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(54) MULTI-STRAND BRAIDING DEVICE AND METHOD

MEHRSTRÄNGIGE FLECHTVORRICHTUNG UND VERFAHREN

DISPOSITIF ET PROCÉDÉ DE TRESSAGE DE MULTIPLES MÈCHES

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Description**Field**

[0001] The present disclosure relates to a device and method for intertwining flexible strands of a material, and more particularly relates to a device and method for braiding hair.

Background

[0002] Braiding is widely recognized as a form of hair-styling, and is commonly used to form ropes and other objects. Numerous devices have been developed to assist in braiding or intertwining hair and other materials. These devices are often directed to braiding hair in a flat, three-strand pattern. For example, U.S. Patent No. 4,369,690 discloses a hand held, hand operated device with a set of three elliptical gears, through which the user places his or her hair. By using a rack and pinion connected to a hand crank, two sector gears move the elliptical gears in an alternating pattern, thus forming the braid. Other hair-braiding devices, such as disclosed in U.S. Patent No. 5,988,181, use motors or actuators to move strands about in a set pattern to result in a three-strand braid.

[0003] US Patent Specification 5,067,525 describes a method and apparatus for weaving three-dimensional fabrics. German Patent Specification DE 199 14 878 describes a manual appliance for braiding dreadlocks wherein rotating bodies and carriers braid strands from bobbins into bonded pigtails to be attached to natural hair at the scalp. US Patent Specification 4,369,690 describes a hand held, hand operated hair braiding device having a plurality of aligned gear members, each having an aperture therethrough for passage therethrough of a strand of hair, with a first pair of adjacent gear members having the positions interchanged in response to actuation of a lever member in a first direction, with the remaining gear member then being interchanged with the adjacent one in response to pivoting of the lever member in the reverse direction.

[0004] Existing hair braiding devices, however, exhibit several drawbacks, including disorderly braids, inconsistent performance, and/or difficult operation. Further, the existing devices are limited to repeating a single braiding pattern using three strands.

Summary

[0005] The present disclosure provides a hand-held device and method for intertwining strands of hair in a variety of patterns. In particular, the device comprises a housing, which contains sector gears and elliptical gears, at least one motor, and a controller for controlling the motor. The hand-held braiding device may also comprise a memory unit and a user interface for selecting and storing different braiding patterns.

According to a first aspect of the present invention therefore, there is provided a hand-held device for intertwining strands of hair, characterized by:

a plurality of sector gears disposed in a group of multiple intersecting circles defining an area of intersection between adjacent circles, at least two of the sector gears being non-adjacent;

at least four elliptical gears, each of the at least four elliptical gears being arranged to rotate with any one of the plurality of sector gears that the elliptical gear comes into contact with, wherein each of the at least four elliptical gears has a hollow center portion for receiving one or more strands of hair, each elliptical gear having a shape of and occupying the area of intersection of adjacent sector gears, the positioning of the elliptical gears within the area of intersection of adjacent sector gears preventing the adjacent sector gears from simultaneous rotation, only non-adjacent sector gears of the group being simultaneously rotatable;

at least one motor engaged to rotate at least one of the sector gears; and a controller having a processor configured to execute a set of instructions from any of a plurality of pattern modules by controlling the at least one motor to selectively rotate one or more of the plurality of sector gears and move the adjacent elliptical gears in an intertwining motion according to the set of instructions of one of the pattern modules.

[0006] Another aspect of the present disclosure provides a method for selecting a pattern module for weaving strands. The pattern module may be selected using the user interface of the hand-held braiding device described above. This pattern module may be stored in the memory unit of the device or in a readable media device. The pattern module is loaded into the controller, for example, using the user interface, and the device is operated using an actuator.

According to this second aspect of the invention therefore a method for intertwining a plurality of strands of hair using a hand-held braiding device comprising:

separating a quantity of strands of hair; inserting each of the quantity of strands into a hand-held braiding device, the device comprising:

at least three sector gears, disposed in a group of multiple intersecting circles defining an area of intersection between adjacent circles, at least two of the sector gears being non-adjacent, each of the at least three sector gears being arranged to rotate about one of at least three pivots;

at least four elliptical gears having a hollow center portion therein, wherein the at least four elliptical gears are arranged to be free to rotate with any one of the at least three sector gears,

each elliptical gear having a shape of and occupying the area of intersection of adjacent sector gears, positioning of the elliptical gears within the area of intersection of adjacent sector gears preventing the adjacent sector gears from simultaneous rotation the positioning of the elliptical gears preventing adjacent sector gears from simultaneous rotation, only nonadjacent sector gears of the group being simultaneously rotatable;

at least one motor for independently rotating each of the at least three sector gears;
a controller for controlling the operation of the at least one motor the controller being configured to execute a set of instructions from any of a plurality of pattern modules; and an actuator for moving the adjacent elliptical gears in an intertwinning motion according to the set of instructions of one of the pattern modules; and operating the hand-held braiding device by engaging the actuator to produce a braid.

[0007] Other systems, methods, features, and advantages of the present disclosure will be or become apparent to one with skill in the art upon examination of the following drawings and detailed description. The features, functions and advantages that have been discussed can be achieved independently in various embodiments of the present invention or may be combined in yet other embodiments further details of which can be seen with reference to the following description and drawings.

Brief Description of the Drawings

[0008] Many aspects of the invention can be better understood with reference to the following drawings. The components in the drawings are not necessarily to scale, emphasis instead being placed upon clearly illustrating the principles of the present invention. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views.

FIG. 1 is a schematic illustrating the relationship of the various features according to one embodiment of the present disclosure;

FIG. 2A is a top view one embodiment of a hair-braiding device in accordance with the present disclosure;

FIG. 2B is a side view of the device shown in FIG. 2A;

FIG. 2C is a partial top view, (without the housing), of the device shown in FIG. 2A;

FIGS. 3A - 3D are illustrations depicting the motion of the gears of a hair-braiding device in accordance with the present disclosure; FIG 3E illustrates an embodiment of a gear set.

