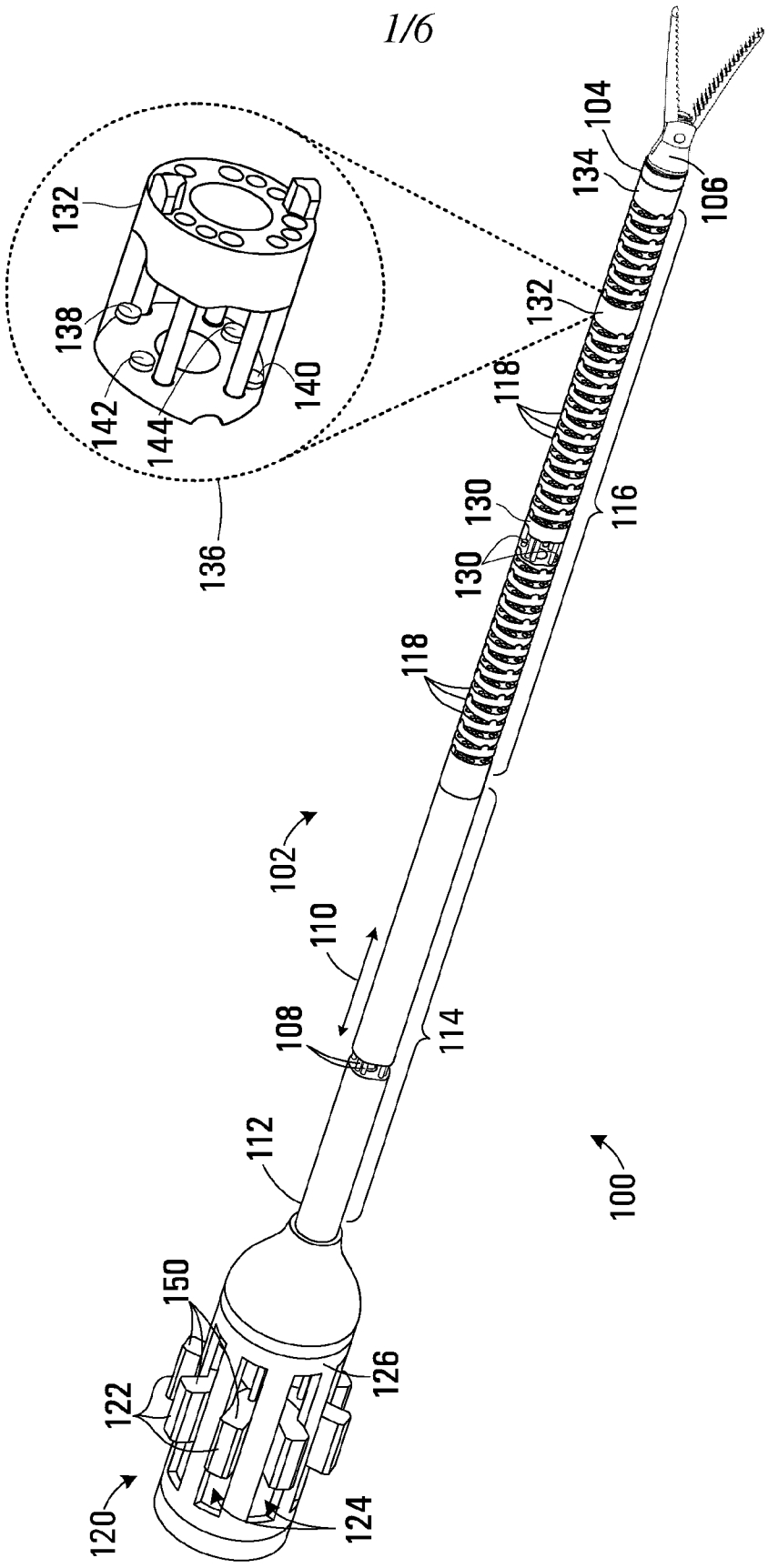
132
138
142
144
140
136
104
134
106
132
118
130
130
116
118
102
110
108
114
112
100
150
122
126
120
124

