(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 244 803 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
20.02.2019 Bulletin 2019/08

(21) Application number: **15706060.9**

(22) Date of filing: **16.01.2015**

(51) Int Cl.:
A61B 1/00 *(2006.01)* ***A61B 8/12*** *(2006.01)*
A61B 8/00 *(2006.01)* ***A61B 1/008*** *(2006.01)*
A61B 1/015 *(2006.01)* ***A61B 1/005*** *(2006.01)*
A61B 1/267 *(2006.01)*

(86) International application number:
PCT/IB2015/050348

(87) International publication number:
WO 2016/113600 (21.07.2016 Gazette 2016/29)

(54) **ARTICULATION ACTIVATION WIRE STRESS RELIEF FOR AN ULTRASOUND IMAGING PROBE**

SPANNUNGSVERMINDERUNG EINES GELENKAKTIVIERUNGSDRAHTES FÜR EINE ULTRASCHALLBILDGEBUNGSSONDE

SOULAGEMENT DE CONTRAINTE DE FIL D'ACTIVATION D'ARTICULATION POUR SONDE D'IMAGERIE ULTRASONORE

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(43) Date of publication of application:
22.11.2017 Bulletin 2017/47

(73) Proprietor: **B-K Medical ApS**
2730 Herlev (DK)

(72) Inventors:
- **CHRISTENSEN, Bjarne Lasse**
4600 Koege (DK)
- **SASADY, Niels-christian LI**
2000 Frederiksberg (DK)

(74) Representative: **Gevers Patents**
Intellectual Property House
Holidaystraat 5
1831 Diegem (BE)

(56) References cited:
US-A- 4 688 555
US-A- 5 413 107
US-A1- 2008 139 886
US-A1- 2012 046 522

EP 3 244 803 B1

Description

TECHNICAL FIELD

[0001] The following generally relates to ultrasound (US) imaging and more particularly to articulation activation wire stress relief for an ultrasound imaging probe.

BACKGROUND

[0002] There are at least two different types of ultrasound imaging probes - flexible and rigid. Flexible ultrasound probes include an articulating portion that is controllably articulated to move the end of the probe head and the transducer array through an angle of, e.g., up to 180° degrees in one to four planes. Figures 1A and 1B show an example of a flexible probe 100; namely, a laparoscopic transducer type 8666, which is a product of BK-Medical ApS, a company of Herlev, Denmark. In Figure 1A, an articulating portion 102 is configured to articulate to an up position 104 or a down position 106. A lever 112 controls up/down articulation. In Figure 1B, the articulating portion 102 is further configured to articulate to a left position 108 or a right position 110. A lever 114 controls left/right articulation. Generally, either the first lever 112 or the second lever 114 is employed during an examination, but not concurrently both of the levers 112 and 114.

[0003] Figure 2A shows the lever 112 attached to a cam 202 and the lever 114 attached to a cam 204. A first wire 206 is connected between a first side of the cam 202 and a first side of the articulating portion 102, and a second wire 208 is connected between a second opposing side of the cam 202 and a second opposing side of the articulating portion 102. A third wire 210 is connected between a first side of the cam 204 and a third side of the articulating portion 102, and a fourth wire 212 is connected between a second side of the cam 204 and a fourth side of the articulating portion 102. The lever 112 rotates the cam 202, and the lever 114 rotates the cam 204. Rotating one of the cams 202 or 204 causes the corresponding wires to push on one side and pull on the opposing side of the articulating portion 102, which causes the articulating portion 102 to articulate. The articulating portion 102 includes a plurality of vertebrae 213 separated by pivots 214. Between neighboring vertebrae 213, a first pair of pivots 214 is for left/right articulation and a second pair of pivots 214 is for up/down articulation. The pivots 214 are located off center with respect to the articulating portion 102.

[0004] In Figure 2B, the lever 112 is rotated counterclockwise, which pulls on the wire 206 and pushes on the wire 208 resulting in left articulation. Since the pivots 214 are off center, the pull and push lengths of the wires 206 and 208 are not the same. That is, a push length is longer than a pull length. However, the cam 202 releases only a same length of wire, which is the pull length. As a consequence, a stress is induced in the pushed wire. Rotating the lever 112 clockwise, the lever 114 counterclockwise, or the lever 114 clockwise likewise induces a stress in the pushed wire. Figures 3A and 3B show down and up articulation with the lever 114. Furthermore, both of the wires of the non-activated lever will be likewise stressed. This can be seen in Figures 2B (wires 210 and 212) and Figures 3A and 3B (wires 206 and 208). One approach to mitigate these stresses are to include springs in the wires. Unfortunately, with such an approach, the springs introduce slack in the wires, causing a delay between the articulation expected by the user and the actual articulation.

[0005] US-A-5413107 discloses an articulated ultrasonic probe similar to that described above with reference to Figures 1A and 1B.

[0006] US-A-2008/0139886 discloses an endoscope having a bending portion which is controlled by an operating wire which is manipulated to bend the bending portion.

[0007] US-A-2012/0046522 also discloses an endoscope having a wire for controlling a tubular section and a bending section. Tensile force applied to the wire by means of an adjustment unit changes the shape of the tubular section.

SUMMARY

[0008] Aspects of the application address the above matters, and others.

[0009] In one aspect, an elongate ultrasound imaging probe includes an articulating member. The articulating member includes at least two vertebrae elements sequentially arranged along a long axis of the elongate ultrasound imaging probe. The articulating member further includes a plurality of pivots located between the at least two vertebrae elements. Each of the plurality of pivots is disposed off-center relative to the at least two vertebrae elements. Each of the plurality of pivots is spatially oriented to provide a pivot point for a different articulation direction of a set of different of articulation directions of a vertebra element of the plurality of vertebrae elements. The probe further includes a plurality of guides, including at least one guide for each of the respective different pivot directions. An actuator with a set of controls, each control configured to actuate a different pair of the plurality of guides for controlling opposing articulation directions, wherein the actuator reduces stress induced on at least one of a pushed guide or a non-activated guide, wherein the stress is induced in response to the actuator pulling a guide.

[0010] In one embodiment, the actuator comprises a disc-shaped cam which is configured to rotate about a rotation axis. The disc-shaped cam includes a first half circle having a first radius, and, a second opposing half circle having a second radius. The second radius is larger than the first radius. The first and second half circles correspond to first and second halves of the disc-shaped cam. The second opposing half circle is configured to face the at least two vertebrae elements.

[0011] In another aspect, an ultrasound imaging system includes a probe and a console. The probe includes a probe head with a transducer array, a shaft, an articulating member disposed between the probe head and the shaft, an articulating member actuator configured to control the articulating member through guide wires, wherein the articulating member reduces stress in the guide wires through a structural elements that slack off at least one of a pushed guide wire or a non-activated guide wire in response to at least one pulled guide wire, and a console interface. The console includes ultrasound imaging components and a probe interface. The console and probe interfaces are complementary interfaces, providing an electrical communications path between the probe and the console.

[0012] Those skilled in the art will recognize still other aspects of the present application upon reading and understanding the attached description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The application is illustrated by way of example and not limitation in the figures of the accompanying drawings, in which like references indicate similar elements and in which:

Figure 1A illustrates up/down articulation of a probe head of a prior art ultrasound imaging probe;

Figure 1B illustrates left/right articulation of the probe head of the prior art ultrasound imaging probe of FIGURE 1A;

Figure 2A illustrates example control of the articulation of the probe of FIGURES 1A and 2B;

Figure 2B illustrates left articulation and stress induced on the pushed wire and the non-actuated wires of the probe of FIGURES 1A and 2B;

Figure 3A illustrates down articulation and stress induced on the pushed wire and the non-actuated wires of the probe of FIGURES 1A and 2B;

Figure 3B illustrates up articulation and stress induced on the pushed wire and the non-actuated wires of the probe of FIGURES 1A and 2B;

Figure 4 schematically illustrates an example ultrasound imaging system with probe with an articulation sub-system.

Figure 5A illustrates an example of the articulation sub-system.

Figure 5B illustrates the example of the articulation sub-system in use.

Figure 5C illustrates the example of the articulation sub-system in connection with prior art..

Figure 6A illustrates another example of the articulation sub-system.

Figure 6B illustrates the example articulation subsystem of Figure 6A in use.

DETAILED DESCRIPTION

[0014] Figure 4 illustrates an imaging system 402 such as ultrasound imaging system. The imaging system 402 includes an elongate ultrasound probe 404 and a console 406. The elongate ultrasound probe 404 includes a handle 408, a shaft (SHFT) 410, an articulating member 412, and a probe head 414. The handle 408, the shaft 410, the articulating member 412 and the probe head 414 respectively are arranged with respect to each along a longitudinal axis 415 of the elongate ultrasound probe 404.

[0015] The probe head 414 includes a first end region 416 and a second end region 418. In the illustrated embodiment, the probe head 414 also includes a transducer array 420. In another embodiment, the probe head 414 can also include a biopsy region. The first end region 416 includes the end of the probe 404. The second end region 418 is affixed to the articulating member 412. The transducer array 420 includes a one or two dimensional array transducer elements. Suitable configurations include, but are not limited to, linear, curved (e.g., convex), and phased arrays. The transducer array 420 is configured to acquire data for A-mode, B-mode, etc. acquisitions, individually and in combination with color flow, Doppler flow, etc.

[0016] The articulating member 412 includes a first end region 422, a second end region 424 and a flexor 426. The first end region 416 is affixed to the second end region 418 of the probe head 414. The second end region 424 is affixed to the shaft 410. The flexor 426 extends along the longitudinal axis 415. The flexor 426 is configured to flex the articulating member 412 to various positions, e.g., in one to four planes through angles of up to ninety (90) degrees or more. Examples of suitable positions include up, down, left, right and/or other positions. As described in greater detail below, in one instance, the flexor includes a plurality of vertebrae with pivots there between.