FIGS. 4A - 4C are illustrations of gear sets in accordance with other embodiments of a hair-braiding de-

vice in accordance with the present disclosure;

FIG. 5A - 5C are illustrations of a sleeve according to one embodiment of the hair-braiding device of the present disclosure;

FIGS. 6A - 6E are illustrations of various steps of a method for forming a four-strand braid according to the present disclosure; and

FIG. 7 is a schematic of one embodiment of a system for selecting a hair-braiding style according to another aspect of the present disclosure.

Detailed Description

[0009] FIG. 1 illustrates one embodiment of the present disclosure, wherein the various features of the hand-held device 100 are represented schematically. In this figure, the features of the device are not represented to scale, but are arranged for convenience in explaining the device. The solid lines between the elements represent the electrical connections from power source 190. The dotted lines represent data or command connections between the various elements and a controller 170. The dashed lines represent the physical connections between the gear set 125 and the at least one motor 140, and between the gear set and the at least one sensor 145. The gear set, which may comprise a conventional set of toothed gears or other strategically shaped items, is driven by at least one motor 140, which is controlled by the controller 170. A plurality of sensors 145 monitor the movement of the gear set 125 and provide data to the controller 170, which is used in the execution of a set of instructions. The instructions are provided to the controller through the memory unit 180 by using a user interface 150. The sectioned line 195 is drawn around the memory unit 180 and the user interface 150 to show that these two features in particular may be separate from the physical hand-held device.

[0010] FIGS. 2A and 2C illustrate another embodiment of a hand-held device 100 according to the present disclosure. The the hand-held device or hair-braiding device 100 comprises a housing 101 with a handle 102 attached thereto. The hair-braiding device 100 also comprises three sector gears 110 and four elliptical gears 120. The sector gears 110 and the elliptical gears 120 are arranged in the housing 101 and are accessible at each of the top and bottom sides of the housing 101 through an opening 105. Each of the elliptical gears 120 is hollow and contains a respective sleeve 130. The various gears are turned by the motors 140, each of which is shown connecting to one of the sector gears 110. Each of the sector gears 110 rotates about a corresponding pivot 115. The illustrated embodiment also shows three sensors 145, each of which is paired with a respective motor 140. The hair-braiding device also comprises an actuator 160.

[0011] FIG. 2B illustrates another embodiment of a hair-braiding device 100 in accordance with the present disclosure, comprising a housing 101 and a handle 102. A user interface 150 is visible on the side of the housing

101. Connector 185 is also visible on the side of the hair-braiding device 100.

[0012] In some embodiments, the housing 101 of the hair-braiding device 100 is comprised of two pieces, an upper housing and a lower housing, which fit together to form the housing 101 having a cavity therein to contain many of the elements of the hair-braiding device 100. Alternatively, the housing 101 may comprise a unitary structure, wherein, for example, the housing comprised two halves that are brought together using a thermoplastic weld. The opening 105 of the housing allows access to the moving parts of the hair-braiding device 100. The material of the housing structure may be comprised of any suitable material, including plastics, metals, and any other material commonly used in the manufacture of household beauty products. The opening 105 may be provided on the top and the bottom of the housing 101, thereby allowing the user to access the gears from either side. Further, the housing 101 may be provided with a protective or decorative cover, which may be used for aesthetic purposes or to cover seams or other parts of the housing 101 in which hair may potentially become caught.

[0013] In various embodiments, the handle 102 may be formed with the housing 101 or as a separate element which is attached to the housing 101 at a later time. In some embodiments, the shape of the handle 102 comprises an ergonomic shape. The handle 102 may also comprise an outer surface formed of foam or another suitable substance for creating a comfortable grip, as may be found commonly in the art.

[0014] In the embodiment shown in FIGS. 2A and 2C, three sector gears 110 and four elliptical gears 120 are visible through the opening 105 in the housing 101. The sector gears 110 are in a shape similar to the profile of a symmetrical apple core in appearance and the elliptical gears are in the approximate shape of an ellipse with two pointed ends. The shape of the sector gears 110 and elliptical gears 120 are complementary, such that by adding the pointed "elliptical" shape of an elliptical gear to each side of the sector gears 110, the objects collectively take the approximate shape of a circle. By arranging the gears in an alternating fashion (elliptical, sector, elliptical, sector, etc.), with the center of each gear forming a straight line, (in a vertical direction looking at FIGS. 2A or 2C), the gear arrangement takes the shape of a series of intersecting circles. See also FIG. 3A.

[0015] The motions of the gears rotate about each of the three pivots 115. Each of the sector gears 110 corresponds to one of the pivots 115, which is located at the center of each of the sector gears 110. In some embodiments the pivot 115 may comprise a pin or other physical feature at the center of the sector gears 110. Alternatively, the pivots 115 may be formed integral to the sector gears 110. In other embodiments, a pivot 115 is merely defined as the location about which the rotation takes place, wherein the motion of the gears is guided, for example, by outer constraints on the movement of the

gears, such as a channel defining the outer bounds of the gear set 125.

