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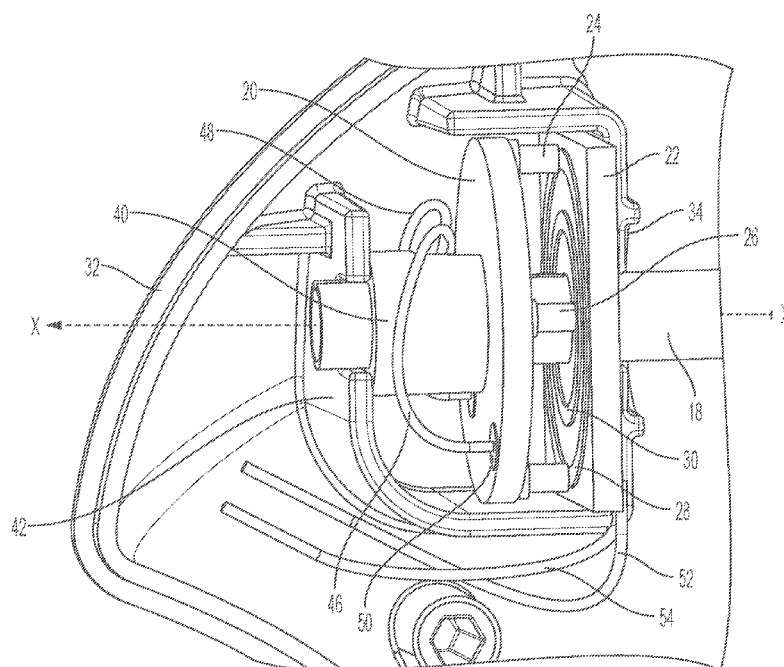
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(81) Designated States (*unless otherwise indicated, for every
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CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO,
DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,
HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP,
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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,
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(54) Title: CONTINUOUS ROTATION OF A SURGICAL INSTRUMENT



(57) Abstract: A continuous rotation assembly that may be positioned in the housing of an electro-surgical device to maintain electrical continuity between an electro-surgical power source and an electro-surgical implement positioned at the end of a rotatable shaft. A stator is positioned about the shaft and fixed against rotation and includes a pair of rings that are electrically isolated from each other. A rotor having first and second sets of pins that are electrically isolated from each other is positioned about the shaft and rotatable therewith. The pins are positioned to stay contact with the pair of rings as the shaft and rotor rotate. A first pair of wires couples the pins to the electro-surgical implement. A second pair of wires couples the pair of rings to an electro-surgical power source, thereby providing power to the implement even if the shaft is rotated continuously.

GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,
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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,
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TITLE

CONTINUOUS ROTATION OF A SURGICAL INSTRUMENT

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority to U.S. Provisional No. 62/749,841, filed on October 24, 2018.

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

[0002] The present invention relates to surgical instruments and, more specifically, to an approach for allowing a surgical instrument to having electrically powered components that can be continuously rotated though 360 degrees.

2. DESCRIPTION OF THE RELATED ART

[0003] Surgical instruments, such as electrosurgical vessel sealers and scalpels, have jaws or other implements positioned at the end of an elongated shaft so that the implements can be easily applied to tissue to be treated. The implements may be electrically powered, such as through the use of radiofrequency energy supplied by an electrical generator that is electrically coupled to the implements. The conventional approach for coupling the implements to the generator is to use current carrying wires. However, many types of surgical devices are designed so that the implements can be rotated. While wired devices may be rotated a certain amount, at some point, further rotation will be limited by the length of the wires that extend between non-rotational elements and the rotating elements. In extreme cases, additional rotation of the implements can cause a disconnection of the wires and loss of electrical function. Thus, there is a need in the art for an approach that can deliver electrical continuity to the powered implements of a surgical device while allowing the user to rotate the implements as much as he or she deems necessary without any concern of loss of power or damage to the device.