[0017] The shaft 410 includes a first end region 428, a second end region 430, and at least a first portion of the flexor control system (FCS) 432. The first end region 428 is affixed to the second end region 424 of the articulating member 412. The second end region 430 is affixed to the handle 408. The flexor control system 426 extends along the longitudinal axis 415. The flexor control system 426 is configured to push and pull on the flexor 426 to flex the articulating member 412 for up/down and left/fight articulation. As described in greater detail below, in one instance, the flexor control system 432 includes a plurality of guides such as wires that pull and push on the vertebrae, pivoting them on the pivots.

[0018] The handle 408 includes a first end region 434, a second end region 436, at least a second portion of the flexor control system 432, a flexor actuator 438, and an interface 440. The first end region 434 is affixed to the second end region 430 of the shaft 410. The second end region 436 represents the other opposing end of the probe 404. The flexor actuator 438 is configured to control

the flexor control system 432 to control the flexing of the flexor 426. In one embodiment, the flexor actuator 438 is as shown in Figures 1A and 1B. In another embodiment, the flexor actuator 438 includes a ratchet mechanism on each activation wheel. The ratchet mechanism can be switched on/off in the handle 408. In yet another embodiment, the flexor actuator 438 includes an electrical based on/off (and copy) button (electrically) on the handle 408. The interface 440 is configured for connection with a complementary interface of an ultrasound console.

[0019] As described in greater detail below, the flexor actuator 438 is configured to mitigate stress induced in the flexor 426 and the flexor control system 432 by actuation of the flexor actuator 438. In one instance, this includes stress induced in the pushed wire for up/down articulation, or stress induced in the pushed wire for left/right articulation. In another instance, this includes stress induced in the non-actuated wires. In yet another instance, this includes both the stress induced in the pushed wire and the stress induced in the non-actuated wires.

[0020] It is to be appreciated that the probe 404 can be used for laparoscopic, endoscopic, and/or other applications, and can be used to assist personnel, for example, with an interventional procedure such as a liver, gall bladder, tumor biopsy, etc., guide personnel, for example, with RF ablation, chemical injection, etc. and/or otherwise. As shown, the probe 404 is employed with the console 406. In other embodiments, the probe 404 can be employed with other consoles.

[0021] The console 406 includes an interface 442. The interface 442 is complementary to the interface 440 of the probe 404. In one instance, the interface 440 includes a cable with an electro-mechanical connector and the interface 442 includes an electro-mechanical connector. The interfaces 440 and 442 are configured to mechanically engage each other and establish electrical communication there between, e.g., through pins and sockets and/or otherwise. Alternatively, the interfaces 440 and 442 are wireless interfaces.

[0022] The console 406 includes a transmit circuit 444 that controls the phasing and/or time of actuation of the individual elements of the transducer array 420, which allows for steering and/or focusing the transmitted beam from predetermined origins along the array and at predetermined angles.

[0023] The console 406 further includes a receive circuit 446 that receives signals indicative of the echoes received by the transducer array 420. The receive circuit 446 can beamform (e.g., delays and sums) the echoes into a sequence of focused, coherent echo samples along focused scanlines of a scanplane, and/or otherwise process the echoes.

[0024] The console 406 further includes a controller 448 that controls the transmit circuit 444 and/or the receive circuit 446. Such control may include, but is not limited to, controlling the frame rate, number of scan line groups, transmit angles, transmit energies, transmit frequencies, transmit and/or receive delays, etc.

[0025] The console 406 further includes a scan converter 450 that scan converts the frames of data to generate data for display, for example, by converting the data to the coordinate system of the display. This may include changing the vertical and/or horizontal scan frequency of signal based on the display. Furthermore, the scan converter 450 can be configured to employ analog and/or digital scan converting techniques.

[0026] The console 406 further includes a display 452 that visually presents the rendered data. The display 452 can be integrated in the console 406 or separate therefrom and in electrical communication therewith via a wired and/or wireless connection.

[0027] The console 406 further includes a user interface 454 that includes input and/or output devices for interacting with the controller 448 to select a data acquisition mode (e.g., B-mode), initiate scanning, etc. The user interface 454 may include various controls such as buttons, knobs, a keypad, a touch screen, etc. The user interface 454 may also include various types of visual (e.g., LCD, LED, etc.) and/or audible displays.

[0028] It is to be understood that the relative size, shape and position of the components of the system 402 are provided for explanatory purposes and are not limiting. In other embodiments, at least one of the size, shape and position of at least one of the components is different.

[0029] Figure 5A schematically illustrates an example of the flexor actuator 438, the flexor control system 432, and the flexor 426.

[0030] This example is configured to compensate for the difference in the push and pull length of the guides. For sake of clarity and brevity, only one of the up/down or the left/right articulation sub-systems is shown. However, it is to be understood that the up/down or the left/right articulation sub-systems include the same components, with one controlling up/down articulation and the other controlling left/right articulation.

[0031] The flexor actuator 438 includes a cam 502. In this example, the cam 502 is disc shaped with two, or first and second half-circles 504 and 506. The first half circle 504 has a first radius 508, and the second half circle 506 has a second radius 510. The first radius 508 is larger than the second radius 510. The cam 502 is rotatably affixed at a rotation axis 512 and is configured to rotate about the rotation axis 512.

[0032] The flexor 426 includes a plurality of vertebrae 514. Adjacent pairs of the plurality of vertebrae 514 have two pairs of pivots disposed there between. A first pair of pivots 516 is for left/right (or up/down) articulation. A second pair of pivots 518 (one is behind the other) is for the up/down (or left/right) articulation. The pivots 516 and 518 are all located off-center, with the pivots 518 in a direction transverse or perpendicular to the pivots 516.

[0033] The flexor control system 432 includes guides (e.g., wires, strings, cables, or the like) 520 and 522. The guide 520 is connected at a perimeter of one of the ends

of the larger half circle 504 at a location where the radius transitions from the larger radius 508 to the smaller radius 510. The guide 522 is connected at a perimeter of the other end of the larger half circle 504, also at a location where the radius transitions from the larger radius 508 to the smaller radius 510. The guides 520 and 522 respectively route through the vertebrae 514, outside of the pivots 516 and 518.

[0034] The flexor actuator 438 further includes a lever 524. The lever 524 is stationarily affixed to the cam 502. The lever 524 represents the lever 512 or 514 of Figure 1. Rotating the lever 512 or 514 rotates the cam 502. Such rotation may include clockwise and/or counter-clockwise rotation.

[0035] The plurality of vertebrae 514 are aligned parallel to each other. The cam 502 is oriented so that neither guide 520 or 522 is pulled or pushed. The second half circle 506 faces the plurality of vertebrae 514 and the first half circle 504 faces away from the plurality of vertebrae 514. In this configuration, the articulating member 412 (Figure 4) and the probe head 414 (Figure 4) extend straight along the longitudinal axis 415 (Figure 4), e.g., as shown in Figure 4, and not articulated.

[0036] In Figure 5B, the lever 524 is rotated in a first or counter-clockwise direction 526. This rotates the cam 502 in the first direction 526. This causes the guide 520 to pull on the plurality of vertebrae 514 on one side of the articulating member 412, and the guide 522 to push on the plurality of vertebrae 514 on the other side of the articulating member 412. In this direction, the plurality of vertebrae 514 pivots on the pivots 516 on the one side, which causes the plurality of vertebrae 514 to separate on the other side.

[0037] As shown in Figure 5C, the smaller radius 510 of the half circle 506 slacks off the pull guide for the same rotational movement, relative to a configuration in which the cam 502 has only the larger radius 508, which is shown in Figure 5C in connection with a guide 520' and a second half circle 506'. In Figure 5C, the guide 520' follows a perimeter of the second half circle 506', whereas the guide 520 follows the perimeter of the second half circle 506. This slacking off of the pull guide reduces the stress on the pushed guide. Furthermore, unlike a configuration in which the guides 520 and 522 include springs, the probe head 414 articulates when expected to articulate by the user.

[0038] In general, the cam 502 can have any shape just as long as it provides a guide travel difference between the pull and push sides to reduce the push guide stress. For example, in another embodiment, rather than include the smaller radius 510 with side 506, the cam 502 includes angled sides 702 and 704 as shown in Figure 7. Other configurations are also included herein.

[0039] Figure 6A schematically illustrates another example of the flexor actuator 438.

[0040] This example is configured to compensate for the stress induced in the non-actuated wires. For sake of clarity and brevity, details are shown for only one of the lever/cam/guide sub-systems. However, it is to be understood that both lever/cam/guide sub-systems include the same components and operate the same, with one controlling up/down articulation and the other controlling left/right articulation.

[0041] In this example, the flexor actuator 438 for the left/right articulation includes a circular shaped cam 602 with a sub-cam 604. The cam 602 is rotabaly affixed at the rotation axis 512 and is configured to rotate about the rotation axis 512. The flexor 426 for the left/right articulation is substantially similar to that described in Figures 5A and 5B and thus will not be described in detail again.

[0042] The flexor control system 432 includes a plurality of fixed rotating wheels 606 and a plurality of pivoting rotating wheels 608. The wheels 606 and 608 are all configured to rotate. The wheels 606 are stationarily fixed. The wheels 608 are attached to free ends of pivot members 610, which pivot about pivot points 612. The pivot points 612 are disposed on a translating member 614, which is configured to translate along a rail 616 between the flexor 426 and the cam 524.

[0043] The flexor actuator 438 for the up/down articulation includes a similar circular shaped cam 616 with a sub-cam 618. The cam 616 is rotabaly affixed at a rotation axis 620 and is configured to rotate about the rotation axis 620. A lever 622 is attached to the cam 616 and configured to rotate the cam 616. The flexor 426 for the up/down articulation is also substantially similar to that described in Figures 5A and 5B and thus will not be described in detail again.

[0044] The sub-cam 618 supports a member 624 when the lever 622 is position for no up/down articulation. A translation arm (push) 626 is affixed at one end to the member 624. The member 624 is movable, e.g., on a track which defines a range of movement. When the cam 616 is turned the member 624 moves up the sub-cam 618 and pushes with the translation arm 626 the translating member 614, which causes the pivot members 610 to pivot about the pivot points 612, which will collapse the wheels 608, reducing the stress in the wires 520/522, as described in greater detail next.