FIG. 1

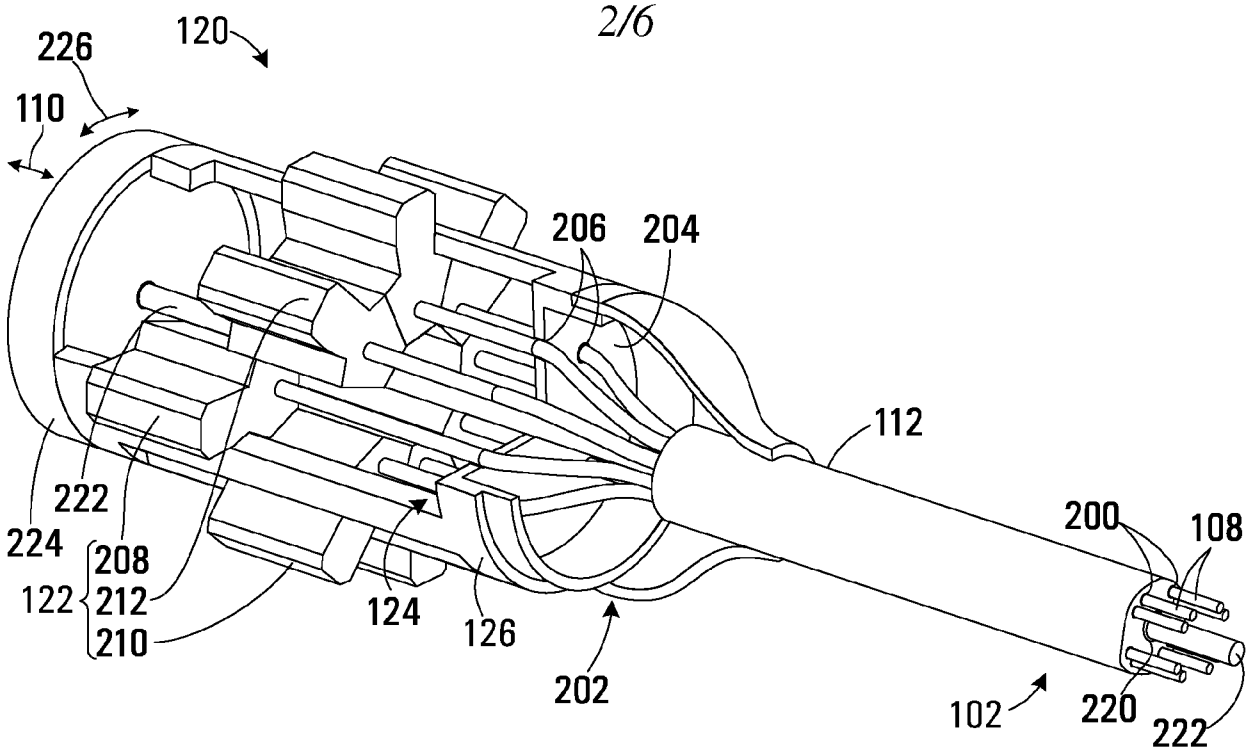

FIG. 2

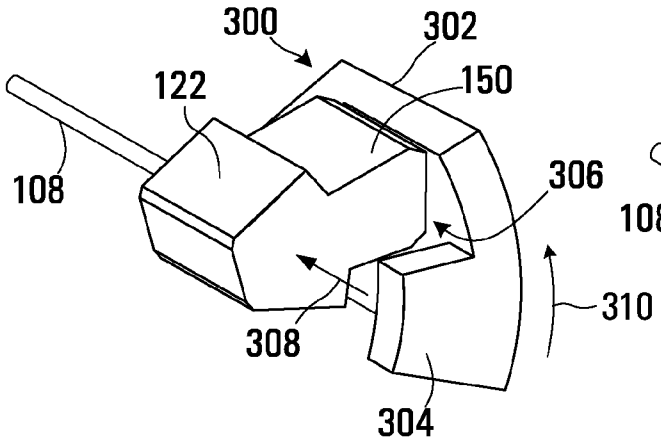

FIG. 3A

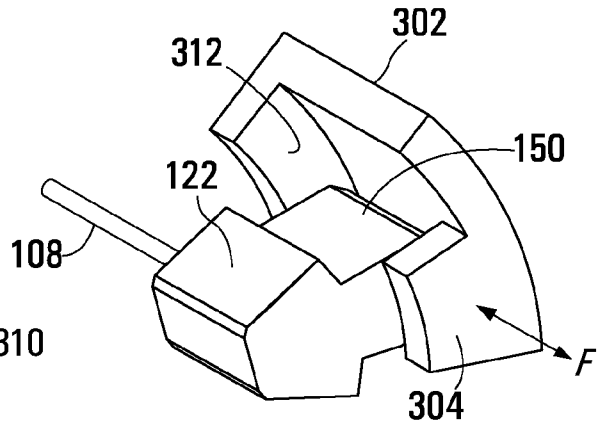

FIG. 3B

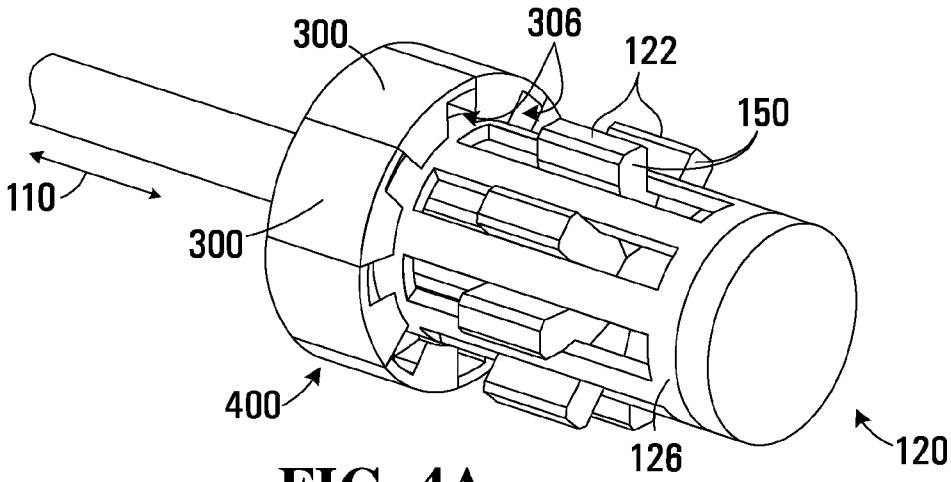

FIG. 4A

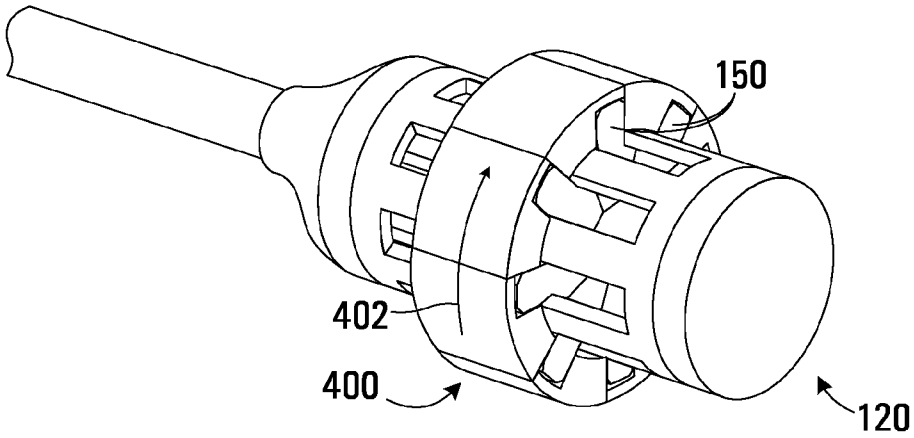

FIG. 4B

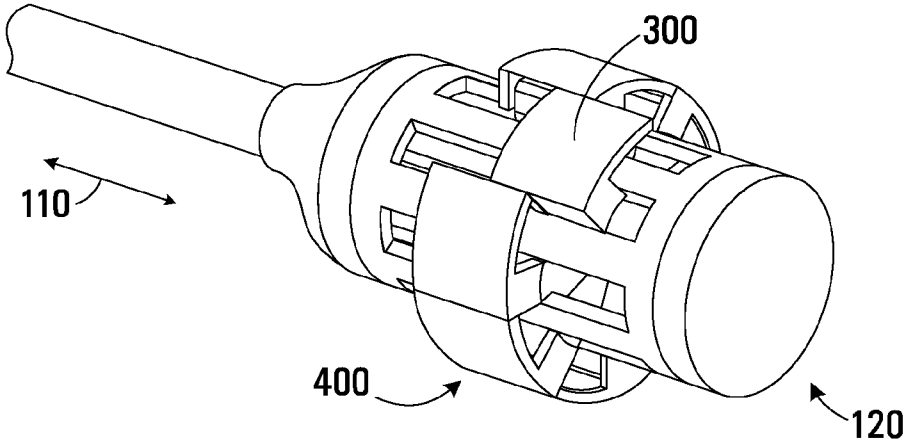

FIG. 4C

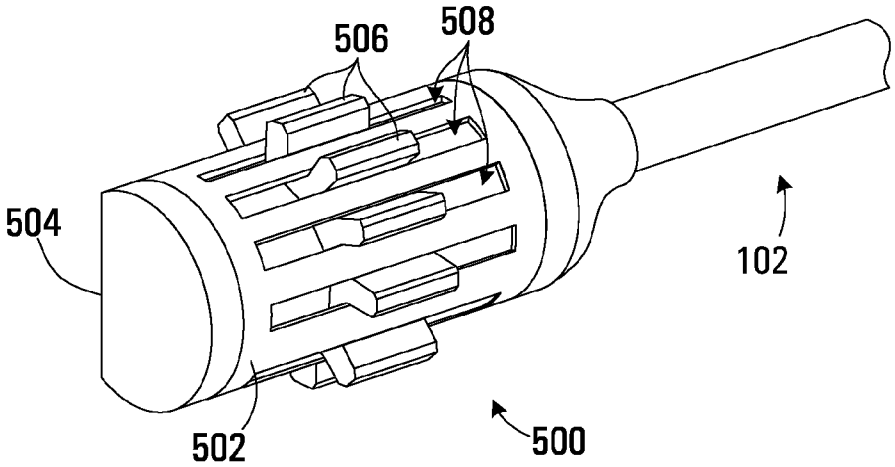

FIG. 5A

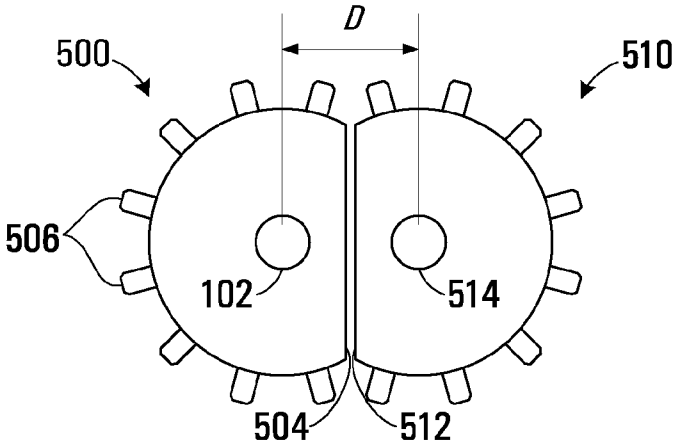

FIG. 5B

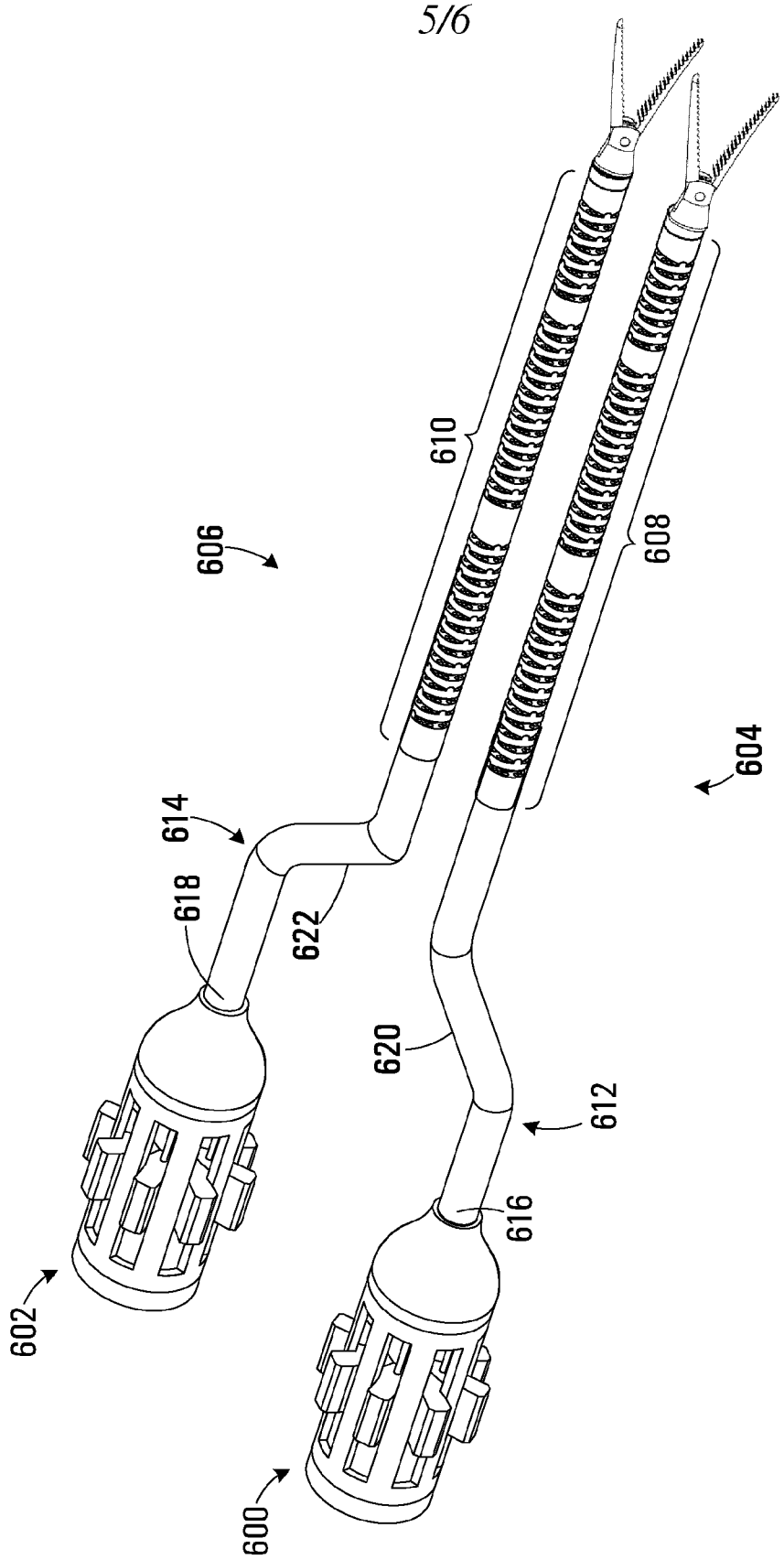

FIG. 6

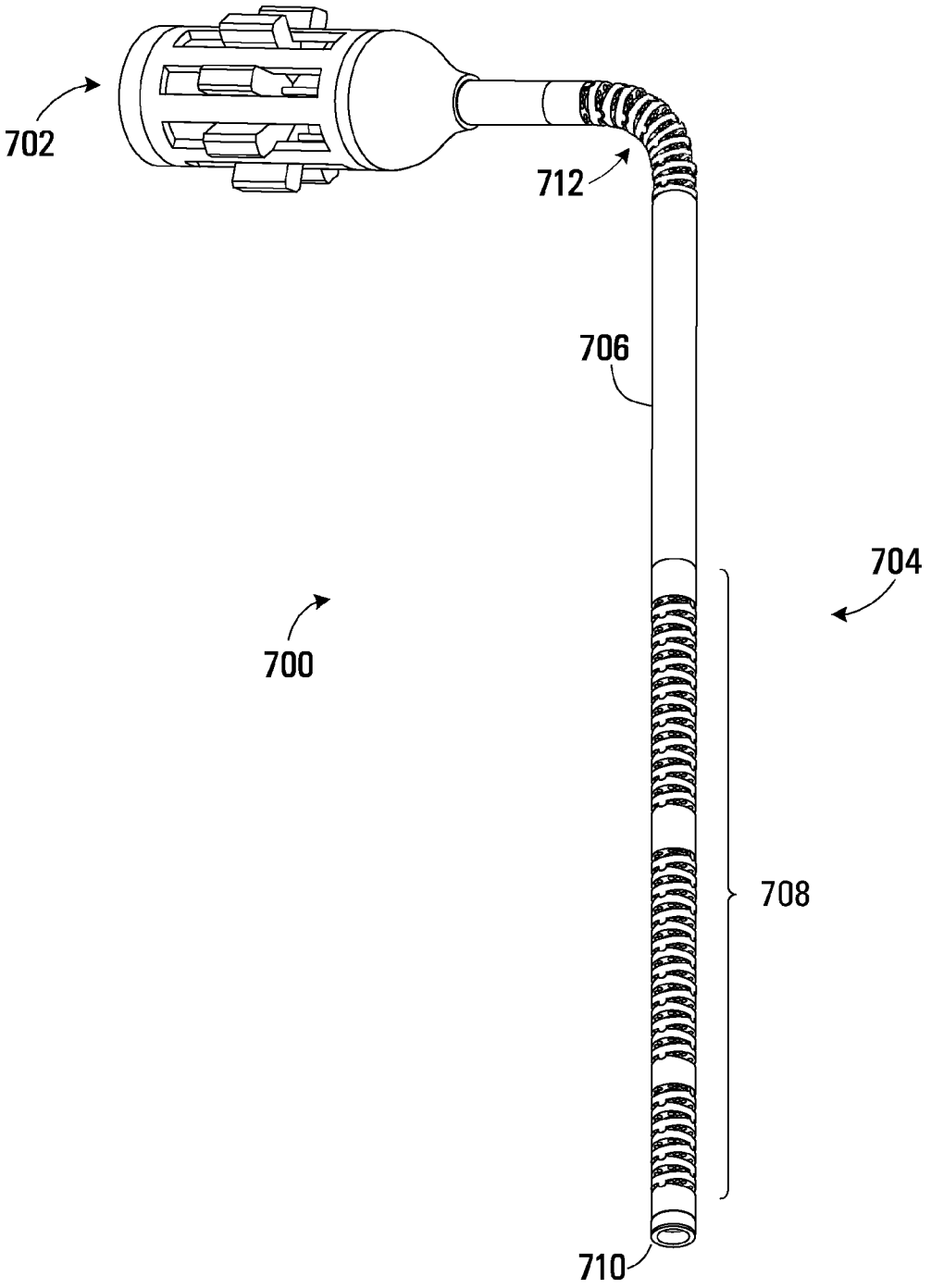

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2020/050755

A. CLASSIFICATION OF SUBJECT MATTER
IPC: ***A61B 34/00*** (2016.01) , ***A61B 17/29*** (2006.01) , ***A61B 34/30*** (2016.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC: A61B 34/00 (2016.01), A61B 17/29 (2006.01), A61B 34/30 (2016.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)
Database: Questel Orbit
Keywords: actuat*, control*, manipul*, link*, end, effector*, articulat*, slid*, linear*, wir*, cable?, surgical, instrument*

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X, D A	WO2014201538A1 (ROBERT et al.) 24 December 2014 (24-12-2014) *col. 7 line 6-col. 8 line 24, Figs. 1, 2 and 8*	16-20 1-15
A	US8784435B2 (COOPER et al.) 22 July 2014 (22-07-2014) *whole document*	1-20
A	US2010004509A1 (NAITO et al.) 07 January 2010 (07-01-2010) *whole document*	1-20

☐ Further documents are listed in the continuation of Box C.

☑ See patent family annex.