BRIEF SUMMARY OF THE INVENTION

[0004] The present invention comprises a continuous rotation assembly that may be positioned in the housing of an electrosurgical device to maintain electrical continuity between an electrosurgical power source and an electrosurgical implement positioned at the end of a rotatable shaft. The present invention comprises a stator having a pair of rings that are electrically isolated from each other. The stator is positioned about the shaft and fixed against rotation. A rotor having first and second sets of pins that are electrically isolated from each other is positioned about the shaft and rotatable therewith. The rotor includes a first set of pins positioned in contact with one of the pair of rings and a second set of pins

positioned in contact with the other of the pair of rings. A pair of wires may be coupled to the pair of rings, respectively, to allow for interconnection to an electrosurgical power source. A housing of the device may define a first rib positioned in abutting relation to the stator to prevent rotation of the stator. The housing may further define a second rib positioned adjacently to the rotor. A bushing may be positioned between the rotor and the second rib to allow for easier rotation of the rotor. The shaft may include a longitudinal slot that engages a tang of the rotor so that they rotate together. The first and second sets of pins may be pogo pins to ensure engagement with the rings. The electrosurgical implement may have first and second opposing jaws, wherein each of the first and second opposing jaws is electrically coupled to a respective one of the first and second sets of pins by each of a second pair of wires.

[0005] The present invention also comprises a method of providing continuous rotation to an electrosurgical device. One step involves coupling a rotor having first and second sets of pins electrically isolated from each other to a rotatable shaft of the electrosurgical device so that the first set of pins are positioned in contact with one of a pair of rings of a stator that is fixed against rotation and the second set of pins are positioned in contact with the other of the pair of rings. Another step involves coupling the first and second sets of pins to an electrosurgical implement of the electrosurgical device that is mounted to the shaft. A further step involves coupling the pair of rings of the stator to an electrosurgical power source so that the electrosurgical power source is in electrical continuity with the electrosurgical implement. The method may additionally include the step of rotating the shaft to cause rotation of the rotor while the stator remains fixed so that electrical continuity is maintained between the electrosurgical power source and the electrosurgical implement as a result of the first and second sets of pins remaining in contact with the pair of rings as the shaft is rotated.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

[0006] The present invention will be more fully understood and appreciated by reading the following Detailed Description in conjunction with the accompanying drawings, in which:

[0007] FIG. 1 is perspective view of a surgical device having electrical continuity and continuous rotation according to the present invention;

[0008] FIG. 2 is an isometric view of an assembly for providing electrical continuity and continuous rotation in a surgical device according to the present invention;

[0009] FIG. 3 is an exploded view of an assembly for providing electrical continuity and continuous rotation in a surgical device according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0010] Referring to the figures, wherein like numeral refer to like parts throughout, there is seen in FIG. 1 a surgical device 10 having a continuous rotation assembly 12 for providing electrical continuity to a surgical instrument, illustrated as a pair of electrosurgical jaws 14 at the end of a shaft 18, that are coupled to a electrosurgical power source 16, such as an electrosurgical generator. It should be recognized that the present invention could be incorporated into other surgical devices having an implement that is coupled to source of electrosurgical power source 16, such as electrosurgical forceps, electrosurgical pencils, and the like.

[0011] Referring to FIG. 2, continuous rotation assembly 12 comprises a rotor 20 held in continuous contact with a stator 22. Rotor 20 carries first and second sets of conductive pins 24 and 26 that are electrically isolated from each other. Stator 22 supports first and second rings 28 and 30 that are electrically isolated from each other and are aligned to mate with first and second sets of pins 24 and 26, respectively. For example, first and second rings 28 may be positioned concentrically around shaft 18. Stator 22 is fixed within a housing 32 of device 10, such as by a first rib 34 formed within the interior of housing 32. Rotor 20 is coupled to shaft 18 of device 10 that supports jaws 14 for rotation therewith. For example, shaft 18 may include a slot 36 that accepts a tang 38 of rotor 20 and imparts rotational force to rotor 20 if shaft 18 is rotated.

[0012] As seen in FIG. 2, first set of pins 24 are positioned to be in contact with first ring 28. Second set of pins 26 are positioned to be in contact second ring 30. First and second sets of pins 24 and 26 are preferably pogo pins that have spring loaded tips to maintain secure electrical contact with first and second rings 28 and 30 during any rotation of rotor 20 relative to stator 22. A bearing 40 may be positioned in abutting relation to a second rib 42 within housing 32 and to rotor 20 to keep rotor 20 in contact with stator 22 so that contact is maintained between first and second pins 24 and 26 corresponding conductive rings 28 and 30.