[0045] In Figure 6B, the lever 622 is rotated counter-clockwise. This causes down articulation in this example. The member 624 rolls out of the sub-cam 618 and onto the perimeter of the cam 616. As a consequence, the wire 626 moves towards the wheel 628, allowing the translating member 614 to translate towards the articulation member 412. Translation of the translating member 614 results in the pivoting members 610 pivoting towards each other. Such pivoting slacks off the guides 520 and 522 for the left/right articulation.

[0046] In one instance, this mitigates the stress induced on the guides 520 and 522 for the left/right articulation due to the down articulation. The same results when rotating in the opposite direction for up articulation. That is, the translating member 614 will translate, slacking off the guides 520 and 522 for the left/right articulation,

mitigating the stress induced on the guides 520 and 522 due to the up articulation. When operating the lever 524, the corresponding translating member will translate, slacking off the guides and for the up/down articulation, mitigating the stress induced on these guides due to the left and right articulation.

[0047] Another embodiment combines the configurations of Figures 5A or 7 and 6A. For example, with the combined configurations, the embodiment includes two cams, 506 and 616, with a sub-cam on top of each other, fixed to each other. Other combinations are also contemplated herein.

[0048] The application has been described with reference to various embodiments. Modifications and alterations will occur to others upon reading the application. It is intended that the invention be construed as including all such modifications and alterations, including insofar as they come within the scope of the appended claims and the equivalents thereof.

Claims

1. An elongate ultrasound imaging probe (404), comprising:

an articulating member (412), including:

at least two vertebrae elements (514) sequentially arranged along a long axis (415) of the elongate ultrasound imaging probe (404); and
a plurality of pivots (516, 518) located between the at least two vertebrae elements (514), each of the plurality of pivots being disposed off-center relative to the at least two vertebrae elements, and, spatially oriented to provide a pivot point for a different articulation direction of a set of different of articulation directions of a vertebra element of the plurality of vertebrae elements;

a plurality of guides (520, 522; 520', 522'), including at least one guide for each of the different articulation directions; and
an actuator (438)with a set of controls, each control being configured to actuate a different pair of the plurality of guides (520, 522; 520', 522') for controlling opposing articulation directions, the actuator being configured to reduce stress induced in response to the actuator pulling a guide on at least one of a pushed guide or a non-activated guide;
characterized in that the actuator (438) further comprises a disc-shaped cam (502) configured to rotate about a rotation axis (512), the disc-shaped cam including:

a first half circle (504) having a first radius (508) and providing a first guide travel distance; and
a second opposing half circle (506) having a second radius (510) and providing a second guide travel distance, the first radius being larger than the second radius (508) and the first guide travel distance being greater than the second guide travel distance, the first and second half circles (504, 506) corresponding to first and second halves of the disc-shaped cam (502), and the second opposing half circle (506) being configured to face the at least two vertebrae elements (514).

2. The probe of claim 1, wherein a first guide (520; 520') of a pair of guides is affixed at the disc-shaped cam (502) at a location corresponding to a first end of the first half circle (504) at a transition from the first to the second half circles (504, 506), and a second guide (522; 522') of the pair of guides is affixed at the disc-shaped cam (502) at a location corresponding to a second opposing end of the first half circle (504) at a transition from the first to the second half circles (504, 506).

3. The probe of claim 2, wherein the actuator (438) comprises:

a lever (524) affixed to the disc-shaped cam (502), the lever being configured for rotating the disc-shaped cam (502) in coordination with rotation of the lever.

4. The probe of claim 3, wherein the second opposing half circle (506) is configured for guiding one of the first or second guides (520, 522; 520', 522') during articulation.

5. The probe of claim 4, wherein the second opposing half circle (506) is configured for guiding a pulled guide (522; 522') of the first or second guides during articulation, resulting in reduced stress on a pushed guide (520; 520') of the first or second guides.

6. The probe of claim 1, wherein one pair of the guides controls up/down articulation directions and another pair of the guides controls left/right articulation directions.

7. The probe of claim 1, wherein the probe includes a laparoscopic probe.

8. An elongate ultrasound imaging probe (404), comprising:

an articulating member (412), including:

at least two vertebrae elements (514) sequentially arranged along a long axis(415) of the elongate ultrasound imaging probe (404); and
a plurality of pivots (516, 518) located between the at least two vertebrae elements (514), each of the plurality of pivots being disposed off-center relative to the at least two vertebrae elements, and, spatially oriented to provide a pivot point for a different articulation direction of a set of different articulation directions of a vertebra element of the plurality of vertebrae elements;

a plurality of guides (520, 522; 520', 522'), including at least one guide for each of the different articulation directions;
an actuator (438) with a set of controls, each control being configured to actuate a different pair of the plurality of guides (520, 522; 520', 522') for controlling opposing articulation directions, the actuator being configured to reduce stress induced in response to the actuator pulling a guide on at least one of a pushed guide or a non-activated guide;
characterized in that the actuator (438) further comprises a cam (502) configured to rotate about a rotation axis (512), the cam including:

a half circle with a first radius and providing a first guide travel distance; and
angled sides (702, 704) providing a second guide travel distance, the second guide travel distance being less than the first guide travel distance;

wherein the half circle and the angled sides (702, 704) correspond to first and second halves of the cam (502), and the angled sides (702, 704) being configured to face the at least two vertebrae elements (514).

9. An elongate ultrasound imaging probe (404), comprising:

an articulating member (412), including:

at least two vertebrae elements (514) sequentially arranged along a long axis(415) of the elongate ultrasound imaging probe (404); and
a plurality of pivots (516, 518) located between the at least two vertebrae elements (514), each of the plurality of pivots being disposed off-center relative to the at least two vertebrae elements, and, spatially oriented to provide a pivot point for a different articulation direction of a set of different articulation directions of a vertebra element of the plurality of vertebrae elements;

a plurality of guides (520, 522), including at least one guide for each of the different articulation directions;
an actuator (438) with a set of controls, each control being configured to actuate a different pair of the plurality of guides (520, 522) for controlling opposing articulation directions, the actuator being configured to reduce stress induced in response to the actuator pulling a guide on at least one of a pushed guide or a non-activated guide;
characterized in that the actuator (438) comprises:

a first control corresponding to first opposing articulation directions, the first control including: a first cam (602), a first lever (524) and a first guide system (606, 608, 610, 612, 614, 624, 626), the first guide system being configured to control a slack of a pair of guides (520, 522) for the first opposing articulation directions; and
a second control corresponding to second opposing articulation directions, the second control including: a second cam (616, 618), a second lever (622), and a member (614) configured to control the first guide system (606, 608, 610, 612) of the first control.

10. The probe of claim 9, wherein the first guide system (606, 608, 610, 612, 614, 624, 626) includes a slide member, a member (624), a translating member (614), a pivoting member (610) and a set of wheels (608), the set of wheels being attached to the pivoting member, the pivoting member being pivotably attached to the translating member, and the translating member being moveably attached to the slide member.

11. The probe of claim 10, wherein the second cam (616) is circular in shape and includes a sub-cam (618), the sub-cam being configured to support the member (624) when the second lever (622) is not actuated, the member being configured to hold the first guide system (606, 608, 610, 612, 614, 624, 626) at a first position along the slide member.

12. The probe of claim 11, wherein a perimeter of the second cam (616), excluding the sub-cam (618), supports the member (624) when the second lever (622) is actuated, the member being configured to hold the first guide system (606, 608, 610, 612, 614, 624, 626) at a second position along the slide member.

13. The probe of claim 12, wherein the set of wheels (608) is configured to pivot towards each other at the second position, slacking off the pair of guides (520, 522).

14. The probe of claim 13, wherein the slacking off the pair of guides reduces stress induced on the non-activated guides.

15. The probe of any one of claims 9 to 14, wherein the first control is configured to control left/right articulation and the second control is configured to control up/down articulation.

Patentansprüche

1. Längliche Ultraschallbildgebungssonde (404), umfassend:

ein Gelenkteil (412), einschließend:

mindestens zwei Wirbelelemente (514), die sequentiell entlang einer Längsachse (415) der länglichen Ultraschallbildgebungssonde (404) angeordnet sind; und
eine Vielzahl von Drehzapfen (516, 518), die sich zwischen den mindestens zwei Wirbelelementen (514) befinden, wobei jeder der Vielzahl von Drehzapfen in Bezug auf die mindestens zwei Wirbelelemente vom Mittelpunkt versetzt eingerichtet, und räumlich ausgerichtet ist, um einen Drehpunkt für eine unterschiedliche Gelenkrichtung eines Satzes von unterschiedlichen Gelenkrichtungen eines Wirbelelements der Vielzahl von Wirbelelementen bereitzustellen;

eine Vielzahl von Führungen (520, 522; 520', 522'), die mindestens eine Führung für jede der unterschiedlichen Gelenkrichtungen einschließen; und
eine Betätigungsvorrichtung (438) mit einem Satz von Steuerungen, wobei jede Steuerung konfiguriert ist, um ein unterschiedliches Paar von der Vielzahl von Führungen (520, 522; 520', 522') zum Steuern von gegenüberliegenden Gelenkrichtungen zu betätigen, wobei die Betätigungsvorrichtung konfiguriert ist, um Spannung zu verringern, die als Antwort darauf, dass die Betätigungsvorrichtung eine Führung zieht, auf mindestens einer von einer geschobenen Führung oder einer nicht aktivierten Führung erzeugt wird;
dadurch gekennzeichnet, dass die Betätigungsvorrichtung (438) weiter eine scheibenförmige Nocke (502) umfasst, die konfiguriert ist, um sich um eine Drehachse (512) zu drehen, wobei die scheibenförmige Nocke einschließt:

einen ersten Halbkreis (504), der einen ersten Radius (508) aufweist und eine erste Führungsbewegungstrecke bereitstellt; und
einen zweiten gegenüberliegenden Halbkreis (506), der einen zweiten Radius (510) aufweist und eine zweite Führungsbewegungsstrecke bereitstellt, wobei der erste Radius größer ist als der zweite Radius (508) und die erste Führungsbewegungstrecke größer ist als die zweite Führungsbewegungstrecke, der erste und zweite Halbkreis (504, 506) der ersten und zweiten Hälfte der scheibenförmigen Nocke (502) entsprechen, und der zweite gegenüberliegende Halbkreis (506) konfiguriert ist, um den mindestens zwei Wirbelelementen (514) zugewandt zu sein.