*	Special categories of cited documents:
"A"	document defining the general state of the art which is not considered to be of particular relevance
"D"	document cited by the applicant in the international application
"E"	earlier application or patent but published on or after the international filing date
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O"	document referring to an oral disclosure, use, exhibition or other means
"P"	document published prior to the international filing date but later than the priority date claimed
"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&"	document member of the same patent family

Date of the actual completion of the international search 06 August 2020 (06-08-2020)	Date of mailing of the international search report 25 August 2020 (25-08-2020)
Name and mailing address of the ISA/CA Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 819-953-2476	Authorized officer Bethany Seaman (819) 963-9765

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
WO2014201538A1	24 December 2014 (24-12-2014)	CA2913943A1	24 December 2014 (24-12-2014)
		CA2913943C	19 June 2018 (19-06-2018)
		CA3004277A1	24 December 2014 (24-12-2014)
		CN105431106A	23 March 2016 (23-03-2016)
		CN105431106B	05 February 2019 (05-02-2019)
		CN110063794A	30 July 2019 (30-07-2019)
		EP2996613A1	23 March 2016 (23-03-2016)
		EP2996613A4	22 June 2016 (22-06-2016)
		EP2996613B1	07 June 2017 (07-06-2017)
		EP3238650A1	01 November 2017 (01-11-2017)
		EP3238650B1	24 June 2020 (24-06-2020)
		ES2639100T3	25 October 2017 (25-10-2017)
		HK1220098A1	28 April 2017 (28-04-2017)
		JP2016528946A	23 September 2016 (23-09-2016)
		JP6274630B2	07 February 2018 (07-02-2018)
		JP2018075432A	17 May 2018 (17-05-2018)
		JP2019088866A	13 June 2019 (13-06-2019)
		US2016143633A1	26 May 2016 (26-05-2016)
		US10278683B2	07 May 2019 (07-05-2019)
		US2019150904A1	23 May 2019 (23-05-2019)
US8784435B2	22 July 2014 (22-07-2014)	AT155059T	15 July 1997 (15-07-1997)
		AT215430T	15 April 2002 (15-04-2002)
		AT238140T	15 May 2003 (15-05-2003)
		AT305639T	15 October 2005 (15-10-2005)
		AT310264T	15 December 2005 (15-12-2005)
		AT365953T	15 July 2007 (15-07-2007)
		AT439808T	15 September 2009 (15-09-2009)
		AT446721T	15 November 2009 (15-11-2009)
		AT449576T	15 December 2009 (15-12-2009)
		AT460127T	15 March 2010 (15-03-2010)
		AT464852T	15 May 2010 (15-05-2010)
		AT495703T	15 February 2011 (15-02-2011)
		AT500793T	15 March 2011 (15-03-2011)
		AT521923T	15 September 2011 (15-09-2011)
		AT523157T	15 September 2011 (15-09-2011)
		AT544414T	15 February 2012 (15-02-2012)
		AT547059T	15 March 2012 (15-03-2012)
		AT547060T	15 March 2012 (15-03-2012)
		BR112012028374A2	21 March 2017 (21-03-2017)
		BR112012028375A2	21 March 2017 (21-03-2017)
		BR112012028465A2	19 July 2016 (19-07-2016)
		BR112012028465B1	07 April 2020 (07-04-2020)
		BR112012029169A2	18 July 2017 (18-07-2017)
		BR112012029169B1	05 May 2020 (05-05-2020)
		CA2128606A1	22 July 1993 (22-07-1993)
		CA2128606C	22 July 2008 (22-07-2008)
		CA2189775A1	16 November 1995 (16-11-1995)
		CA2189775C	11 July 2000 (11-07-2000)
		CA2255692A1	27 November 1997 (27-11-1997)
		CA2255692C	09 December 2003 (09-12-2003)
		CA2255934A1	27 November 1997 (27-11-1997)
		CA2255934C	13 September 2005 (13-09-2005)
		CA2273939A1	18 June 1998 (18-06-1998)
		CA2273939C	11 April 2006 (11-04-2006)
		CA2498922A1	27 November 1997 (27-11-1997)
		CA2498922C	11 April 2006 (11-04-2006)

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
		CA2632123A1	22 July 1993 (22-07-1993)
		CA2632123C	23 March 2010 (23-03-2010)
		CN101027010A	29 August 2007 (29-08-2007)
		CN101027010B	07 September 2011 (07-09-2011)
		CN101222882A	16 July 2008 (16-07-2008)
		CN101222882B	27 March 2013 (27-03-2013)
		CN101227870A	23 July 2008 (23-07-2008)
		CN101227870B	08 August 2012 (08-08-2012)
		CN101242788A	13 August 2008 (13-08-2008)
		CN101242788B	13 April 2011 (13-04-2011)
		CN101242789A	13 August 2008 (13-08-2008)
		CN101242789B	19 October 2011 (19-10-2011)
		CN101321606A	10 December 2008 (10-12-2008)
		CN101321606B	17 April 2013 (17-04-2013)
		CN101325920A	17 December 2008 (17-12-2008)
		CN101325920B	01 February 2012 (01-02-2012)
		CN101340848A	07 January 2009 (07-01-2009)
		CN101340848B	21 March 2012 (21-03-2012)
		CN101340850A	07 January 2009 (07-01-2009)
		CN101340850B	15 June 2011 (15-06-2011)
		CN101340852A	07 January 2009 (07-01-2009)
		CN101340852B	28 December 2011 (28-12-2011)
		CN101426412A	06 May 2009 (06-05-2009)
		CN101426412B	11 December 2013 (11-12-2013)
		CN101500470A	05 August 2009 (05-08-2009)
		CN101500470B	25 March 2015 (25-03-2015)
		CN101912307A	15 December 2010 (15-12-2010)
		CN101912307B	24 June 2015 (24-06-2015)
		CN102058437A	18 May 2011 (18-05-2011)
		CN102058437B	25 March 2015 (25-03-2015)
		CN102076276A	25 May 2011 (25-05-2011)
		CN102076276B	14 January 2015 (14-01-2015)
		CN102170835A	31 August 2011 (31-08-2011)
		CN102170835B	21 January 2015 (21-01-2015)
		CN102327152A	25 January 2012 (25-01-2012)
		CN102327152B	23 February 2018 (23-02-2018)
		CN102341054A	01 February 2012 (01-02-2012)
		CN102341054B	16 March 2016 (16-03-2016)
		CN102341055A	01 February 2012 (01-02-2012)
		CN102448399A	09 May 2012 (09-05-2012)
		CN102448399B	16 December 2015 (16-12-2015)
		CN102448680A	09 May 2012 (09-05-2012)
		CN102448680B	27 April 2016 (27-04-2016)
		CN102458294A	16 May 2012 (16-05-2012)
		CN102764159A	07 November 2012 (07-11-2012)
		CN102764159B	21 January 2015 (21-01-2015)
		CN102802550A	28 November 2012 (28-11-2012)
		CN102802550B	09 March 2016 (09-03-2016)
		CN102892363A	23 January 2013 (23-01-2013)
		CN102892374A	23 January 2013 (23-01-2013)
		CN102892374B	24 June 2015 (24-06-2015)
		CN102892375A	23 January 2013 (23-01-2013)
		CN102892375B	19 August 2015 (19-08-2015)
		CN102892376A	23 January 2013 (23-01-2013)
		CN102892376B	20 April 2016 (20-04-2016)
		CN102905641A	30 January 2013 (30-01-2013)
		CN102905641B	16 March 2016 (16-03-2016)