[0013] A first pair of wires 46 and 48 may be coupled to first and second sets of pins 24 and 26, respectively, via contact pads 50. Wires 46 and 48 extend within shaft 18 to connect to electrodes held within jaws 14. First pair of wires 46 and 48 will rotate along with rotor 20 and shaft 18 and thus will not come under any tension regarding of how shaft 18 is rotated. A second set of wires 52 and 54 interconnects each of rings 28 and 30 to

electrosurgical power source 16. As a result, electrosurgical power source 16 is electrically interconnected to jaws 14 such as for cutting and coagulation procedures. If shaft 18 of device 10 is rotated about longitudinal axis X-X during an electrosurgical procedure, rotor 20 will rotate along with shaft 18 while stator 22 remains stationary. First and second sets of pins 24 and 26 of rotor 20 will remain in contact with rings 28 and 30, respectively, during any rotation. As stator 22 is fixed in place, wires 52 and 54 are not required to move or stretch along with rotation of shaft 18, and will therefore not become inadvertently disconnected regardless of how shaft 18 is rotated. As a result, electrical continuity between jaws 14 and electrosurgical power source 16 is maintained regardless of the extent of rotation of shaft 18. In fact, shaft 18 may be rotated continuously while still maintaining electrical connectivity between jaws 14 and electrosurgical power source 16 without concern of loss of electrical continuity due to disconnected wires or electrical components.

CLAIMS

What is claimed is:

1. An electrosurgical device, comprising:
an electrosurgical implement supported by a shaft for rotation about a longitudinal axis;
a stator positioned about the shaft and fixed against rotation, wherein the stator includes a pair of rings that are electrically isolated from each other and configured for connection to an electrosurgical power source; and
a rotor having first and second sets of pins that are electrically isolated from each other and electrically coupled to the electrosurgical implement, wherein the rotor is positioned about and rotatable with the shaft such that the first set of pins are positioned in contact with one of the pair of rings and the second set of pins are positioned in contact with the other of the pair of rings.
2. The electrosurgical device of claim 1, further comprising a housing defining a first rib positioned in abutting relation to the stator and preventing rotation of the stator.
3. The electrosurgical device of claim 2, wherein the housing further defines a second rib positioned adjacently to the rotor.
4. The electrosurgical device of claim 3, further comprising a bushing positioned between the rotor and the second rib to allow rotation of the rotor.
5. The electrosurgical device of claim 4, wherein the shaft includes a longitudinal slot.
6. The electrosurgical device of claim 5, wherein the rotor includes a tang that engages the slot of the shaft.
7. The electrosurgical device of claim 6, wherein the first and second sets of pins comprise pogo pins.
8. The electrosurgical device of claim 7, wherein the electrosurgical implement comprises first and second opposing jaws, wherein each of the first and second opposing jaws is electrically coupled to a respective one of the first and second sets of pins by each of a second pair of wires.
9. A method of providing continuous rotation to an electrosurgical device, comprising the steps of:
coupling a rotor having first and second sets of pins electrically isolated from each other to a rotatable shaft of the electrosurgical device so that the first set of pins are

positioned in contact with one of a pair of rings of a stator that is fixed against rotation and the second set of pins are positioned in contact with the other of the pair of rings;

coupling the first and second sets of pins to an electrosurgical implement of the electrosurgical device that is mounted to the shaft; and