2. Sonde nach Anspruch 1, wobei eine erste Führung (520; 520') eines Paars von Führungen an der scheibenförmigen Nocke (502) an einer Stelle angebracht ist, die einem ersten Ende des ersten Halbkreises (504) an einem Übergang vom ersten zum zweiten Halbkreis (504, 506) entspricht, und eine zweite Führung (522; 522') des Paars von Führungen an der scheibenförmigen Nocke (502) an einer Stelle angebracht ist, die einem zweiten gegenüberliegenden Ende des ersten Halbkreises (504) an einem Übergang vom ersten zum zweiten Halbkreis (504, 506) entspricht.

3. Sonde nach Anspruch 2, wobei die Betätigungsvorrichtung (438) umfasst:

einen Hebel (524), der an der scheibenförmigen Nocke (502) angebracht ist, wobei der Hebel konfiguriert ist, um die scheibenförmige Nocke (502) in Abstimmung mit einer Drehung des Hebels zu drehen.

4. Sonde nach Anspruch 3, wobei der zweite gegenüberliegende Halbkreis (506) konfiguriert ist, um eine von der ersten oder zweiten Führung (520, 522; 520', 522') während einer Gelenkverbindung zu führen.

5. Sonde nach Anspruch 4, wobei der zweite gegenüberliegende Halbkreis (506) konfiguriert ist, um eine gezogene Führung (522; 522') von der ersten oder zweiten Führung während einer Gelenkverbindung zu führen, was eine verringerte Spannung auf die geschobene Führung (520; 520') von der ersten oder zweiten Führung zur Folge hat.

6. Sonde nach Anspruch 1, wobei ein Paar der Führungen herauf/herunter-Gelenkrichtungen steuert

und ein anderes Paar der Führungen links/rechts-Gelenkrichtungen steuert.

7. Sonde nach Anspruch 1, wobei die Sonde eine laparoskopische Sonde einschließt.

8. Längliche Ultraschallbildgebungssonde (404), umfassend:

ein Gelenkteil (412), einschließend:

mindestens zwei Wirbelelemente (514), die sequentiell entlang einer Längsachse (415) der länglichen Ultraschallbildgebungssonde (404) angeordnet sind; und
eine Vielzahl von Drehzapfen (516, 518), die sich zwischen den mindestens zwei Wirbelelementen (514) befinden, wobei jeder der Vielzahl von Drehzapfen in Bezug auf die mindestens zwei Wirbelelemente vom Mittelpunkt versetzt eingerichtet, und räumlich ausgerichtet ist, um einen Drehpunkt für eine unterschiedliche Gelenkrichtung eines Satzes von unterschiedlichen Gelenkrichtungen eines Wirbelelements der Vielzahl von Wirbelelementen bereitzustellen;

eine Vielzahl von Führungen (520, 522; 520', 522'), die mindestens eine Führung für jede der unterschiedlichen Gelenkrichtungen einschließen; und
eine Betätigungsvorrichtung (438) mit einem Satz von Steuerungen, wobei jede Steuerung konfiguriert ist, um ein unterschiedliches Paar von der Vielzahl von Führungen (520, 522; 520', 522') zum Steuern von gegenüberliegenden Gelenkrichtungen zu betätigen, wobei die Betätigungsvorrichtung konfiguriert ist, um Spannung zu verringern, die als Antwort darauf, dass die Betätigungsvorrichtung eine Führung zieht, auf mindestens einer von einer geschobenen Führung oder einer nicht aktivierten Führung erzeugt wird;
dadurch gekennzeichnet, dass die Betätigungsvorrichtung (438) weiter eine Nocke (502) umfasst, die konfiguriert ist, um sich um eine Drehachse (512) zu drehen, wobei die Nocke einschließt:

einen Halbkreis mit einem ersten Radius und der eine erste Führungsbewegungstrecke bereitstellt; und
angewinkelte Seiten (702, 704), die eine zweite Führungsbewegungsstrecke bereitstellen, wobei die zweite Führungsbewegungsstrecke kleiner ist als die erste Führungsbewegungsstrecke;
wobei der Halbkreis und die angewinkelten Seiten (702, 704) einer ersten und zweiten Hälfte der Nocke (502) entsprechen, und die angewinkelten Seiten (702, 704) konfiguriert sind, um den mindestens zwei Wirbelelementen (514) zugewandt zu sein.

9. Längliche Ultraschallbildgebungssonde (404), umfassend:

ein Gelenkteil (412), einschließend:

mindestens zwei Wirbelelemente (514), die sequentiell entlang einer Längsachse (415) der länglichen Ultraschallbildgebungssonde (404) angeordnet sind; und
eine Vielzahl von Drehzapfen (516, 518), die sich zwischen den mindestens zwei Wirbelelementen (514) befinden, wobei jeder der Vielzahl von Drehzapfen in Bezug auf die mindestens zwei Wirbelelemente vom Mittelpunkt versetzt eingerichtet, und räumlich ausgerichtet ist, um einen Drehpunkt für eine unterschiedliche Gelenkrichtung eines Satzes von unterschiedlichen Gelenkrichtungen eines Wirbelelements der Vielzahl von Wirbelelementen bereitzustellen;

eine Vielzahl von Führungen (520, 522), die mindestens eine Führung für jede der unterschiedlichen Gelenkrichtungen einschließen; und
eine Betätigungsvorrichtung (438) mit einem Satz von Steuerungen, wobei jede Steuerung konfiguriert ist, um ein unterschiedliches Paar von der Vielzahl von Führungen (520, 522) zum Steuern von gegenüberliegenden Gelenkrichtungen zu betätigen, wobei die Betätigungsvorrichtung konfiguriert ist, um Spannung zu verringern, die als Antwort darauf, dass die Betätigungsvorrichtung eine Führung zieht, auf mindestens einer von einer geschobenen Führung oder einer nicht aktivierten Führung erzeugt wird;
dadurch gekennzeichnet, dass die Betätigungsvorrichtung (438) umfasst:

eine erste Steuerung, die ersten gegenüberliegenden Gelenkrichtungen entspricht, wobei die erste Steuerung einschließt: eine erste Nocke (602), einen ersten Hebel (524) und ein erstes Führungssystem (606, 608, 610, 612, 614, 624, 626), wobei das erste Führungssystem konfiguriert ist, um ein Nachlassen eines Paars von Führungen (520, 522) für die ersten gegenüberliegenden Gelenkrichtungen zu steuern; und
eine zweite Steuerung, die zweiten gegenüberliegenden Gelenkrichtungen entspricht, wobei die zweite Steuerung ein-

schließt: eine zweite Nocke (616, 618), einen zweiten Hebel (622) und ein Teil (614), das konfiguriert ist, um das erste Führungssystem (606, 608, 610, 612) der ersten Steuerung zu steuern.

10. Sonde nach Anspruch 9, wobei das erste Führungssystem (606, 608, 610, 612, 614, 624, 626) ein Gleitteil, ein Teil (624), ein Translationsteil (614), ein Drehteil (610) und einen Satz von Rädern (608) einschließt, wobei der Satz von Rädern am Drehteil befestigt ist, das Drehteil drehbar am Translationsteil befestigt ist und das Translationsteil bewegbar am Gleitteil befestigt ist.

11. Sonde nach Anspruch 10, wobei die zweite Nocke (616) eine kreisförmige Form aufweist und eine Unternocke (618) einschließt, wobei die Unternocke konfiguriert ist, um das Teil (624) zu stützen, wenn der zweite Hebel (622) nicht betätigt wird, wobei das Teil konfiguriert ist, um das erste Führungssystem (606, 608, 610, 612, 614, 624, 626) an einer ersten Stelle entlang des Gleitteils zu halten.

12. Sonde nach Anspruch 11, wobei ein Umfang der zweiten Nocke (616), ausschließlich der Unternocke (618), das Teil (624) stützt, wenn der zweite Hebel (622) betätigt wird, wobei das Teil konfiguriert ist, um das erste Führungssystem (606, 608, 610, 612, 614, 624, 626) an einer zweiten Stelle entlang des Gleitteils zu halten.

13. Sonde nach Anspruch 12, wobei der Satz von Rädern (608) konfiguriert ist, um sich zueinander an der zweiten Stelle zu drehen, sodass das Paar von Führungen (520, 522) nachlässt.

14. Sonde nach Anspruch 13, wobei das Nachlassen des Paars von Führungen Spannung verringert, die auf den nicht aktivierten Führungen erzeugt wird.

15. Sonde nach einem der Ansprüche 9 bis 14, wobei die erste Steuerung konfiguriert ist, um eine links/rechts-Gelenkverbindung zu steuern und die zweite Steuerung konfiguriert ist, um eine herauf/herunter-Gelenkverbindung zu steuern.