[0016] The elliptical gears 120 also rotate about one of the pivots 115, but may rotate about any one of the pivots, depending on the relative position of the elliptical gear. The elliptical gears 120 also rotate about one of the pivots 115, but may rotate about any one of the pivots, depending on the relative position of the elliptical gear. For example, FIGS. 3A-3D demonstrate the relative motion of the gears wherein the gears are rotated about one of the pivots 115 at a time, wherein the arrows show the direction of rotation. FIG. 3A shows the gears in a default position, wherein the gear arrangement takes the shape of a set of intersecting circles, as explained above. FIG. 3B shows a first motion of the gears wherein sector gear 111 is rotated about pivot 116; FIG. 3C shows a second motion wherein sector gear 112 is rotated about pivot 117; and FIG. 3D shows a third motion wherein sector gear 113 is rotated about pivot 118. In some embodiments sector gears 111 and 113 may be rotated simultaneously. By performing these motions in the desired order, the relative position of elliptical gears 120 may be changed. Note, for example, open space 135 (shaded), which changes position through each of FIGS. 3A-3D, as these motions are performed in succession. In some embodiments, the sector gears 110 may be rotated in either direction about the corresponding pivot 115.

[0017] In the embodiment illustrated in FIG. 2C, the motion of the sector gears 110 and elliptical gears 120 is manipulated by three separate motors 140. As shown in FIG. 2C, the motors 140 may be in contact with the sector gears when the gears are in the default position (FIG. 3A). The outlying portions of the sector gears 110 and the perimeter of each of the elliptical gears may include a plurality of teeth. These teeth may then be manipulated by one or more of the motors 140, which may be a worm drive or similar actuator to rotate the gears about any one of the pivots 115 as desired. The teeth of the sector gears 110 of one embodiment of a gear set 125 are visible in FIG. 3E.

[0018] Other motors and arrangements of motors relative to the gears are further contemplated by this disclosure, as may be apparent to one of ordinary skill in the art. For example, in some embodiments, the motors 140 may be rotary in nature and connected to one of the pivots 115, either directly or by some other mechanical device such as a drive belt, thereby turning the respective gears. In this alternative example, the sector gears 110 and elliptical gears 120 may be toothless. In this respect, the use of the term "gear" within the present disclosure may be construed to include a plurality of moving parts which may result in a similar motion.

[0019] In one alternative embodiment, the hand-held device 100 of the present disclosure may comprise one motor 140 which provides power to drive each of the sector gears independently. This alternative arrangement may be achieved using, for example, a clutch for each of the rotating sector gears, wherein the controller oper-

ates the engagement of each clutch.

[0020] The present disclosure further includes alternative embodiments comprising expanded gear sets with the ability to handle more than four strands of hair or filaments. One alternative embodiment is shown in FIG. 4A, wherein the gear set 225 comprises five sector gears 210 and six elliptical gears 220, in a linear arrangement. Similarly, other linear arrangements may be devised comprising "n" sector gears and "n+1" elliptical gears. FIG. 4B illustrates another embodiment of the present disclosure, wherein gear set 325 has 12 elliptical gears arranged around four sector gears. This embodiment is therefore able to weave up to 12 strands of hair or filament at one time. FIG. 4C illustrates another embodiment comprising a gear set 425 arranged in a triangular formation, having seven elliptical gears and three sector gears. Further embodiments with numerous potential arrangements are also contemplated by the present disclosure, as may be apparent to one having ordinary skill in the art.

[0021] As discussed above, the elliptical gears 120 comprise a hollow center for carrying strands of a flexible material. In some embodiments, the hair-braiding device of the present disclosure comprises a plurality of sleeves 130, which fit into the hollow center of the corresponding elliptical gears 120. The sleeves 130 are formed from a flexible material that may be removed from the elliptical gears and replaced. The sleeves 130 may be used to assist in bundling the flexible material into strands (including bundles of individual strands). The sleeves 130 may also be configured to preserve tension on the strands without requiring additional work from a user. This may be accomplished by selecting a tactile material for the sleeves 130.

[0022] FIG. 5 illustrates another embodiment of the present disclosure, wherein the sleeves 530 may be constructed with a surface 535 that substantially fills the hollow space within the elliptical gears. In the embodiment shown in FIG. 5, the sleeve 530 further includes a slot 536, through which the strands may be inserted. The sleeve 530 should be formed of a flexible material, wherein slot 536 exhibits some elastic properties, thereby accommodating various sizes of strands. The elastic properties of sleeve 530 also help to create tension on the strands when in use.

[0023] The present disclosure may be implemented using a variety of mechanisms to hold the strands in place while operating the hand-held device 100. In a further embodiment, for example, the sleeves 130 may be replaced by individual clasps that hold the individual strands in the hollow center portion of the elliptical gears 120. Alternatively, the clasps may be provided at the free end of the strands.

[0024] Referring again to FIG. 2C, the controller 170 sends signals to each of the motors 140, which turn the sector gears 110, thereby rearranging the elliptical gears 120 and the respective strands which pass through the elliptical gears, resulting in the formation of the desired braid. In some embodiments the motors 140 can be con-

trolled to operate in a number of different sequences, each one forming a unique braid. Further, the operation of the motors may be changed from one pattern to another after a specified number of turns, thereby forming a series of alternating braid patterns in the strands of hair or filaments. The hair-braiding device 100 may also comprise a number of sensors 145, which allow the controller to sense the rotation of the gears. In some embodiments, the controller comprises a processor.

[0025] The various braiding patterns discussed above may be stored, for example, as a pattern module comprising a set of instructions. For example, the memory unit 180 may be provided with free space thereon, whereby additional or new patterns may be loaded onto the memory unit 180 and stored therein. The controller 170 may recall any of the stored braiding patterns via user input. Referring again to FIG. 2B, the user input may be provided via the user interface 150. The user interface 150 may be a simple switch or dial or may be provided as a graphical user interface (GUI), as shown, wherein the GUI comprises a touchscreen. In alternative embodiments, the functions of the user interface may be fulfilled using an external computing device, such as a smart phone, or a computer.

[0026] In some embodiments, the pattern modules may be stored in the memory unit using a number of different methods. For example, the user may provide new patterns for the hair-braiding device 100 by uploading them into the device or by using the GUI. Patterns may be uploaded, for example, using connector 185, which may be configured to receive a communications cable, such as a USB interface. Alternatively, the patterns may be uploaded wirelessly, using a suitable communication protocol, such as Bluetooth, Wi-Fi, infrared transmission, or some other type of communication.