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
		CN105748026A	13 July 2016 (13-07-2016)
		CN105748026B	10 November 2017 (10-11-2017)
		CN105852974A	17 August 2016 (17-08-2016)
		CN105852974B	08 January 2019 (08-01-2019)
		CN105852976A	17 August 2016 (17-08-2016)
		CN105852976B	05 November 2019 (05-11-2019)
		CN106236277A	21 December 2016 (21-12-2016)
		CN106236277B	31 May 2019 (31-05-2019)
		CN106456265A	22 February 2017 (22-02-2017)
		CN106456265B	30 July 2019 (30-07-2019)
		CN106901837A	30 June 2017 (30-06-2017)
		CN106901837B	08 November 2019 (08-11-2019)
		CN107397591A	28 November 2017 (28-11-2017)
		CN107397591B	03 April 2020 (03-04-2020)
		CN107595392A	19 January 2018 (19-01-2018)
		CN108143497A	12 June 2018 (12-06-2018)
		CN108143497B	26 June 2020 (26-06-2020)
		CN108309454A	24 July 2018 (24-07-2018)
		CN108309458A	24 July 2018 (24-07-2018)
		CN108524001A	14 September 2018 (14-09-2018)
		CN109077699A	25 December 2018 (25-12-2018)
		CN109171975A	11 January 2019 (11-01-2019)
		CN109700535A	03 May 2019 (03-05-2019)
		CN110115630A	13 August 2019 (13-08-2019)
		CN110604619A	24 December 2019 (24-12-2019)
		DE60022911D1	09 February 2006 (09-02-2006)
		DE60022911T2	22 June 2006 (22-06-2006)
		DE60024079D1	22 December 2005 (22-12-2005)
		DE60024079T2	17 August 2006 (17-08-2006)
		DE60143909D1	03 March 2011 (03-03-2011)
		DE69312053D1	14 August 1997 (14-08-1997)
		DE69312053T2	30 October 1997 (30-10-1997)
		DE69331789D1	08 May 2002 (08-05-2002)
		DE69331789T2	13 March 2003 (13-03-2003)
		DE69332914D1	28 May 2003 (28-05-2003)
		DE69332914T2	26 February 2004 (26-02-2004)
		DE69535523D1	09 August 2007 (09-08-2007)
		DE69535523T2	03 April 2008 (03-04-2008)
		DE69941305D1	01 October 2009 (01-10-2009)
		DE69941600D1	10 December 2009 (10-12-2009)
		DE69941725D1	07 January 2010 (07-01-2010)
		DE69942129D1	22 April 2010 (22-04-2010)
		DE69942281D1	02 June 2010 (02-06-2010)
		DE102006059163A1	16 August 2007 (16-08-2007)
		DE102006059163B4	06 June 2019 (06-06-2019)
		DE102006059165A1	09 August 2007 (09-08-2007)
		DE102006059165B4	04 September 2014 (04-09-2014)
		DE602006020599D1	21 April 2011 (21-04-2011)
		EP0623066A1	09 November 1994 (09-11-1994)
		EP0623066B1	09 July 1997 (09-07-1997)
		EP0758469A1	19 February 1997 (19-02-1997)
		EP0758469A4	05 November 1997 (05-11-1997)
		EP0758469B1	27 June 2007 (27-06-2007)
		EP0776738A2	04 June 1997 (04-06-1997)
		EP0776738A3	16 July 1997 (16-07-1997)
		EP0776738B1	03 April 2002 (03-04-2002)
		EP0776739A2	04 June 1997 (04-06-1997)

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
		EP0776739A3	16 July 1997 (16-07-1997)
		EP0776739B1	23 April 2003 (23-04-2003)
		EP1015068A1	05 July 2000 (05-07-2000)
		EP1015068A4	09 April 2008 (09-04-2008)
		EP1015068B1	07 September 2011 (07-09-2011)
		EP1015944A1	05 July 2000 (05-07-2000)
		EP1015944A4	31 December 2008 (31-12-2008)
		EP1015944B1	27 February 2013 (27-02-2013)
		EP1131004A1	12 September 2001 (12-09-2001)
		EP1131004A4	11 July 2007 (11-07-2007)
		EP1131004B1	28 October 2009 (28-10-2009)
		EP1139881A1	10 October 2001 (10-10-2001)
		EP1139881A4	11 July 2007 (11-07-2007)
		EP1139881B1	25 November 2009 (25-11-2009)
		EP1146830A1	24 October 2001 (24-10-2001)
		EP1146830A4	29 December 2004 (29-12-2004)
		EP1146830B1	21 April 2010 (21-04-2010)
		EP1148807A1	31 October 2001 (31-10-2001)
		EP1148807A4	11 July 2007 (11-07-2007)
		EP1148807B1	10 March 2010 (10-03-2010)
		EP1150601A2	07 November 2001 (07-11-2001)
		EP1150601A4	15 August 2007 (15-08-2007)
		EP1150601B1	19 August 2009 (19-08-2009)
		EP1181627A2	27 February 2002 (27-02-2002)
		EP1181627A4	16 October 2002 (16-10-2002)
		EP1181627B1	16 November 2005 (16-11-2005)
		EP1269389A1	02 January 2003 (02-01-2003)
		EP1269389A4	29 October 2003 (29-10-2003)
		EP1269389B1	28 September 2005 (28-09-2005)
		EP1355565A2	29 October 2003 (29-10-2003)
		EP1355565A4	26 August 2009 (26-08-2009)
		EP1355565B1	19 January 2011 (19-01-2011)
		EP1356781A2	29 October 2003 (29-10-2003)
		EP1356781A3	24 July 2013 (24-07-2013)
		EP1471830A1	03 November 2004 (03-11-2004)
		EP1471830A4	20 October 2010 (20-10-2010)
		EP1650615A1	26 April 2006 (26-04-2006)
		EP1650615B1	24 August 2011 (24-08-2011)
		EP1793761A2	13 June 2007 (13-06-2007)
		EP1793761B1	01 May 2013 (01-05-2013)
		EP1840818A2	03 October 2007 (03-10-2007)
		EP1840818A3	01 July 2015 (01-07-2015)
		EP1849566A2	31 October 2007 (31-10-2007)
		EP1849566A3	01 July 2015 (01-07-2015)
		EP1885273A2	13 February 2008 (13-02-2008)
		EP1885273B1	08 February 2012 (08-02-2012)
		EP1893118A1	05 March 2008 (05-03-2008)
		EP1893118B1	11 July 2018 (11-07-2018)
		EP1897511A2	12 March 2008 (12-03-2008)
		EP1897511A3	23 July 2008 (23-07-2008)
		EP1897511B1	12 February 2014 (12-02-2014)
		EP1901884A2	26 March 2008 (26-03-2008)
		EP1901884B1	13 February 2019 (13-02-2019)
		EP1928342A1	11 June 2008 (11-06-2008)
		EP1928342B1	12 February 2020 (12-02-2020)
		EP1931275A1	18 June 2008 (18-06-2008)
		EP1931275B1	09 March 2011 (09-03-2011)

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
		EP1962711A1	03 September 2008 (03-09-2008)
		EP1962711B1	29 February 2012 (29-02-2012)
		EP1965711A2	10 September 2008 (10-09-2008)
		EP1965711B1	31 August 2016 (31-08-2016)
		EP1965717A2	10 September 2008 (10-09-2008)
		EP1965717B1	16 May 2012 (16-05-2012)
		EP2037794A2	25 March 2009 (25-03-2009)
		EP2037794A4	04 March 2015 (04-03-2015)
		EP2038712A2	25 March 2009 (25-03-2009)
		EP2038712B1	17 August 2011 (17-08-2011)
		EP2038712B2	28 August 2019 (28-08-2019)
		EP2046538A2	15 April 2009 (15-04-2009)
		EP2046538B1	21 December 2011 (21-12-2011)
		EP2106764A2	07 October 2009 (07-10-2009)
		EP2106764A3	23 December 2009 (23-12-2009)
		EP2135577A2	23 December 2009 (23-12-2009)
		EP2135577A3	25 August 2010 (25-08-2010)
		EP2135637A2	23 December 2009 (23-12-2009)
		EP2135637A3	15 February 2012 (15-02-2012)
		EP2135637B1	21 May 2014 (21-05-2014)
		EP2138105A2	30 December 2009 (30-12-2009)
		EP2138105A3	31 March 2010 (31-03-2010)
		EP2138105B1	29 February 2012 (29-02-2012)
		EP2231050A1	29 September 2010 (29-09-2010)
		EP2231050B1	20 June 2012 (20-06-2012)
		EP2253288A2	24 November 2010 (24-11-2010)
		EP2253288A3	17 July 2013 (17-07-2013)
		EP2253288B1	27 March 2019 (27-03-2019)
		EP2253289A2	24 November 2010 (24-11-2010)
		EP2253289A3	27 June 2012 (27-06-2012)
		EP2253289B1	24 August 2016 (24-08-2016)
		EP2263592A2	22 December 2010 (22-12-2010)
		EP2263592A3	20 March 2013 (20-03-2013)
		EP2263592B1	09 December 2015 (09-12-2015)
		EP2263593A2	22 December 2010 (22-12-2010)
		EP2263593A3	13 March 2013 (13-03-2013)
		EP2263593B1	11 March 2015 (11-03-2015)
		EP2263594A2	22 December 2010 (22-12-2010)
		EP2263594A3	10 April 2013 (10-04-2013)
		EP2263594B1	31 August 2016 (31-08-2016)
		EP2263595A2	22 December 2010 (22-12-2010)
		EP2263595A3	06 March 2013 (06-03-2013)
		EP2263595B1	17 September 2014 (17-09-2014)
		EP2269500A2	05 January 2011 (05-01-2011)
		EP2269500A3	18 May 2011 (18-05-2011)
		EP2269500B1	21 June 2017 (21-06-2017)
		EP2289455A2	02 March 2011 (02-03-2011)
		EP2289455A3	06 April 2016 (06-04-2016)
		EP2289455B1	13 November 2019 (13-11-2019)
		EP2298216A2	23 March 2011 (23-03-2011)
		EP2298216A3	22 October 2014 (22-10-2014)
		EP2298216B1	20 April 2016 (20-04-2016)
		EP2298217A2	23 March 2011 (23-03-2011)
		EP2298217A3	22 October 2014 (22-10-2014)
		EP2298217B1	10 August 2016 (10-08-2016)
		EP2298218A2	23 March 2011 (23-03-2011)
		EP2298218A3	13 June 2012 (13-06-2012)