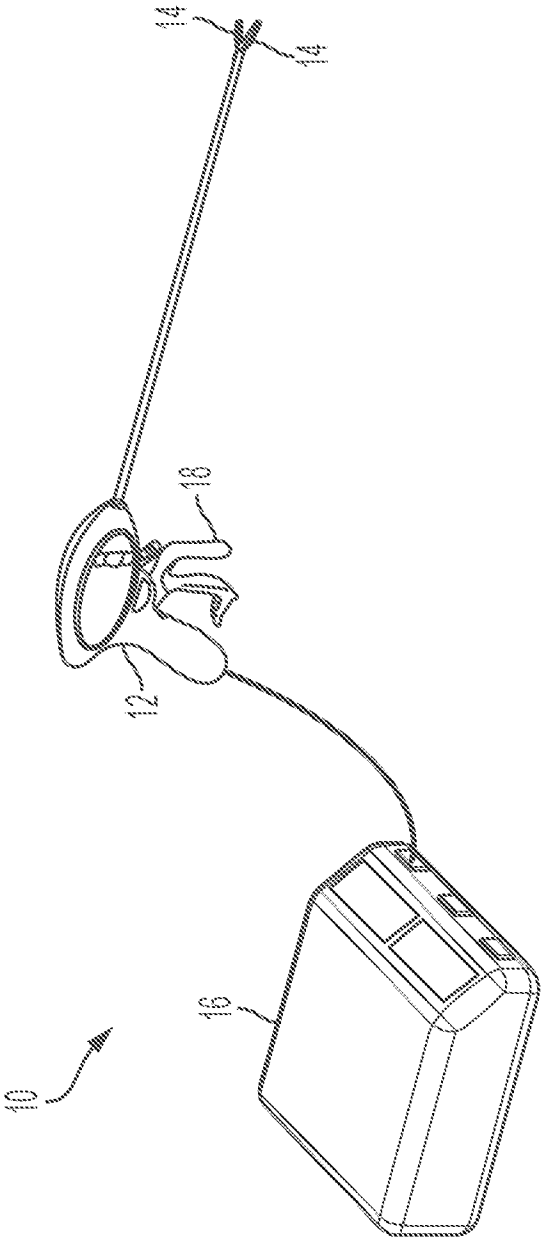
coupling the pair of rings of the stator to an electrosurgical power source so that the electrosurgical power source is in electrical continuity with the electrosurgical implement.

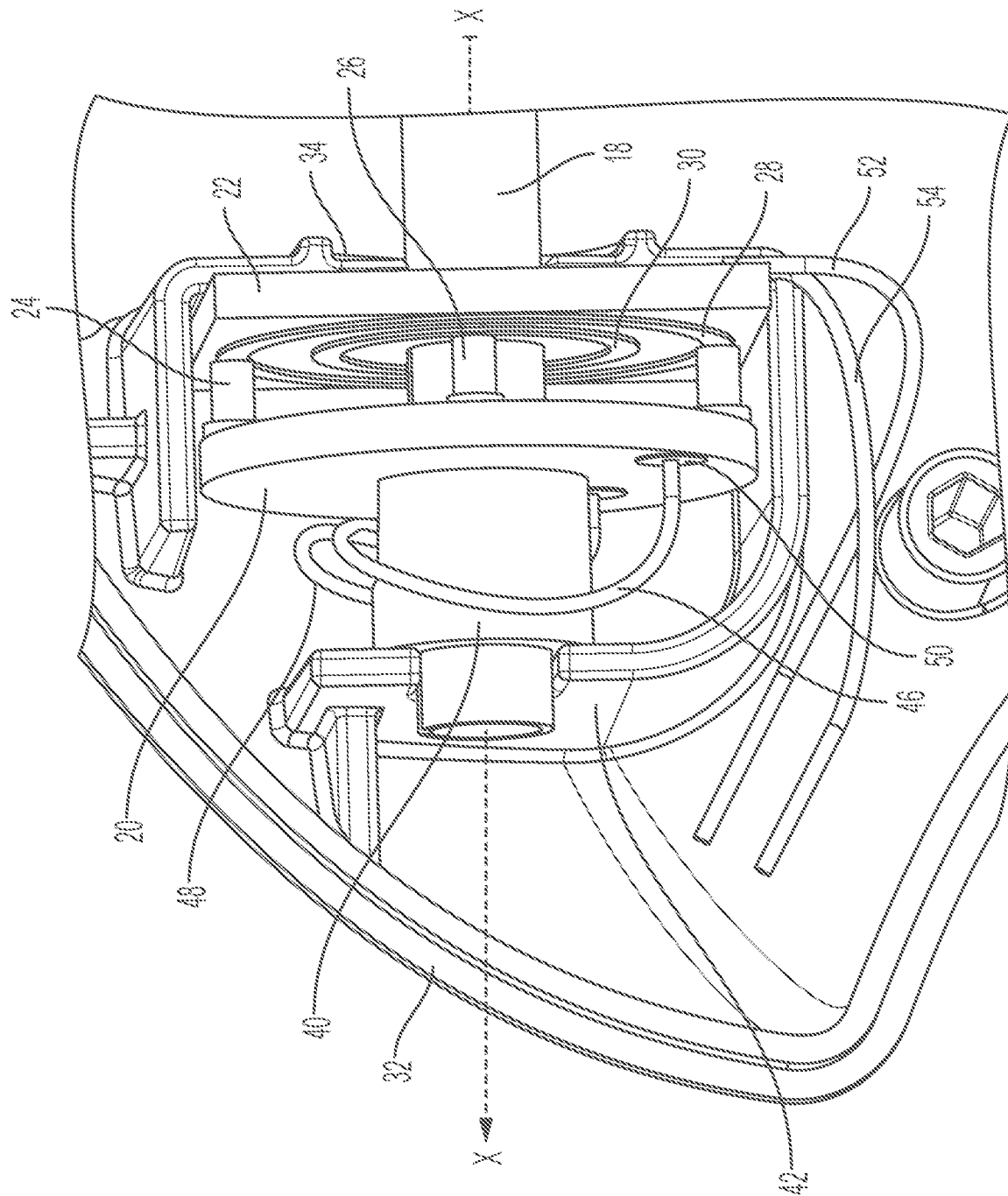
10. The method of claim 9, further comprising the step of rotating the shaft to cause rotation of the rotor while the stator remains fixed so that electrical continuity is maintained between the electrosurgical power source and the electrosurgical implement as a result of the first and second sets of pins remaining in contact with the pair of rings as the shaft is rotated.