[0027] The actuator 160 allows the user to control the starting and stopping of the motor without disrupting the overall set of instructions being executed by the controller 170. The actuator 160, which may alternatively comprise a trigger, button, lever, or switch, allows the user to have direct control over the device. The actuator 160 may further include a spring. In some embodiments, the actuator 160 comprises multiple settings to control the speed of the gears. This may be controlled, for example, based on the amount of force placed on the actuator 160. Also, the actuator 160 may comprise a sliding selector, which may be moved laterally to control the speed of the output.

[0028] The hair-braiding device 100 further comprises a power source 190, which provides electrical power to the various parts of the device. The power source may comprise a battery, an AC connection, and/or the connector 185. The power source may comprise a rechargeable battery in connection with an AC connection and/or power from the connector 185. In FIG. 2C, the embodiment is shown with the power source 190 residing inside the handle 102. In other embodiments, the power source 190 may be located within the housing 101 or external to the device 100.

[0029] In operation, the hair-braiding device 100 of the present disclosure may be used as part of a method for intertwining multiple strands of a flexible material in various braid patterns. In one embodiment, shown in FIG. 6A, the method comprises separating four strands 601 (wherein a strand may be a bundle of individual hairs, filaments, or other flexible material). This flexible material may include flexible metallic elements, fibrous elements, human or animal hair (such as a horse's tail), animal skins, textiles, or any other flexible material that the user may desire to weave. Alternatively, where the strands comprise a bundle of flexible material, the bundle may be temporarily held together with a rubber band or a small strip of paper, as is commonly known in the art.

[0030] In FIG. 6B, the strands 601 are shown being inserted into the sleeves 130. Referring to FIG. 6C, once each of the strands are placed into the sleeves, the sleeves 130 are placed in the hair-braiding device 100 at the center of the elliptical gears 120 (not shown). Alternatively, the strands may be placed directly into the elliptical gears without the sleeves 130 or the sleeves may be left in the elliptical gears 120 while the strands are inserted.

[0031] Next, the user selects the desired pattern and begins operating the hair-braiding device 100 using actuator 160. FIG. 6D illustrates the weaving action of the hair-braiding device 100 when in use. The resulting braid will have a more aesthetic appearance where the correct amount of tension is placed on each strand 601. In some embodiments, this tension is provided by the sleeves 130, as discussed above. Finally, once the weaving action is complete, the hair-braiding device 100, including the sleeves 130, is removed from the ends of the strands.

[0032] Referring to FIG. 6E, the resulting weave or braid is then secured. In some embodiments, the woven strands may be secured by using a tie 602, which may be a ribbon or an elastic band. Alternatively, the woven strands may be secured by singeing, by use of an adhesive, or by another known method.

[0033] Referring to FIG. 7, another aspect of the present disclosure provides a method 700 for selecting a desired pattern module 701 for use with a hair-braiding device in accordance with the present disclosure. As with the various embodiments discussed above, the hair-braiding device 100 may be employed in connection with many other flexible materials in addition to hair. A pattern 701 may be located on an internet server 705, on a computing device 710, (such as a smart phone, tablet, or computer), or on a readable media device 755, (such as, for example, a flash drive, a memory card, a cartridge, or some other proprietary or commonly used design). The pattern module 701 may be downloaded from the internet server 705 to the computing device 710, or from the computing device 710 to the readable media device 755. The pattern module 701 may be stored in the memory unit 735 of the hand-held device 720, or it may be loaded directly into the controller 730. The storing or loading of the pattern module 701 may be accomplished using

wireless communication, as described above, or through a connector, such as cable connector 740 or readable media connector 750. Where a plurality of pattern modules 701 are stored on the memory unit 735, the desired pattern module 701 may be selected using the user interface 725. Alternatively, the function of the user interface 725 may be performed using the computing device 710.

Claims

1. A hand-held device (100, 720) for intertwining strands (601) of hair, **characterized by:**

a plurality of sector gears (110, 111, 112, 113, 210), disposed in a group (125, 225, 325, 425) of multiple intersecting circles defining an area of intersection between adjacent circles, at least two of the sector gears (110, 111, 112, 113, 210) being non-adjacent;

at least four elliptical gears (120, 220), each of the at least four elliptical gears (120, 220) being arranged to rotate with any one of the plurality of sector gears (110, 111, 112, 113, 210) that the elliptical gear (120, 220) comes into contact with, wherein each of the at least four elliptical gears (120, 220) has a hollow center portion for receiving one or more strands (601) of hair, each elliptical gear (120, 220) having a shape of and occupying the area of intersection of adjacent sector gears (110, 111, 112, 113, 210), the positioning of the elliptical gears (120, 220) within the area of intersection of adjacent sector gears (110, 111, 112, 113, 210) preventing the adjacent sector gears (110, 111, 112, 113, 210) from simultaneous rotation, only non-adjacent sector gears (110, 111, 112, 113, 210) of the group (125, 225, 325, 425) being simultaneously rotatable;

at least one motor (140), engaged to rotate at least one of the sector gears (110, 111, 112, 113, 210); and

a controller (170, 730), having a processor, configured to execute a set of instructions from any of a plurality of pattern modules (701) by controlling the at least one motor (140) to selectively rotate one or more of the plurality of sector gears (110, 111, 112, 113, 210) and move the adjacent elliptical gears (120, 220) in an intertwining motion according to the set of instructions of one of the pattern modules (701).

2. The device of claim 1, wherein the plurality of sector gears (110, 111, 112, 113, 210) are of a quantity that is one less than a quantity of the at least four elliptical gears (120, 220).