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
		EP2298218B1	15 June 2016 (15-06-2016)
		EP2298219A2	23 March 2011 (23-03-2011)
		EP2298219A3	30 May 2012 (30-05-2012)
		EP2298219B1	20 April 2016 (20-04-2016)
		EP2298222A2	23 March 2011 (23-03-2011)
		EP2298222A3	07 March 2012 (07-03-2012)
		EP2326277A1	01 June 2011 (01-06-2011)
		EP2326277B1	21 March 2018 (21-03-2018)
		EP2332477A2	15 June 2011 (15-06-2011)
		EP2332477A3	22 August 2012 (22-08-2012)
		EP2332477B1	07 March 2018 (07-03-2018)
		EP2332478A2	15 June 2011 (15-06-2011)
		EP2332478A3	14 November 2012 (14-11-2012)
		EP2332478B1	16 August 2017 (16-08-2017)
		EP2332479A2	15 June 2011 (15-06-2011)
		EP2332479A3	22 August 2012 (22-08-2012)
		EP2332479B1	05 July 2017 (05-07-2017)
		EP2332480A2	15 June 2011 (15-06-2011)
		EP2332480A3	10 October 2012 (10-10-2012)
		EP2332480B1	26 April 2017 (26-04-2017)
		EP2332481A2	15 June 2011 (15-06-2011)
		EP2332481A3	29 August 2012 (29-08-2012)
		EP2332481B1	05 July 2017 (05-07-2017)
		EP2332482A2	15 June 2011 (15-06-2011)
		EP2332482A3	28 November 2012 (28-11-2012)
		EP2332482B1	12 April 2017 (12-04-2017)
		EP2332483A2	15 June 2011 (15-06-2011)
		EP2332483A3	14 November 2012 (14-11-2012)
		EP2332483B1	12 April 2017 (12-04-2017)
		EP2332484A2	15 June 2011 (15-06-2011)
		EP2332484A3	26 September 2012 (26-09-2012)
		EP2332484B1	25 January 2017 (25-01-2017)
		EP2335635A1	22 June 2011 (22-06-2011)
		EP2335635B1	20 July 2016 (20-07-2016)
		EP2338432A1	29 June 2011 (29-06-2011)
		EP2338432B1	11 February 2015 (11-02-2015)
		EP2338433A1	29 June 2011 (29-06-2011)
		EP2338433B1	11 February 2015 (11-02-2015)
		EP2349053A1	03 August 2011 (03-08-2011)
		EP2349053B1	21 February 2018 (21-02-2018)
		EP2356951A1	17 August 2011 (17-08-2011)
		EP2359769A1	24 August 2011 (24-08-2011)
		EP2359769B1	14 October 2015 (14-10-2015)
		EP2359770A1	24 August 2011 (24-08-2011)
		EP2359770B1	06 May 2015 (06-05-2015)
		EP2360708A1	24 August 2011 (24-08-2011)
		EP2362283A2	31 August 2011 (31-08-2011)
		EP2362283A3	05 March 2014 (05-03-2014)
		EP2362283B1	25 November 2015 (25-11-2015)
		EP2362284A2	31 August 2011 (31-08-2011)
		EP2362284A3	22 May 2013 (22-05-2013)
		EP2362284B1	20 May 2015 (20-05-2015)
		EP2362285A2	31 August 2011 (31-08-2011)
		EP2362285A3	03 July 2013 (03-07-2013)
		EP2362285B1	25 March 2015 (25-03-2015)
		EP2362286A2	31 August 2011 (31-08-2011)
		EP2362286A3	26 February 2014 (26-02-2014)

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
		EP2362286B1	02 September 2015 (02-09-2015)
		EP2363091A2	07 September 2011 (07-09-2011)
		EP2363091A3	28 March 2012 (28-03-2012)
		EP2363091B1	27 April 2016 (27-04-2016)
		EP2391289A1	07 December 2011 (07-12-2011)
		EP2391289B1	23 November 2016 (23-11-2016)
		EP2391290A1	07 December 2011 (07-12-2011)
		EP2391290B1	05 February 2020 (05-02-2020)
		EP2414137A2	08 February 2012 (08-02-2012)
		EP2414137B1	21 June 2017 (21-06-2017)
		EP2416727A2	15 February 2012 (15-02-2012)
		EP2416727B1	17 May 2017 (17-05-2017)
		EP2441394A2	18 April 2012 (18-04-2012)
		EP2441394A3	02 July 2014 (02-07-2014)
		EP2441394B1	05 April 2017 (05-04-2017)
		EP2441395A2	18 April 2012 (18-04-2012)
		EP2441395A3	18 June 2014 (18-06-2014)
		EP2442743A1	25 April 2012 (25-04-2012)
		EP2442743B1	03 October 2018 (03-10-2018)
		EP2444004A2	25 April 2012 (25-04-2012)
		EP2444004A3	18 July 2012 (18-07-2012)
		EP2444004B1	02 March 2016 (02-03-2016)
		EP2444005A2	25 April 2012 (25-04-2012)
		EP2444005A3	18 July 2012 (18-07-2012)
		EP2444005B1	19 August 2015 (19-08-2015)
		EP2444006A2	25 April 2012 (25-04-2012)
		EP2444006A3	18 July 2012 (18-07-2012)
		EP2444006B1	26 August 2015 (26-08-2015)
		EP2445436A1	02 May 2012 (02-05-2012)
		EP2445436B1	30 November 2016 (30-11-2016)
		EP2559396A2	20 February 2013 (20-02-2013)
		EP2559396A3	11 December 2013 (11-12-2013)
		EP2559396B1	25 March 2020 (25-03-2020)
		EP2568894A1	20 March 2013 (20-03-2013)
		EP2568908A1	20 March 2013 (20-03-2013)
		EP2568908B1	11 March 2020 (11-03-2020)
		EP2568909A1	20 March 2013 (20-03-2013)
		EP2568909B1	08 November 2017 (08-11-2017)
		EP2568912A1	20 March 2013 (20-03-2013)
		EP2568912B1	28 November 2018 (28-11-2018)
		EP2568913A1	20 March 2013 (20-03-2013)
		EP2568913B1	12 February 2020 (12-02-2020)
		EP2687182A1	22 January 2014 (22-01-2014)
		EP2687183A1	22 January 2014 (22-01-2014)
		EP2687183B1	25 March 2020 (25-03-2020)
		EP2687184A1	22 January 2014 (22-01-2014)
		EP2687184B1	01 March 2017 (01-03-2017)
		EP2687185A1	22 January 2014 (22-01-2014)
		EP2687185B1	17 April 2019 (17-04-2019)
		EP2687186A1	22 January 2014 (22-01-2014)
		EP2689740A1	29 January 2014 (29-01-2014)
		EP2689740B1	25 October 2017 (25-10-2017)
		EP2745795A1	25 June 2014 (25-06-2014)
		EP2775950A1	17 September 2014 (17-09-2014)
		EP2775950A4	26 August 2015 (26-08-2015)
		EP2775950B1	08 January 2020 (08-01-2020)
		EP2775951A1	17 September 2014 (17-09-2014)