Revendications

1. Sonde d'imagerie ultrasonore allongée (404), comprenant :

un élément d'articulation (412), incluant :

au moins deux éléments vertébraux (514) séquentiellement agencés le long d'un axe long (415) de la sonde d'imagerie ultrasonore allongée (404) ; et
une pluralité de pivots (516, 518) situés entre les au moins deux éléments vertébraux (514), chacun de la pluralité de pivots étant disposé décentré par rapport aux au moins deux éléments vertébraux, et, spatialement orienté pour fournir un point de pivotement pour une direction d'articulation différente d'un ensemble de directions d'articulation différentes d'un élément vertébral de la pluralité d'éléments vertébraux ;

une pluralité de guides (520, 522 ; 520', 522'), incluant au moins un guide pour chacune des différentes directions d'articulation ; et
un actionneur (438) avec un ensemble de commandes, chaque commande étant configurée pour actionner une paire différente de la pluralité de guides (520, 522 ; 520', 522') pour commander des directions d'articulation opposées, l'actionneur étant configuré pour réduire la contrainte induite en réponse à l'actionneur tirant un guide sur au moins l'un d'un guide poussé ou d'un guide non activé ;
caractérisée en ce que l'actionneur (438) comprend en outre une came discoïde (502) configurée pour tourner autour d'un axe de rotation (512), la came discoïde incluant :

un premier demi-cercle (504) ayant un premier rayon (508) et fournissant une première distance de déplacement de guidage ; et un second demi-cercle opposé (506) ayant un second rayon (510) et fournissant une seconde distance de déplacement de guidage, le premier rayon étant plus grand que le second rayon (508) et la première distance de déplacement de guidage étant plus grande que la seconde distance de déplacement de guidage, les premier et second demi-cercles (504, 506) correspondant à des première et seconde moitiés de la came discoïde (502), et le second demi-cercle opposé (506) étant configuré pour faire face aux au moins deux éléments vertébraux (514).

2. Sonde selon la revendication 1, dans laquelle un premier guide (520 ; 520') d'une paire de guides est fixé au niveau de la came discoïde (502) à un endroit correspondant à une première extrémité du premier demi-cercle (504) au niveau d'une transition du premier vers le second demi-cercle (504, 506), et un second guide (522 ; 522') de la paire de guides est fixé au niveau de la came discoïde (502) à un endroit correspondant à une seconde extrémité opposée du premier demi-cercle (504) au niveau d'une transition du premier vers le second demi-cercle (504, 506).

3. Sonde selon la revendication 2, dans laquelle l'actionneur (438) comprend :

un levier (524) fixé à la came discoïde (502), le levier étant configuré pour faire tourner la came discoïde (502) en coordination avec la rotation du levier.

4. Sonde selon la revendication 3, dans laquelle le second demi-cercle opposé (506) est configuré pour guider l'un des premiers ou second guides (520, 522 ; 520', 522') durant l'articulation.

5. Sonde selon la revendication 4, dans laquelle le second demi-cercle opposé (506) est configuré pour guider un guide tiré (522 ; 522') des premiers ou seconds guides durant l'articulation, résultant dans une réduction de la contrainte sur un guide poussé (520 ; 520') des premiers ou seconds guides.

6. Sonde selon la revendication 1, dans laquelle une paire des guides commande des directions d'articulation haut/bas et une autre paire des guides commande des directions d'articulation gauche/droite.

7. Sonde selon la revendication 1, dans laquelle la sonde inclut une sonde laparoscopique.

8. Sonde d'imagerie ultrasonore allongée (404), comprenant :

un élément d'articulation (412), incluant :

au moins deux éléments vertébraux (514) séquentiellement agencés le long d'un axe long (415) de la sonde d'imagerie ultrasonore allongée (404) ; et
une pluralité de pivots (516, 518) situés entre les au moins deux éléments vertébraux (514), chacun de la pluralité de pivots étant disposé décentré par rapport aux au moins deux éléments vertébraux, et, spatialement orienté pour fournir un point de pivotement pour une direction d'articulation différente d'un ensemble de directions d'articulation différentes d'un élément vertébral de la pluralité d'éléments vertébraux ;

une pluralité de guides (520, 522 ; 520', 522'), incluant au moins un guide pour chacune des différentes directions d'articulation ;
un actionneur (438) avec un ensemble de commandes, chaque commande étant configurée pour actionner une paire différente de la pluralité de guides (520, 522 ; 520', 522') pour commander des directions d'articulation opposées, l'actionneur étant configuré pour réduire la contrainte induite en réponse à l'actionneur tirant un guide sur au moins l'un d'un guide poussé ou d'un guide non activé ;
caractérisée en ce que l'actionneur (438) comprend en outre une came (502) configurée pour tourner autour d'un axe de rotation (512), la came incluant :

un demi-cercle ayant un premier rayon et fournissant une première distance de déplacement de guidage ; et
des côtés inclinés (702, 704) fournissant une seconde distance de déplacement de guidage, la seconde distance de déplacement de guidage étant plus petite que la première distance de déplacement de guidage ;
dans laquelle le demi-cercle et les côtés inclinés (702, 704) correspondent à des première et seconde moitiés de la came (502), et les côtés inclinés (702, 704) étant configurés pour faire face aux au moins deux éléments vertébraux (514).

9. Sonde d'imagerie ultrasonore allongée (404), comprenant :

un élément d'articulation (412), incluant :

au moins deux éléments vertébraux (514) séquentiellement agencés le long d'un axe long (415) de la sonde d'imagerie ultrasonore allongée (404) ; et
une pluralité de pivots (516, 518) situés entre les au moins deux éléments vertébraux (514), chacun de la pluralité de pivots étant disposé décentré par rapport aux au moins deux éléments vertébraux, et, spatialement orienté pour fournir un point de pivotement pour une direction d'articulation différente d'un ensemble de directions d'articulation différentes d'un élément vertébral de la pluralité d'éléments vertébraux ;

une pluralité de guides (520, 522), incluant au moins un guide pour chacune des différentes directions d'articulation ;
un actionneur (438) avec un ensemble de commandes, chaque commande étant configurée pour actionner une paire différente de la pluralité de guides (520, 522) pour commander des directions d'articulation opposées, l'actionneur étant configuré pour réduire la contrainte induite en réponse à l'actionneur tirant un guide sur au moins l'un d'un guide poussé ou d'un guide non activé ;
caractérisée en ce que l'actionneur (438) comprend:

une première commande correspondant à des premières directions d'articulation opposées, la première commande incluant : une première came (602), un premier levier (524) et un premier système de guidage (606, 608, 610, 612, 614, 624, 626), le premier système de guidage étant configuré pour commander un mou d'une paire de guides (520, 522) pour les premières directions d'articulation opposées ; et
une seconde commande correspondant à des secondes directions d'articulation opposées, la seconde commande incluant : une seconde came (616, 618), un second levier (622) et un élément (614) configuré pour commander le premier système de guidage (606, 608, 610, 612) de la première commande.

10. Sonde selon la revendication 9, dans laquelle le premier système de guidage (606, 608, 610, 612, 614, 624, 626) inclut un élément coulissant, un élément (624), un élément de translation (614), un élément pivotant (610) et un ensemble de roues (608), l'ensemble de roues étant attaché à l'élément pivotant, l'élément pivotant étant attaché de manière pivotante à l'élément de translation, et l'élément de translation étant attaché de manière mobile à l'élément coulissant.

11. Sonde selon la revendication 10, dans laquelle la seconde came (616) est de forme circulaire et inclut une sous-came (618), la sous-came étant configurée pour supporter l'élément (624) quand le second levier (622) n'est pas actionné, l'élément étant configuré pour maintenir le premier système de guidage (606, 608, 610, 612, 614, 624, 626) dans une première position le long de l'élément coulissant.

12. Sonde selon la revendication 11, dans laquelle un périmètre de la seconde (616), à l'exclusion de la sous-came (618), supporte l'élément (624) quand le second levier (622) est actionné, l'élément étant configuré pour maintenir le premier système de guidage (606, 608, 610, 612, 614, 624, 626) dans une seconde position le long de l'élément coulissant.

13. Sonde selon la revendication 12, dans laquelle l'ensemble de roues (608) est configuré pour pivoter les unes vers les autres dans la seconde position, relâchant la paire de guides (520, 522).

14. Sonde selon la revendication 13, dans laquelle le relâchement de la paire de guides réduit la contrainte induite sur les guides non activés.

15. Sonde selon l'une quelconque des revendications 9 à 14, dans laquelle la première commande est configurée pour commander l'articulation gauche/droite et la seconde commande est configurée pour commander l'articulation haut/bas.

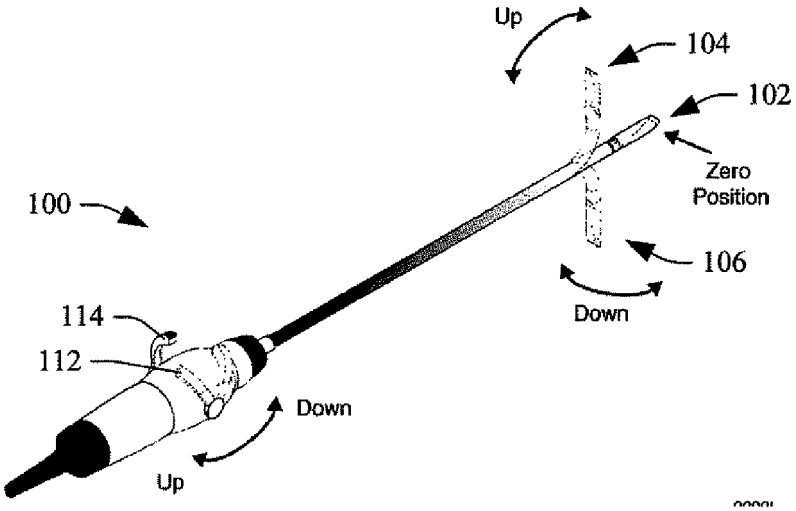

FIGURE 1A
(PRIOR ART)