3. The device of claim 1 or claim 2, wherein each of the at least one motors (140) is connected to a worm drive.
4. The device of any one of claims 1 to 3, further comprising a plurality of pivots (115, 116, 117, 118), each pivot (115, 116, 117, 118) corresponding to one of the sector gears (110, 111, 112, 113, 210), wherein each of the sector gears (110, 111, 112, 113, 210) is configured to rotate about one of the plurality of pivot (115, 116, 117, 118).
5. The device of any one of the preceding claims, further comprising a housing (101) for containing the plurality of sector gears (110, 111, 112, 113, 210), the plurality of elliptical gears (120, 220), and the at least one motor (140); and a top opening in a top of the housing (101) and a bottom opening in a bottom of the housing (101), wherein at least the plurality of elliptical gears (120, 220) are accessible through both the top opening and the bottom opening.
6. The device of any one of the preceding claims, further comprising a plurality of sensors (145), wherein each of the plurality of sensors (145) is configured to monitor rotational displacement relative to each of the plurality of sector gears (110, 111, 112, 113, 210), and wherein the controller (170, 730) is configured to receive data from the sensors (145).
7. The device of any one of the preceding claims, wherein each of the at least four elliptical gears (120, 220) and at least a portion of each of the plurality of sector gears (110, 111, 112, 113, 210) comprise gear teeth on the periphery thereof.
8. The device of any one of the preceding claims, further comprising at least four sleeves (130, 530), each sleeve (130, 530) corresponding to one of the at least four elliptical gears (120, 220), wherein each of the at least four sleeves (130, 530) is configured to be placed in the hollow center portion of one of the at least four elliptical gears (120, 220).
9. The device of claim 8, and wherein each sleeve (130, 530) is formed of a flexible elastic material and includes a slot (536).
10. The device of any one of claims 1 to 7, further comprising a clasp located in the hollow center portion of each elliptical gear (120, 220).
11. The device of any one of the preceding claims, further comprising a graphical user interface (150, 725).
12. The device of any one of the preceding claims, further comprising a memory unit (180).
13. The device of any one of the preceding claims further comprising a connector (185) configurable to receive a communications cable.
14. The device of any one of the preceding claims and wherein the sector gears (110, 210) are in a linear array.
15. A method for intertwining a plurality of strands (601) of hair using a hand-held braiding device (100, 720), comprising:

separating a quantity of strands (601) of hair; inserting each of the quantity of strands (601) into a hand-held braiding device (100, 720), the device (100, 720) comprising:

at least three sector gears (110, 111, 112, 113, 210), disposed in a group (125, 225, 325, 425) of multiple intersecting circles defining an area of intersection between adjacent circles, at least two of the sector gears (110, 111, 112, 113, 210) being non-adjacent, each of the at least three sector gears (110, 111, 112, 113, 210) being arranged to rotate about one of at least three pivots (115, 116, 117, 118);

at least four elliptical gears (120, 220) having a hollow center portion therein, wherein the at least four elliptical gears (120, 220) are arranged to be free to rotate with any one of the at least three sector gears (110, 111, 112, 113, 210), each elliptical gear (120, 220) having a shape of and occupying the area of intersection of adjacent sector gears (110, 111, 112, 113, 210), positioning of the elliptical gears (120, 220) within the area of intersection of adjacent sector gears (110, 111, 112, 113, 210) preventing the adjacent sector gears (110, 111, 112, 113, 210) from simultaneous rotation the positioning of the elliptical gears (120, 220) preventing adjacent sector gears (110, 111, 112, 113, 210) from simultaneous rotation, only nonadjacent sector gears (110, 111, 112, 113, 210) of the group (125, 225, 325, 425) being simultaneously rotatable;

at least one motor (140) for independently rotating each of the at least three sector gears (110, 111, 112, 113, 210);,

a controller (170, 730) for controlling the operation of the at least one motor (140), the controller (170, 730) being configured to execute a set of instructions from any of a plurality of pattern modules (701); and

an actuator (160) for moving the adjacent elliptical gears (120, 220) in an intertwining motion according to the set of instructions

of one of the pattern modules (701); and operating the hand-held braiding device (100, 720) by engaging the actuator (160) to produce a braid.

Patentansprüche

1. Handgehaltene Vorrichtung (100, 720) zum Verweben von Strängen (601) aus Haar, **gekennzeichnet durch:**

eine Vielzahl von Zahnbögen (110, 111, 112, 113, 210), die in einer Gruppe (125, 225, 325, 425) aus mehreren sich durchschneidenden Kreisen angeordnet sind, die zwischen angrenzenden Kreisen einen Schnittflächenbereich definieren, wobei mindestens zwei der Zahnbögen (110, 111, 112, 113, 210) nicht aneinander angrenzen;
mindestens vier elliptische Zahnräder (120, 220), wobei jedes der mindestens vier elliptischen Zahnräder (120, 220) so angeordnet ist, dass es sich mit irgendeinem von der Vielzahl von Zahnbögen (110, 111, 112, 113, 210) dreht, mit dem das elliptische Zahnrad (120, 220) in Kontakt kommt, wobei jedes der mindestens vier elliptischen Zahnräder (120, 220) einen hohlen Mittelteil zum Aufnehmen von ein oder mehreren Strängen (601) aus Haar aufweist, wobei jedes elliptische Zahnrad (120, 220) eine Form des Schnittflächenbereichs von angrenzenden Zahnbögen (110, 111, 112, 113, 210) aufweist und den Schnittflächenbereich von angrenzenden Zahnbögen (110, 111, 112, 113, 210) besetzt, wobei die Positionierung der elliptischen Zahnräder (120, 220) innerhalb des Schnittflächenbereichs von angrenzenden Zahnbögen (110, 111, 112, 113, 210) die angrenzenden Zahnbögen (110, 111, 112, 113, 210) an einer gleichzeitigen Drehung hindert, wobei nur nicht-angrenzende Zahnbögen (110, 111, 112, 113, 210) aus der Gruppe (125, 225, 325, 425) gleichzeitig drehbar sind;
mindestens einen Motor (140), der in Eingriff steht, um mindestens einen der Zahnbögen (110, 111, 112, 113, 210) zu drehen; und
eine Steuerung (170, 730), die einen Prozessor aufweist, der konfiguriert ist, einen Instruktionssatz aus einer Vielzahl von Mustermodule (701) durch das Steuern von mindestens einem Motor (140) auszuführen, um selektiv einen oder mehrere von der Vielzahl von Zahnbögen (110, 111, 112, 113, 210) zu drehen und die angrenzenden elliptischen Zahnräder (120, 220) in einer Verwebebewegung gemäß dem Instruktionssatz von einem der Mustermodule (701) zu bewegen.