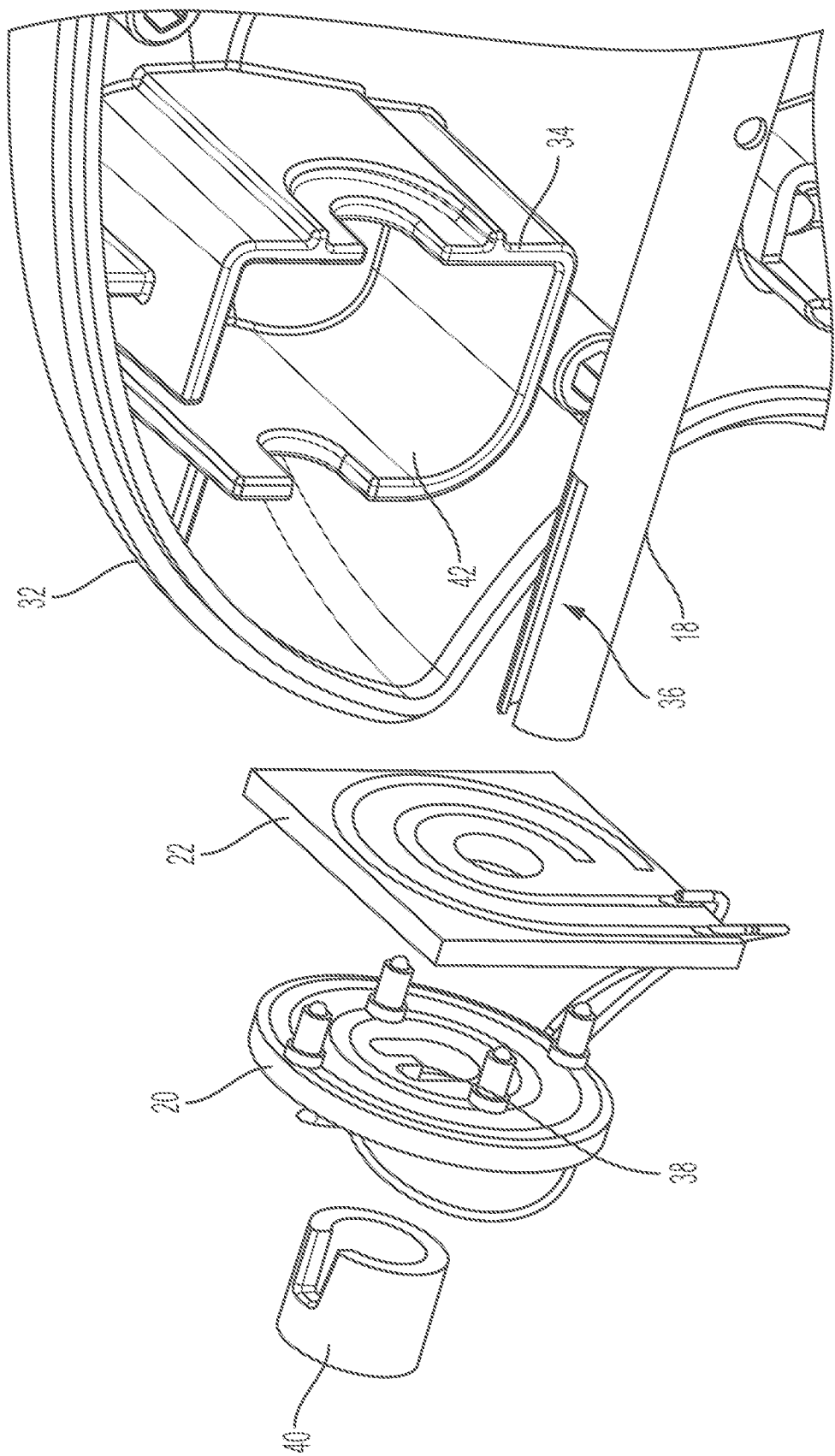
11. The method of claim 10, wherein the first and second sets of pins are spring loaded to remain in contact with the pair of rings.