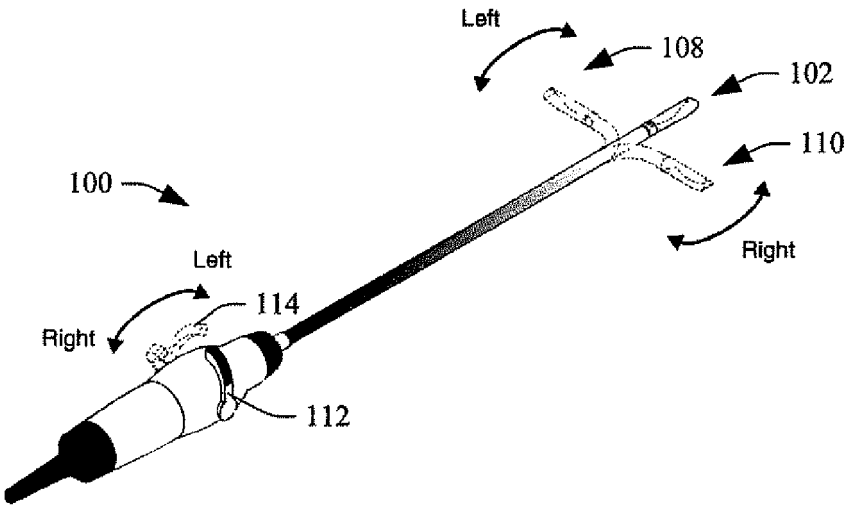

FIGURE 1B
(PRIOR ART)

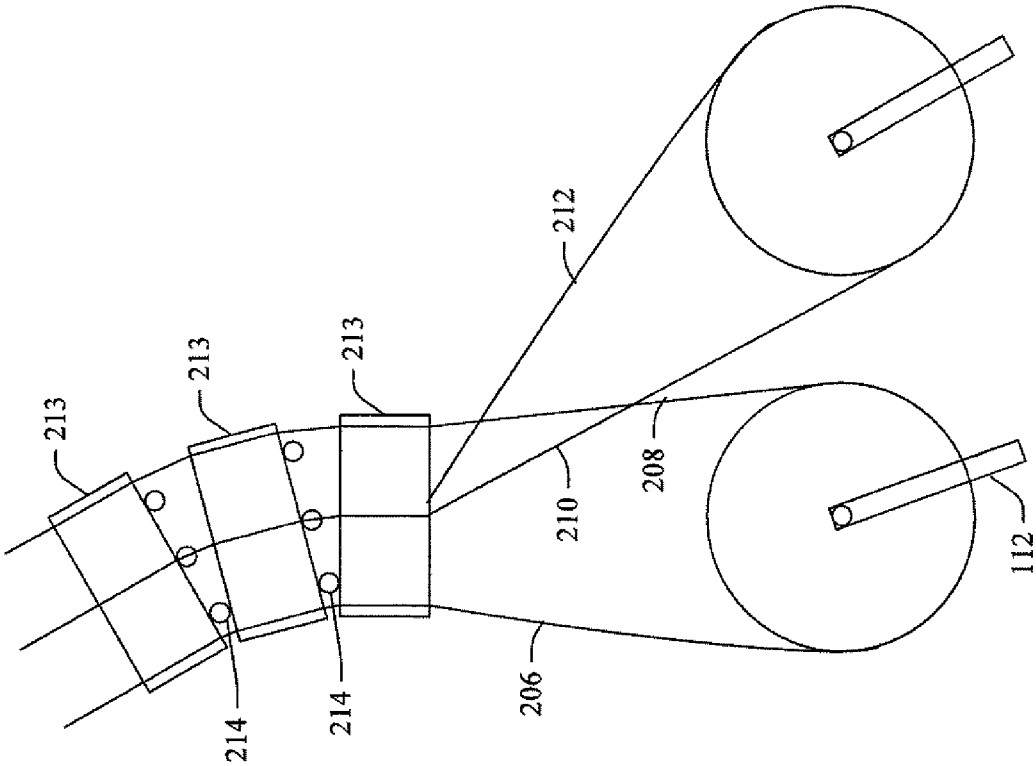

FIGURE 2B
(PRIOR ART)

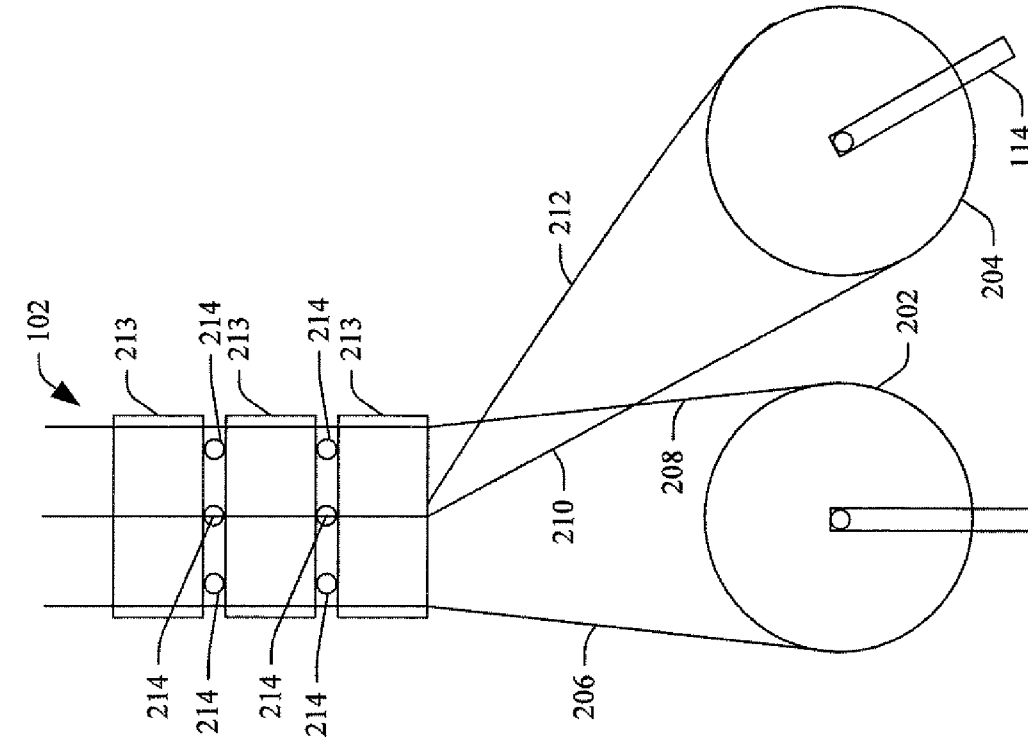

FIGURE 2A
(PRIOR ART)

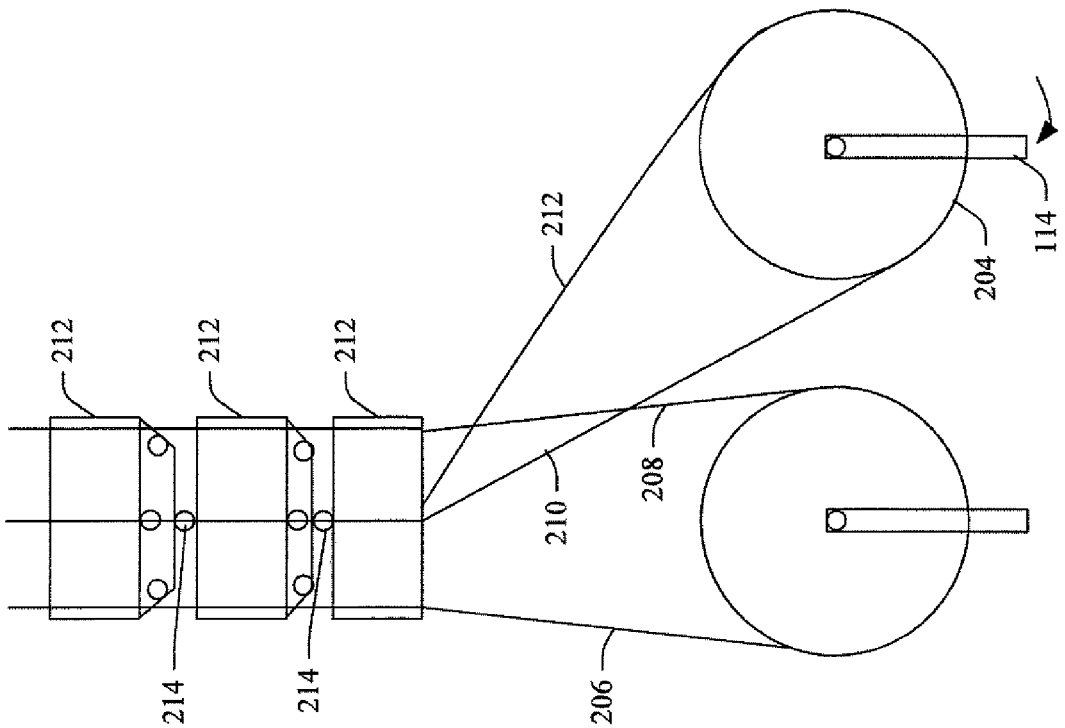

FIGURE 3B
(PRIOR ART)

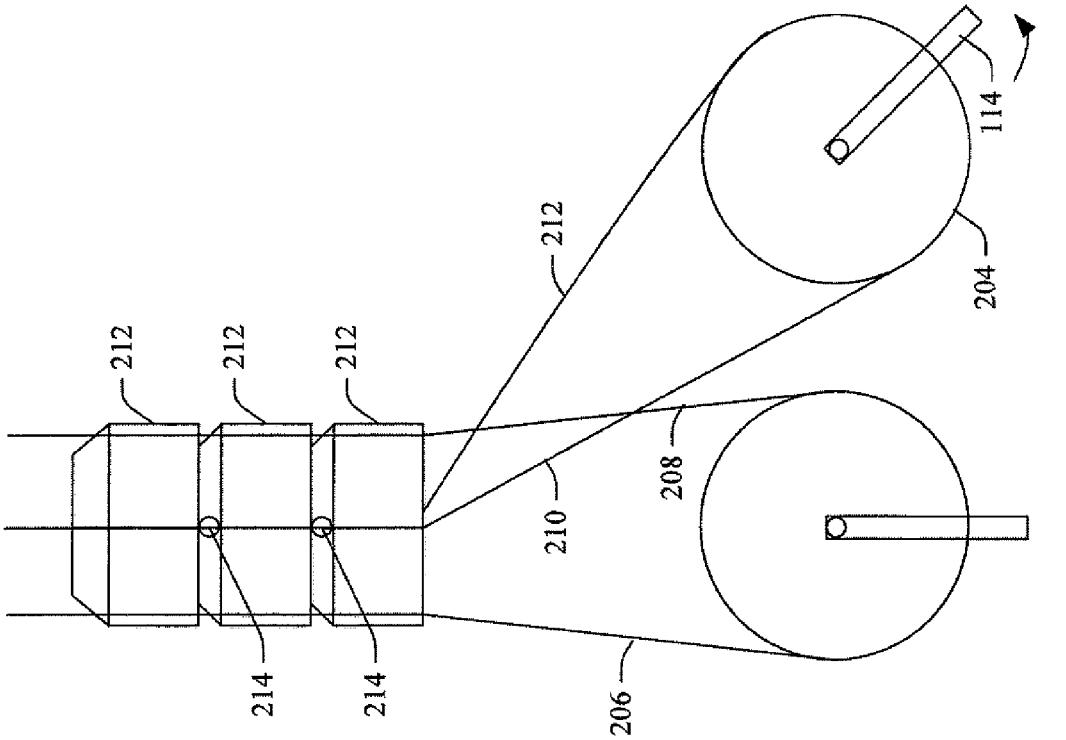

FIGURE 3A
(PRIOR ART)