2. Vorrichtung nach Anspruch 1, wobei die Vielzahl von Zahnbögen (110, 111, 112, 113, 210) eine Menge ist, die eins weniger als die Menge von den mindestens vier elliptischen Zahnrädern (120, 220) beträgt.

3. Vorrichtung nach Anspruch 1 oder Anspruch 2, wobei jeder von den mindestens einen Motor (140) mit einem Schneckenantrieb verbunden ist.

4. Vorrichtung nach einem der Ansprüche 1 bis 3, ferner umfassend eine Vielzahl von Drehpunkten (115, 116, 117, 118), wobei jeder Drehpunkt (115, 116, 117, 118) einem der Zahnbögen (110, 111, 112, 113, 210) entspricht, wobei jeder der Zahnbögen (110, 111, 112, 113, 210) konfiguriert ist, sich um einen von der Vielzahl von Drehpunkten (115, 116, 117, 118) zu drehen.

5. Vorrichtung nach einem der vorhergehenden Ansprüche, ferner umfassend ein Gehäuse (101) zum Enthalten von der Vielzahl von Zahnbögen (110, 111, 112, 113, 210), der Vielzahl von elliptischen Zahnrädern (120, 220) und dem mindestens einen Motor (140); und eine obere Öffnung in einem Ober- teil des Gehäuses (101) und eine untere Öffnung in einem unteren Teil des Gehäuses (101), wobei mindestens die Vielzahl von elliptischen Zahnrädern (120, 220) durch sowohl die obere Öffnung als auch die untere Öffnung zugänglich ist.

6. Vorrichtung nach einem der vorhergehenden Ansprüche, ferner umfassend eine Vielzahl von Sensoren (145), wobei jeder von der Vielzahl von Sensoren (145) konfiguriert ist, die Drehverschiebung in Bezug auf jeden von der Vielzahl von Zahnbögen (110, 111, 112, 113, 210) zu überwachen, und wobei die Steuerung (170, 730) konfiguriert ist, die Daten von den Sensoren (145) zu empfangen.

7. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei jeder von den mindestens vier elliptischen Zahnrädern (120, 220) und mindestens ein Teil von jedem von der Vielzahl von Zahnbögen (110, 111, 112, 113, 210) Zahnradzähne auf seinem Außenbereich umfasst.

8. Vorrichtung nach einem der vorhergehenden Ansprüche, ferner umfassend mindestens vier Hülsen (130, 530), wobei jede Hülse (130, 530) einem von den mindestens vier elliptischen Zahnrädern (120, 220) entspricht, wobei jede von den mindestens vier Hülsen (130, 530) konfiguriert ist, um in dem hohlen Mittelteil von einem von den mindestens vier elliptischen Zahnrädern (120, 220) platziert zu werden.

9. Vorrichtung nach Anspruch 8, wobei jede Hülse (130, 530) aus einem flexiblen, elastischen Material gebildet ist und einen Schlitz (536) umfasst.