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
		EP2775951A4	26 August 2015 (26-08-2015)
		EP2854687A1	08 April 2015 (08-04-2015)
		EP2854687A4	17 February 2016 (17-02-2016)
		EP2854688A1	08 April 2015 (08-04-2015)
		EP2854688A4	17 February 2016 (17-02-2016)
		EP2854690A1	08 April 2015 (08-04-2015)
		EP2854690A4	27 January 2016 (27-01-2016)
		EP2854690B1	01 April 2020 (01-04-2020)
		EP2884935A1	24 June 2015 (24-06-2015)
		EP2884935A4	22 June 2016 (22-06-2016)
		EP2884935B1	08 April 2020 (08-04-2020)
		EP2884936A1	24 June 2015 (24-06-2015)
		EP2884936A4	27 April 2016 (27-04-2016)
		EP2884937A1	24 June 2015 (24-06-2015)
		EP2884937A4	13 April 2016 (13-04-2016)
		EP2885114A1	24 June 2015 (24-06-2015)
		EP2885114A4	29 June 2016 (29-06-2016)
		EP2932884A1	21 October 2015 (21-10-2015)
		EP2969403A1	20 January 2016 (20-01-2016)
		EP2969404A1	20 January 2016 (20-01-2016)
		EP2969405A1	20 January 2016 (20-01-2016)
		EP2969406A1	20 January 2016 (20-01-2016)
		EP2969407A1	20 January 2016 (20-01-2016)
		EP2969409A1	20 January 2016 (20-01-2016)
		EP2969409A4	16 November 2016 (16-11-2016)
		EP2987461A1	24 February 2016 (24-02-2016)
		EP2987461B1	13 September 2017 (13-09-2017)
		EP3042625A1	13 July 2016 (13-07-2016)
		EP3042625B1	01 May 2019 (01-05-2019)
		EP3104324A1	14 December 2016 (14-12-2016)
		EP3104324B1	18 April 2018 (18-04-2018)
		EP3111876A2	04 January 2017 (04-01-2017)
		EP3111876A3	29 March 2017 (29-03-2017)
		EP3111876B1	24 July 2019 (24-07-2019)
		EP3115159A1	11 January 2017 (11-01-2017)
		EP3115159B1	16 May 2018 (16-05-2018)
		EP3119319A1	25 January 2017 (25-01-2017)
		EP3119319A4	22 November 2017 (22-11-2017)
		EP3119319B1	15 July 2020 (15-07-2020)
		EP3181087A1	21 June 2017 (21-06-2017)
		EP3181087B1	18 December 2019 (18-12-2019)
		EP3199120A1	02 August 2017 (02-08-2017)
		EP3199120B1	24 July 2019 (24-07-2019)
		EP3231386A1	18 October 2017 (18-10-2017)
		EP3231387A1	18 October 2017 (18-10-2017)
		EP3231387B1	06 November 2019 (06-11-2019)
		EP3231388A1	18 October 2017 (18-10-2017)
		EP3246135A1	22 November 2017 (22-11-2017)
		EP3281752A1	14 February 2018 (14-02-2018)
		EP3281752B1	05 August 2020 (05-08-2020)
		EP3351203A1	25 July 2018 (25-07-2018)
		EP3372184A1	12 September 2018 (12-09-2018)
		EP3385039A1	10 October 2018 (10-10-2018)
		EP3385039B1	06 November 2019 (06-11-2019)
		EP3395508A1	31 October 2018 (31-10-2018)
		EP3398728A1	07 November 2018 (07-11-2018)
		EP3398728B1	27 November 2019 (27-11-2019)

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
		EP3459429A1	27 March 2019 (27-03-2019)
		EP3590459A1	08 January 2020 (08-01-2020)
		EP3613547A1	26 February 2020 (26-02-2020)
		EP3632629A1	08 April 2020 (08-04-2020)
		EP3636197A1	15 April 2020 (15-04-2020)
		EP3639784A1	22 April 2020 (22-04-2020)
		EP3673857A1	01 July 2020 (01-07-2020)
		EP3677209A1	08 July 2020 (08-07-2020)
		ES2248066T3	16 March 2006 (16-03-2006)
		ES2287934T3	16 December 2007 (16-12-2007)
		ES2371533T3	04 January 2012 (04-01-2012)
		ES2381462T3	28 May 2012 (28-05-2012)
		ES2381975T3	04 June 2012 (04-06-2012)
		FR2894807A1	22 June 2007 (22-06-2007)
		FR2894807B1	03 August 2012 (03-08-2012)
		FR2895230A1	29 June 2007 (29-06-2007)
		FR2895230B1	27 July 2012 (27-07-2012)
		FR2974000A1	19 October 2012 (19-10-2012)
		FR2974000B1	20 December 2013 (20-12-2013)
		FR2996116A1	04 April 2014 (04-04-2014)
		FR2996116B1	19 April 2019 (19-04-2019)
		JPH07504363A	18 May 1995 (18-05-1995)
		JP3583777B2	04 November 2004 (04-11-2004)
		JP2002504863A	12 February 2002 (12-02-2002)
		JP3999816B2	31 October 2007 (31-10-2007)
		JP2002500524A	08 January 2002 (08-01-2002)
		JP4058113B2	05 March 2008 (05-03-2008)
		JP2002503976A	05 February 2002 (05-02-2002)
		JP4077516B2	16 April 2008 (16-04-2008)
		JP2005261956A	29 September 2005 (29-09-2005)
		JP4156606B2	24 September 2008 (24-09-2008)
		JPH10504763A	12 May 1998 (12-05-1998)
		JP4172816B2	29 October 2008 (29-10-2008)
		JP2004322310A	18 November 2004 (18-11-2004)
		JP4324511B2	02 September 2009 (02-09-2009)
		JP2007325960A	20 December 2007 (20-12-2007)
		JP4430095B2	10 March 2010 (10-03-2010)
		JP2007325961A	20 December 2007 (20-12-2007)
		JP4430096B2	10 March 2010 (10-03-2010)
		JP2007050270A	01 March 2007 (01-03-2007)
		JP4443548B2	31 March 2010 (31-03-2010)
		JP2005515012A	26 May 2005 (26-05-2005)
		JP4723186B2	13 July 2011 (13-07-2011)
		JP2007260429A	11 October 2007 (11-10-2007)
		JP4799489B2	26 October 2011 (26-10-2011)
		JP2007260430A	11 October 2007 (11-10-2007)
		JP4799490B2	26 October 2011 (26-10-2011)
		JP2008514357A	08 May 2008 (08-05-2008)
		JP4943338B2	30 May 2012 (30-05-2012)
		JP2007167644A	05 July 2007 (05-07-2007)
		JP5043414B2	10 October 2012 (10-10-2012)
		JP2009520573A	28 May 2009 (28-05-2009)
		JP5101519B2	19 December 2012 (19-12-2012)
		JP2009183733A	20 August 2009 (20-08-2009)
		JP5131598B2	30 January 2013 (30-01-2013)
		JP2009522017A	11 June 2009 (11-06-2009)
		JP5152993B2	27 February 2013 (27-02-2013)