12. The method of claim 11, wherein the rotor is coupled to the shaft by a tang of the rotor engaging a slot in the shaft.

13. The method of claim 12, wherein the rotor is further coupled to the rotatable shaft by a bushing that surrounds the shaft and abuts a rib of a housing of the electrosurgical device.







INTERNATIONAL SEARCH REPORT

International application No
PCT/US2019/057788

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61B18/14
ADD.

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)
A61B

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2016/121143 A1 (MUMAW DANIEL J [US] ET AL) 5 May 2016 (2016-05-05) paragraphs [0080] - [0101]; figures 1-10, 16-19, 25-29 -----	1-13
A	US 2018/206884 A1 (BEAUPRE JEAN [US]) 26 July 2018 (2018-07-26) paragraphs [0050] - [0058], [0070] - [0075]; figures 1-8 -----	1-13
A	US 2016/235468 A1 (PRISCO JOHN R [US] ET AL) 18 August 2016 (2016-08-18) paragraphs [0018] - [0029] -----	1-13
A	US 2014/005704 A1 (VAKHARIA OMAR J [US] ET AL) 2 January 2014 (2014-01-02) paragraphs [0059], [0111] - [0119]; figures 1-2, 8-10, 12, 16-32 -----	1-13



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search

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Lahorte, Philippe

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2016121143	A1	05-05-2016	NONE

US 2018206884	A1	26-07-2018	CN 108848667 A 20-11-2018
		EP 3386410 A1 17-10-2018	
		EP 3545893 A1 02-10-2019	
		TW 201731462 A 16-09-2017	
		US 2018206884 A1 26-07-2018	
		WO 2017100728 A1 15-06-2017	

US 2016235468	A1	18-08-2016	US 2016235468 A1 18-08-2016
		US 2019314080 A1 17-10-2019	

US 2014005704	A1	02-01-2014	AU 2013280951 A1 22-01-2015
		BR 112014032915 A2 27-06-2017	
		CA 2877690 A1 03-01-2014	
		CN 104602624 A 06-05-2015	
		EP 2866698 A1 06-05-2015	
		ES 2605986 T3 17-03-2017	
		JP 6174136 B2 02-08-2017	
		JP 2015524683 A 27-08-2015	
		US 2014005704 A1 02-01-2014	
		US 2016346001 A1 01-12-2016	
		WO 2014004120 A1 03-01-2014	