10. Vorrichtung nach einem der Ansprüche 1 bis 7, ferner umfassend eine Klammer, die in dem hohlen Mittelteil von jedem elliptischen Zahnrad (120, 220) lokalisiert ist. 5
11. Vorrichtung nach einem der vorhergehenden Ansprüche, ferner umfassend eine grafische Benutzerschnittstelle (150, 725).
12. Vorrichtung nach einem der vorhergehenden Ansprüche, ferner umfassend eine Speichereinheit (180). 10
13. Vorrichtung nach einem der vorhergehenden Ansprüche, ferner umfassend einen Verbinder (185), der konfigurierbar ist, um ein Kommunikationskabel aufzunehmen. 15
14. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Zahnbögen (110, 210) linear angeordnet sind. 20
15. Verfahren zum Verweben von einer Vielzahl von Strängen (601) aus Haar, wobei eine handgehaltene Flechtvorrichtung (100, 720) verwendet wird, wobei das Verfahren das Folgende umfasst: 25
- Trennen von einer Menge von Strängen (601) aus Haar;
- Einführen von jedem von der Menge von Strängen (601) in eine handgehaltene Flechtvorrichtung (100, 720), wobei die Vorrichtung (100, 720) das Folgende umfasst: 30
- mindestens drei Zahnbögen (110, 111, 112, 113, 210), die in einer Gruppe (125, 225, 325, 425) aus mehreren sich durchschneidenden Kreisen angeordnet sind, die zwischen angrenzenden Kreisen einen Schnittflächenbereich definieren, wobei mindestens zwei der Zahnbögen (110, 111, 112, 113, 210) nicht aneinander angrenzen, wobei jeder von den mindestens drei Zahnbögen (110, 111, 112, 113, 210) so angeordnet ist, dass er sich um mindestens einen von den mindestens drei Drehpunkten (115, 116, 117, 118) dreht; 35
- mindestens vier elliptische Zahnräder (120, 220), die in sich einen hohlen Mittelteil aufweisen, wobei die mindestens vier elliptischen Zahnräder (120, 220) so angeordnet sind, dass sie sich frei mit irgendeinem der mindestens drei Zahnbögen (110, 111, 112, 113, 210) drehen können, wobei jedes elliptische Zahnrad (120, 220) eine Form des Schnittflächenbereichs von angrenzenden Zahnbögen (110, 111, 112, 113, 210) aufweist und den Schnittflächenbereich von 40
- mindestens drei Zahnbögen (110, 111, 112, 113, 210) besetzt, wobei die Positionierung der elliptischen Zahnräder (120, 220) innerhalb des Schnittflächenbereichs von angrenzenden Zahnbögen (110, 111, 112, 113, 210) die angrenzenden Zahnbögen (110, 111, 112, 113, 210) an einer gleichzeitigen Drehung hindert, wobei die Positionierung der elliptischen Zahnräder (120, 220) die angrenzenden Zahnbögen (110, 111, 112, 113, 210) an einer gleichzeitigen Drehung hindert, wobei nur nicht-angrenzende Zahnbögen (110, 111, 112, 113, 210) aus der Gruppe (125, 225, 325, 425) gleichzeitig drehbar sind; 45
- mindestens einen Motor (140), um jeden der mindestens drei Zahnbögen (110, 111, 112, 113, 210) unabhängig zu drehen; eine Steuerung (170, 730) zum Steuern des Betriebs von dem mindestens einen Motor (140), wobei die Steuerung (170, 730) konfiguriert ist, einen Instruktionssatz aus einer Vielzahl von Mustermodulen (701) auszuführen; und 50
- einen Antrieb (160) zum Bewegen der angrenzenden elliptischen Zahnräder (120, 220) in einer Verwebebewegung gemäß dem Instruktionssatz von einem der Mustermodule (701); und Betreiben der handgehaltenen Flechtvorrichtung (100, 720) durch das Eingreifen des Antrieb (160), um einen Zopf herzustellen. 55

angrenzenden Zahnbögen (110, 111, 112, 113, 210) besetzt, wobei die Positionierung der elliptischen Zahnräder (120, 220) innerhalb des Schnittflächenbereichs von angrenzenden Zahnbögen (110, 111, 112, 113, 210) die angrenzenden Zahnbögen (110, 111, 112, 113, 210) an einer gleichzeitigen Drehung hindert, wobei die Positionierung der elliptischen Zahnräder (120, 220) die angrenzenden Zahnbögen (110, 111, 112, 113, 210) an einer gleichzeitigen Drehung hindert, wobei nur nicht-angrenzende Zahnbögen (110, 111, 112, 113, 210) aus der Gruppe (125, 225, 325, 425) gleichzeitig drehbar sind; mindestens einen Motor (140), um jeden der mindestens drei Zahnbögen (110, 111, 112, 113, 210) unabhängig zu drehen; eine Steuerung (170, 730) zum Steuern des Betriebs von dem mindestens einen Motor (140), wobei die Steuerung (170, 730) konfiguriert ist, einen Instruktionssatz aus einer Vielzahl von Mustermodulen (701) auszuführen; und einen Antrieb (160) zum Bewegen der angrenzenden elliptischen Zahnräder (120, 220) in einer Verwebebewegung gemäß dem Instruktionssatz von einem der Mustermodule (701); und Betreiben der handgehaltenen Flechtvorrichtung (100, 720) durch das Eingreifen des Antrieb (160), um einen Zopf herzustellen.

Revendications

1. Dispositif portatif (100, 720) d'entrelacement de mèches (601) de cheveux, **caractérisé par** :

une pluralité de secteurs dentés (110, 111, 112, 113, 210), disposés en un groupe (125, 225, 325, 425) de multiples cercles s'intersectant définissant une zone d'intersection entre des cercles adjacents, au moins deux des secteurs dentés (110, 111, 112, 113, 210) étant non adjacents ;

au moins quatre engrenages elliptiques (120, 220), chacun des au moins quatre engrenages elliptiques (120, 220) étant agencé pour tourner avec l'un quelconque de la pluralité de secteurs dentés (110, 111, 112, 113, 210) avec lesquels l'engrenage elliptique (120, 220) vient en contact, dans lequel chacun des au moins quatre engrenages elliptiques (120, 220) a une portion centrale creuse pour recevoir une ou plusieurs mèches (601) de cheveux, chaque engrenage elliptique (120, 220) ayant une forme de et occupant la zone d'intersection de secteurs dentés