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
		JP2009509653A	12 March 2009 (12-03-2009)
		JP5193049B2	08 May 2013 (08-05-2013)
		JP2011025058A	10 February 2011 (10-02-2011)
		JP5207558B2	12 June 2013 (12-06-2013)
		JP2011156407A	18 August 2011 (18-08-2011)
		JP5213993B2	19 June 2013 (19-06-2013)
		JP2011183186A	22 September 2011 (22-09-2011)
		JP5219226B2	26 June 2013 (26-06-2013)
		JP2011183187A	22 September 2011 (22-09-2011)
		JP5255670B2	07 August 2013 (07-08-2013)
		JP2009522016A	11 June 2009 (11-06-2009)
		JP5264505B2	14 August 2013 (14-08-2013)
		JP2012120884A	28 June 2012 (28-06-2012)
		JP5283241B2	04 September 2013 (04-09-2013)
		JP2009509654A	12 March 2009 (12-03-2009)
		JP5288609B2	11 September 2013 (11-09-2013)
		JP2011200666A	13 October 2011 (13-10-2011)
		JP5289504B2	11 September 2013 (11-09-2013)
		JP2011194247A	06 October 2011 (06-10-2011)
		JP5301607B2	25 September 2013 (25-09-2013)
		JP2010214166A	30 September 2010 (30-09-2010)
		JP5318826B2	16 October 2013 (16-10-2013)
		JP2009539573A	19 November 2009 (19-11-2009)
		JP5324432B2	23 October 2013 (23-10-2013)
		JP2012213655A	08 November 2012 (08-11-2012)
		JP5372225B2	18 December 2013 (18-12-2013)
		JP2012152583A	16 August 2012 (16-08-2012)
		JP5386602B2	15 January 2014 (15-01-2014)
		JP2012061350A	29 March 2012 (29-03-2012)
		JP5398036B2	29 January 2014 (29-01-2014)
		JP2007167643A	05 July 2007 (05-07-2007)
		JP5403864B2	29 January 2014 (29-01-2014)
		JP2012157744A	23 August 2012 (23-08-2012)
		JP5431527B2	05 March 2014 (05-03-2014)
		JP2012115690A	21 June 2012 (21-06-2012)
		JP5458122B2	02 April 2014 (02-04-2014)
		JP2011525845A	29 September 2011 (29-09-2011)
		JP5583123B2	03 September 2014 (03-09-2014)
		JP2012125589A	05 July 2012 (05-07-2012)
		JP5610547B2	22 October 2014 (22-10-2014)
		JP2013066775A	18 April 2013 (18-04-2013)
		JP5642208B2	17 December 2014 (17-12-2014)
		JP2013135859A	11 July 2013 (11-07-2013)
		JP5649143B2	07 January 2015 (07-01-2015)
		JP2012504017A	16 February 2012 (16-02-2012)
		JP5675621B2	25 February 2015 (25-02-2015)
		JP2013075195A	25 April 2013 (25-04-2013)
		JP5700584B2	15 April 2015 (15-04-2015)
		JP2013188574A	26 September 2013 (26-09-2013)
		JP5707449B2	30 April 2015 (30-04-2015)
		JP2013027733A	07 February 2013 (07-02-2013)
		JP5709318B2	30 April 2015 (30-04-2015)
		JP2014054535A	27 March 2014 (27-03-2014)
		JP5744130B2	01 July 2015 (01-07-2015)
		JP2013528064A	08 July 2013 (08-07-2013)
		JP5775154B2	09 September 2015 (09-09-2015)
		JP2014004483A	16 January 2014 (16-01-2014)

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
		JP5778234B2	16 September 2015 (16-09-2015)
		JP2013530738A	01 August 2013 (01-08-2013)
		JP5782114B2	24 September 2015 (24-09-2015)
		JP2013138965A	18 July 2013 (18-07-2013)
		JP5787374B2	30 September 2015 (30-09-2015)
		JP2014012212A	23 January 2014 (23-01-2014)
		JP5791203B2	07 October 2015 (07-10-2015)
		JP2014076361A	01 May 2014 (01-05-2014)
		JP5807974B2	10 November 2015 (10-11-2015)
		JP2014057849A	03 April 2014 (03-04-2014)
		JP5839612B2	06 January 2016 (06-01-2016)
		JP2014057850A	03 April 2014 (03-04-2014)
		JP5839613B2	06 January 2016 (06-01-2016)
		JP2014057851A	03 April 2014 (03-04-2014)
		JP5839614B2	06 January 2016 (06-01-2016)
		JP2014054534A	27 March 2014 (27-03-2014)
		JP5839615B2	06 January 2016 (06-01-2016)
		JP2014057853A	03 April 2014 (03-04-2014)
		JP5839616B2	06 January 2016 (06-01-2016)
		JP2012521855A	20 September 2012 (20-09-2012)
		JP5840121B2	06 January 2016 (06-01-2016)
		JP2013526337A	24 June 2013 (24-06-2013)
		JP5849090B2	27 January 2016 (27-01-2016)
		JP2014057848A	03 April 2014 (03-04-2014)
		JP5851459B2	03 February 2016 (03-02-2016)
		JP2014028228A	13 February 2014 (13-02-2014)
		JP5851460B2	03 February 2016 (03-02-2016)
		JP2014111080A	19 June 2014 (19-06-2014)
		JP5866123B2	17 February 2016 (17-02-2016)
		JP2012143582A	02 August 2012 (02-08-2012)
		JP5868746B2	24 February 2016 (24-02-2016)
		JP2013135862A	11 July 2013 (11-07-2013)
		JP5898105B2	06 April 2016 (06-04-2016)
		JP2015006423A	15 January 2015 (15-01-2015)
		JP5996592B2	21 September 2016 (21-09-2016)
		JP6058111B2	11 January 2017 (11-01-2017)
		JP2015506850A	05 March 2015 (05-03-2015)
		JP6087368B2	01 March 2017 (01-03-2017)
		JP2013150833A	08 August 2013 (08-08-2013)
		JP6087697B2	01 March 2017 (01-03-2017)
		JP6104353B2	29 March 2017 (29-03-2017)
		JP2015211865A	26 November 2015 (26-11-2015)
		JP6113787B2	12 April 2017 (12-04-2017)
		JP2015154956A	27 August 2015 (27-08-2015)
		JP6130428B2	17 May 2017 (17-05-2017)
		JP2015502198A	22 January 2015 (22-01-2015)
		JP6153936B2	28 June 2017 (28-06-2017)
		JP2015147059A	20 August 2015 (20-08-2015)
		JP6189889B2	30 August 2017 (30-08-2017)
		JP6220877B2	25 October 2017 (25-10-2017)
		JP6255401B2	27 December 2017 (27-12-2017)
		JP6255402B2	27 December 2017 (27-12-2017)
		JP6255403B2	27 December 2017 (27-12-2017)
		JP6261629B2	17 January 2018 (17-01-2018)
		JP6262216B2	17 January 2018 (17-01-2018)
		JP6285064B2	28 February 2018 (28-02-2018)
		JP2015526115A	10 September 2015 (10-09-2015)

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
		JP6291484B2	14 March 2018 (14-03-2018)
		JP2015521084A	27 July 2015 (27-07-2015)
		JP6368710B2	01 August 2018 (01-08-2018)
		JP6421171B2	07 November 2018 (07-11-2018)
		JP6422530B2	14 November 2018 (14-11-2018)
		JP6423853B2	14 November 2018 (14-11-2018)
		JP6433481B2	05 December 2018 (05-12-2018)
		JP6475804B2	27 February 2019 (27-02-2019)
		JP6535653B2	26 June 2019 (26-06-2019)
		JP6576002B2	18 September 2019 (18-09-2019)
		JP6585265B2	02 October 2019 (02-10-2019)
		JP6617114B2	04 December 2019 (04-12-2019)
		JP6637529B2	29 January 2020 (29-01-2020)
		JP6691578B2	28 April 2020 (28-04-2020)
		JP2007289726A	08 November 2007 (08-11-2007)
		JP2007325959A	20 December 2007 (20-12-2007)
		JP2008544814A	11 December 2008 (11-12-2008)
		JP2009542362A	03 December 2009 (03-12-2009)
		JP2012061351A	29 March 2012 (29-03-2012)
		JP2012179363A	20 September 2012 (20-09-2012)
		JP2012254360A	27 December 2012 (27-12-2012)
		JP2012529970A	29 November 2012 (29-11-2012)
		JP2013081870A	09 May 2013 (09-05-2013)
		JP2013528065A	08 July 2013 (08-07-2013)
		JP2014057852A	03 April 2014 (03-04-2014)
		JP2014057854A	03 April 2014 (03-04-2014)
		JP2014097431A	29 May 2014 (29-05-2014)
		JP2014111081A	19 June 2014 (19-06-2014)
		JP2014138903A	31 July 2014 (31-07-2014)
		JP2014236969A	18 December 2014 (18-12-2014)
		JP2014236976A	18 December 2014 (18-12-2014)
		JP2015051287A	19 March 2015 (19-03-2015)
		JP2015061671A	02 April 2015 (02-04-2015)
		JP2015062734A	09 April 2015 (09-04-2015)
		JP2015062751A	09 April 2015 (09-04-2015)
		JP2015091331A	14 May 2015 (14-05-2015)
		JP2015107340A	11 June 2015 (11-06-2015)
US2010004509A1	07 January 2010 (07-01-2010)	CN101610709A	23 December 2009 (23-12-2009)
		CN101610709B	01 June 2011 (01-06-2011)
		EP2127591A1	02 December 2009 (02-12-2009)
		EP2127591A4	06 June 2012 (06-06-2012)
		JP2008237812A	09 October 2008 (09-10-2008)
		WO2008120422A1	09 October 2008 (09-10-2008)