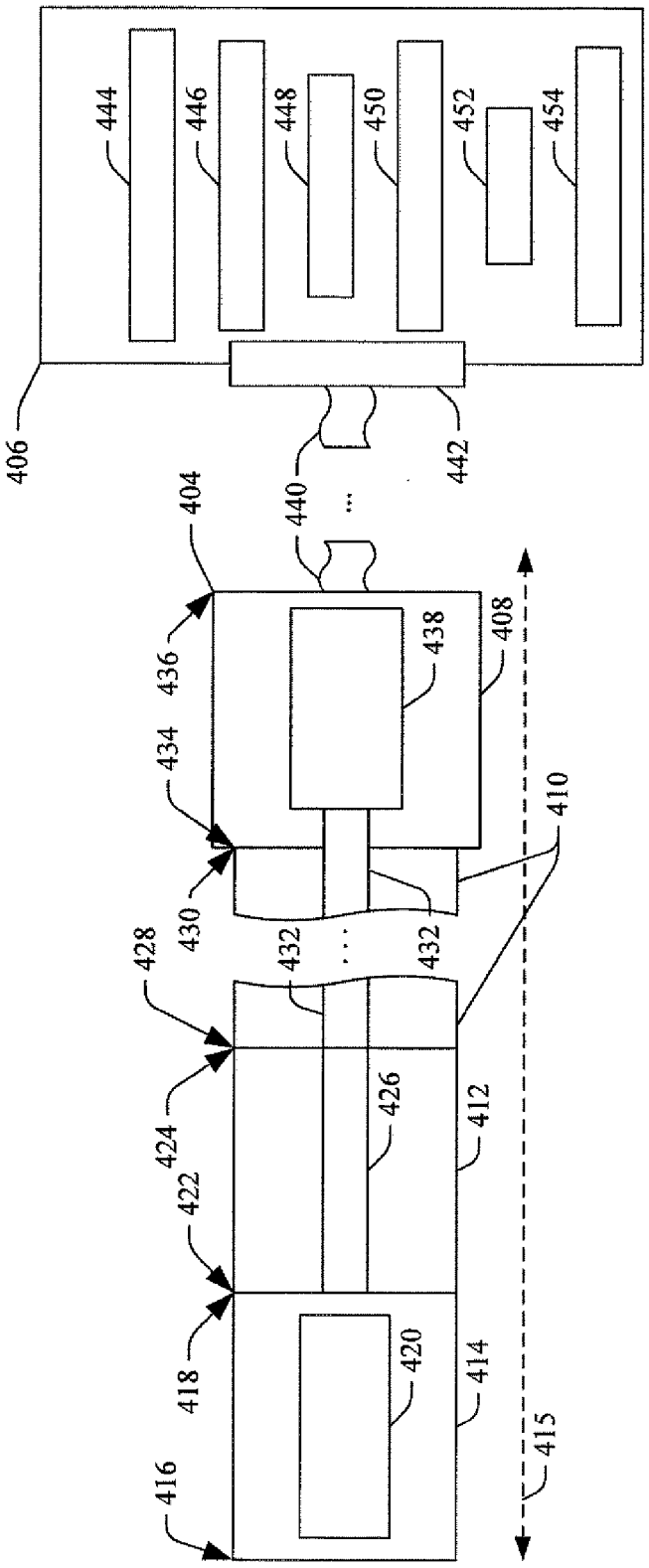
406
444
446
448
450
452
454
440
442
404
436
438
408
434
410
430
428
432
432
424
426
412
422
418
420
414
416
415

FIGURE 4

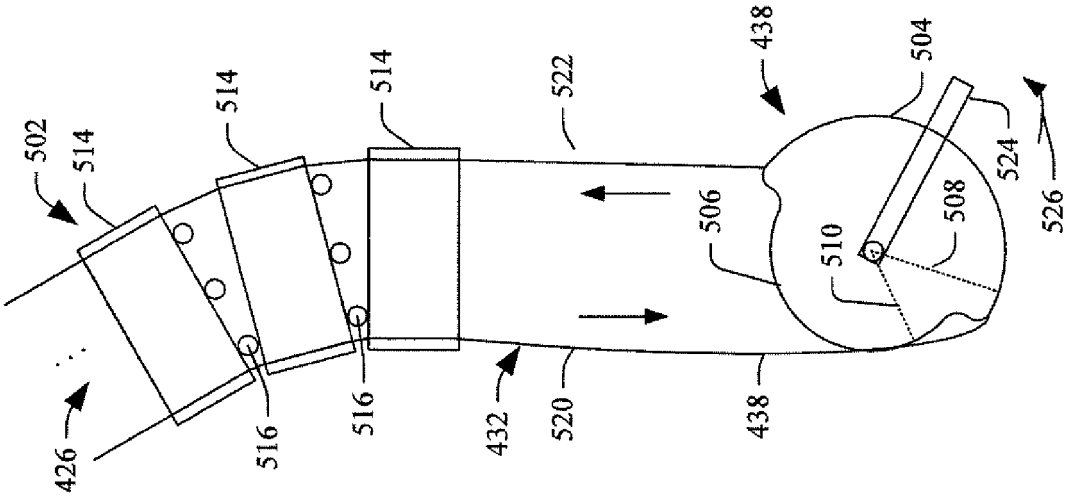

FIGURE 5B

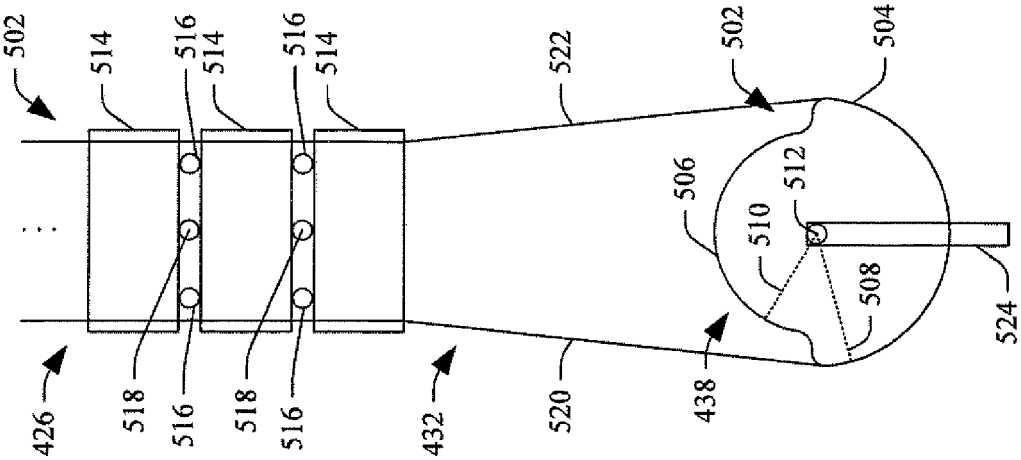

FIGURE 5A

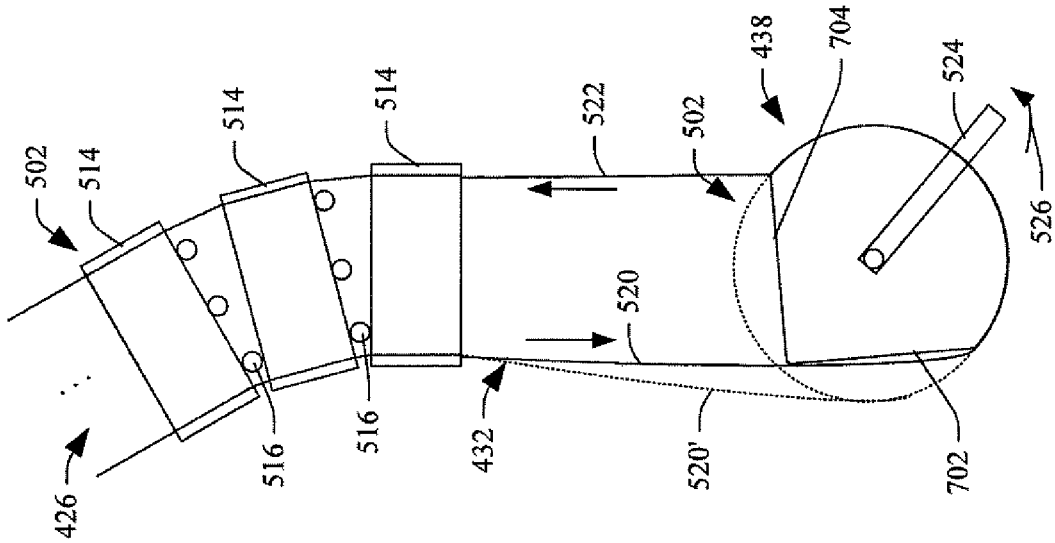

FIGURE 7

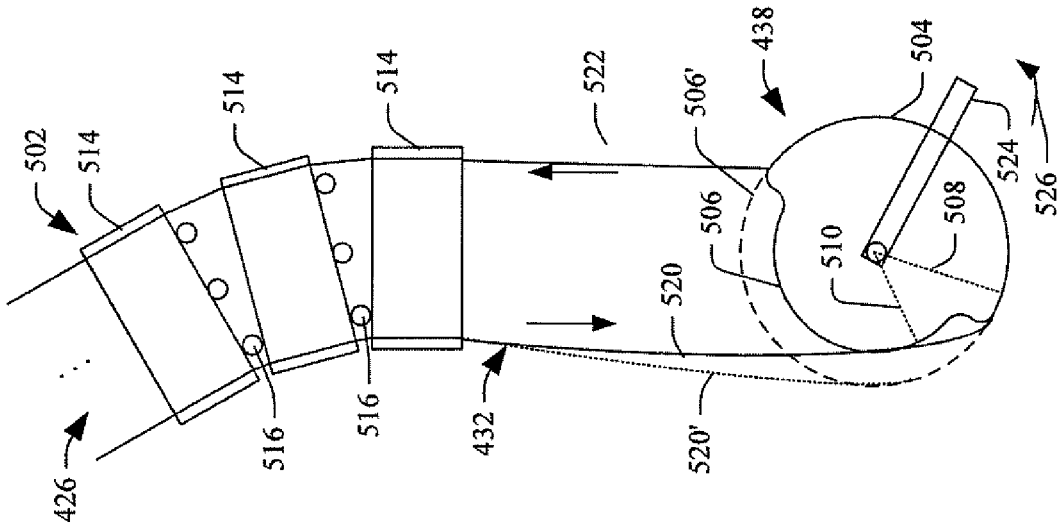

FIGURE 5C

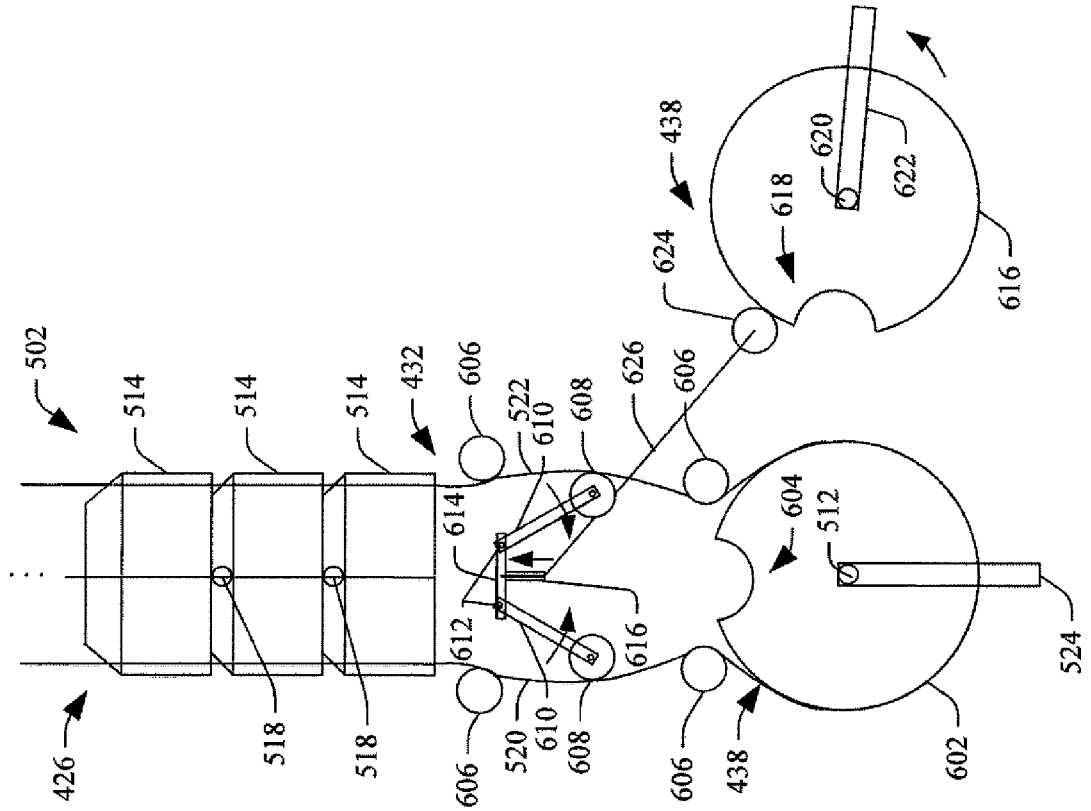

FIGURE 6B

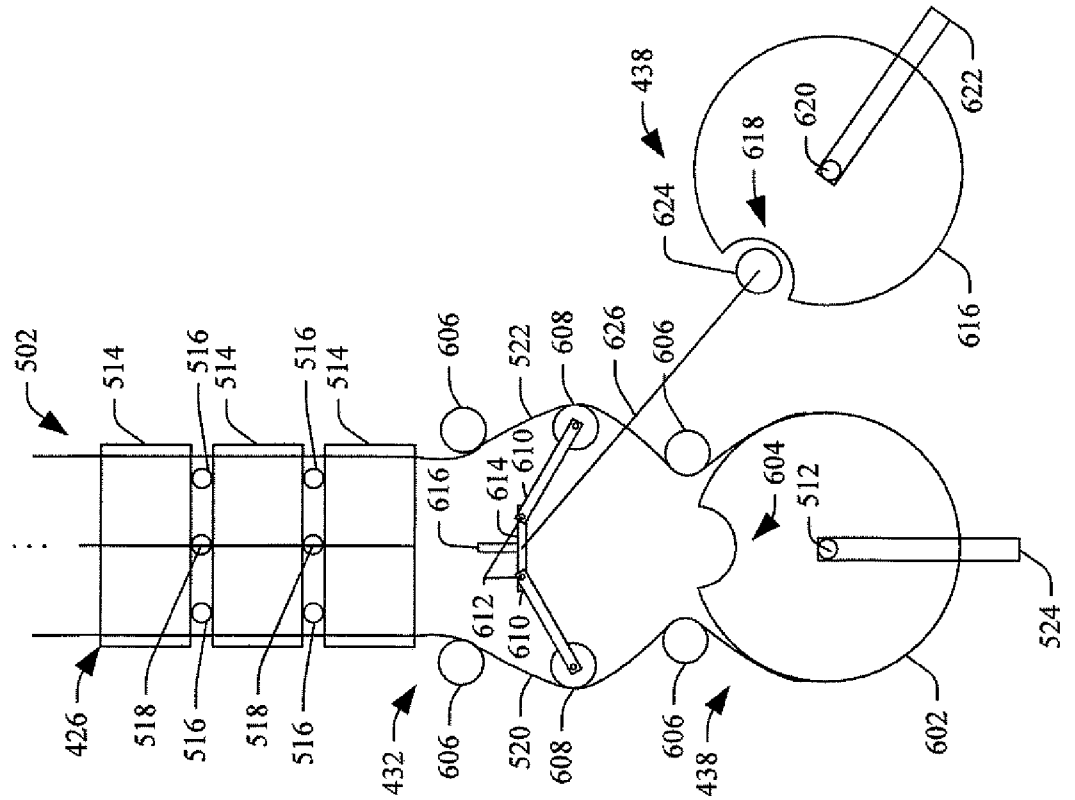

FIGURE 6A

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 5413107 A **[0005]**
- US 20080139886 A **[0006]**
- US 20120046522 A **[0007]**

专利名称(译)	超声成像探头的关节激活线应力消除		
公开(公告)号	EP3244803B1	公开(公告)日	2019-02-20
申请号	EP2015706060	申请日	2015-01-16
[标]申请(专利权)人(译)	B-K医疗公司		
申请(专利权)人(译)	B-ķ医疗APS		
当前申请(专利权)人(译)	B-ķ医疗APS		
[标]发明人	CHRISTENSEN BJARNE LASSE SASADY NIELS CHRISTIAN LL		
发明人	CHRISTENSEN, BJARNE LASSE SASADY, NIELS-CHRISTIAN LL		
IPC分类号	A61B1/00 A61B8/12 A61B8/00 A61B1/008 A61B1/015 A61B1/005 A61B1/267		
CPC分类号	A61B1/008 A61B1/00006 A61B1/00016 A61B1/00133 A61B1/0052 A61B1/0057 A61B1/015 A61B1/267 A61B8/12 A61B8/445		
其他公开文献	EP3244803A1		
外部链接	Espacenet		

摘要(译)

探针包括铰接构件，该铰接构件具有沿细长超声成像探头的长轴顺序布置的至少两个椎骨元件。铰接构件包括位于至少两个椎骨元件之间的枢轴。枢轴相对于至少两个椎骨元件偏心地设置。枢轴在空间上定向以为椎骨元件的不同关节运动方向提供枢转点。探针还包括多个引导件，包括用于各个不同枢转方向中的每一个的至少一个引导件。探针还包括具有一组控制器的致动器，每个控制器配置成致动不同对的多个引导件以控制相对的铰接方向，其中致动器减小在被推动的引导件或未激活的引导件中的至少一个上引起的应力。导向装置，其中响应于致动器拉动导向装置而引起应力。

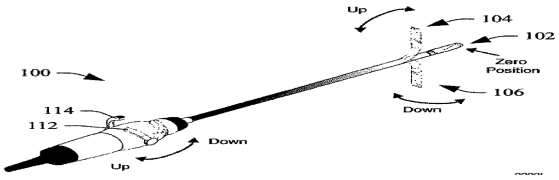

FIGURE 1A
(PRIOR ART)

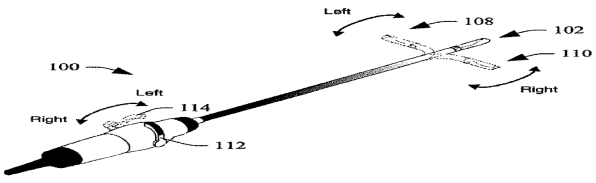

FIGURE 1B
(PRIOR ART)