- (110, 111, 112, 113, 210) adjacents, le positionnement des engrenages elliptiques (120, 220) dans la zone d'intersection de secteurs dentés (110, 111, 112, 113, 210) adjacents empêchant les secteurs dentés (110, 111, 112, 113, 210) adjacents de tourner simultanément, seuls les secteurs dentés (110, 111, 112, 113, 210) non adjacents du groupe (125, 225, 325, 425) étant aptes à tourner simultanément ; au moins un moteur (140), mis en prise pour faire tourner au moins l'un des secteurs dentés (110, 111, 112, 113, 210) ; et un dispositif de commande (170, 730), ayant un processeur, configuré pour exécuter un ensemble d'instructions provenant de l'un quelconque d'une pluralité de modules de motif (701) en commandant l'au moins un moteur (140) de faire tourner sélectivement un ou plusieurs de la pluralité de secteurs dentés (110, 111, 112, 113, 210) et de déplacer les engrenages elliptiques (120, 220) adjacents dans un mouvement d'entrelacement selon l'ensemble d'instructions de l'un des modules de motif (701).
2. Dispositif selon la revendication 1, dans lequel la pluralité de secteurs dentés (110, 111, 112, 113, 210) sont présents en une quantité minorée de un par rapport à une quantité des au moins quatre engrenages elliptiques (120, 220).
 3. Dispositif selon la revendication 1 ou la revendication 2, dans lequel chacun de l'au moins un moteur (140) est raccordé à un entraînement par vis sans fin.
 4. Dispositif selon l'une quelconque des revendications 1 à 3, comprenant en outre une pluralité de pivots (115, 116, 117, 118), chaque pivot (115, 116, 117, 118) correspondant à l'un des secteurs dentés (110, 111, 112, 113, 210), dans lequel chacun des secteurs dentés (110, 111, 112, 113, 210) est configuré pour tourner autour de l'un de la pluralité de pivots (115, 116, 117, 118).
 5. Dispositif selon l'une quelconque des revendications précédentes, comprenant en outre un boîtier (101) pour contenir la pluralité de secteurs dentés (110, 111, 112, 113, 210), la pluralité d'engrenages elliptiques (120, 220), et l'au moins un moteur (140) ; et une ouverture de partie supérieure dans une partie supérieure du boîtier (101) et une ouverture de partie inférieure dans une partie inférieure du boîtier (101), dans lequel au moins la pluralité d'engrenages elliptiques (120, 220) sont accessibles à la fois par l'ouverture de partie supérieure et l'ouverture de partie inférieure.
 6. Dispositif selon l'une quelconque des revendications précédentes, comprenant en outre une pluralité de capteurs (145), dans lequel chacun de la pluralité de capteurs (145) est configuré pour surveiller un déplacement rotatif par rapport à chacun de la pluralité de secteurs dentés (110, 111, 112, 113, 210), et dans lequel le dispositif de commande (170, 730) est configuré pour recevoir des données provenant des capteurs (145).
 7. Dispositif selon l'une quelconque des revendications précédentes, dans lequel chacun des au moins quatre engrenages elliptiques (120, 220) et au moins une portion de chacun de la pluralité de secteurs dentés (110, 111, 112, 113, 210) comprennent des dents d'engrenage sur leur périphérie.
 8. Dispositif selon l'une quelconque des revendications précédentes, comprenant en outre au moins quatre manchons (130, 530), chaque manchon (130, 530) correspondant à l'un des au moins quatre engrenages elliptiques (120, 220), dans lequel chacun des au moins quatre manchons (130, 530) est configuré pour être placé dans la portion centrale creuse de l'un des au moins quatre engrenages elliptiques (120, 220).
 9. Dispositif selon la revendication 8, et dans lequel chaque manchon (130, 530) est formé d'un matériau élastique flexible et comporte une fente (536).
 10. Dispositif selon l'une quelconque des revendications 1 à 7, comprenant en outre un fermoir situé dans la portion centrale creuse de chaque engrenage elliptique (120, 220).
 11. Dispositif selon l'une quelconque des revendications précédentes, comprenant en outre une interface utilisateur graphique (150, 725).
 12. Dispositif selon l'une quelconque des revendications précédentes, comprenant en outre une unité de mémoire (180).
 13. Dispositif selon l'une quelconque des revendications précédentes, comprenant en outre un connecteur (185) configurable pour recevoir un câble de communications.
 14. Dispositif selon l'une quelconque des revendications précédentes et dans lequel les secteurs dentés (110, 210) sont dans un réseau linéaire.
 15. Procédé d'entrelacement d'une pluralité de mèches (601) de cheveux à l'aide d'un dispositif de tressage portatif (100, 720), comprenant :
 - la séparation d'une quantité de mèches (601) de cheveux ;
 - l'insertion de chacune de la quantité de mèches

(601) dans un dispositif de tressage portatif (100, 720), le dispositif (100, 720) comprenant :

au moins trois secteurs dentés (110, 111, 112, 113, 210), disposés en un groupe (125, 225, 325, 425) de multiples cercles s'intersectant définissant une zone d'intersection entre des cercles adjacents, au moins deux des secteurs dentés (110, 111, 112, 113, 210) étant non adjacents, chacun des au moins trois secteurs dentés (110, 111, 112, 113, 210) étant agencé pour tourner autour de l'un d'au moins trois pivots (115, 116, 117, 118) ;
 au moins quatre engrenages elliptiques (120, 220), dans lesquels se trouve une portion centrale creuse, dans lequel les au moins quatre engrenages elliptiques (120, 220) sont agencés pour être libres de tourner avec l'un quelconque des au moins trois secteurs dentés (110, 111, 112, 113, 210), chaque engrenage elliptique (120, 220) ayant une forme de et occupant la zone d'intersection de secteurs dentés (110, 111, 112, 113, 210) adjacents, le positionnement des engrenages elliptiques (120, 220) dans la zone d'intersection de secteurs dentés (110, 111, 112, 113, 210) adjacents empêchant les secteurs dentés (110, 111, 112, 113, 210) adjacents de tourner simultanément, le positionnement des engrenages elliptiques (120, 220) empêchant des secteurs dentés (110, 111, 112, 113, 210) adjacents de tourner simultanément, seuls des secteurs dentés (110, 111, 112, 113, 210) non adjacents du groupe (125, 225, 325, 425) étant aptes à tourner simultanément ;
 au moins un moteur (140) pour faire tourner indépendamment chacun des au moins trois secteurs dentés (110, 111, 112, 113, 210) ;
 un dispositif de commande (170, 730) pour commander le fonctionnement de l'au moins un moteur (140), le dispositif de commande (170, 730) étant configuré pour exécuter un ensemble d'instructions provenant de l'un quelconque d'une pluralité de modules de motif (701) ; et
 un actionneur (160) pour déplacer les engrenages elliptiques (120, 220) adjacents en un mouvement d'entrelacement selon l'ensemble d'instructions de l'un des modules de motif (701) ; et
 le fonctionnement du dispositif de tressage portatif (100, 720) en engageant l'actionneur (160) à produire une tresse.

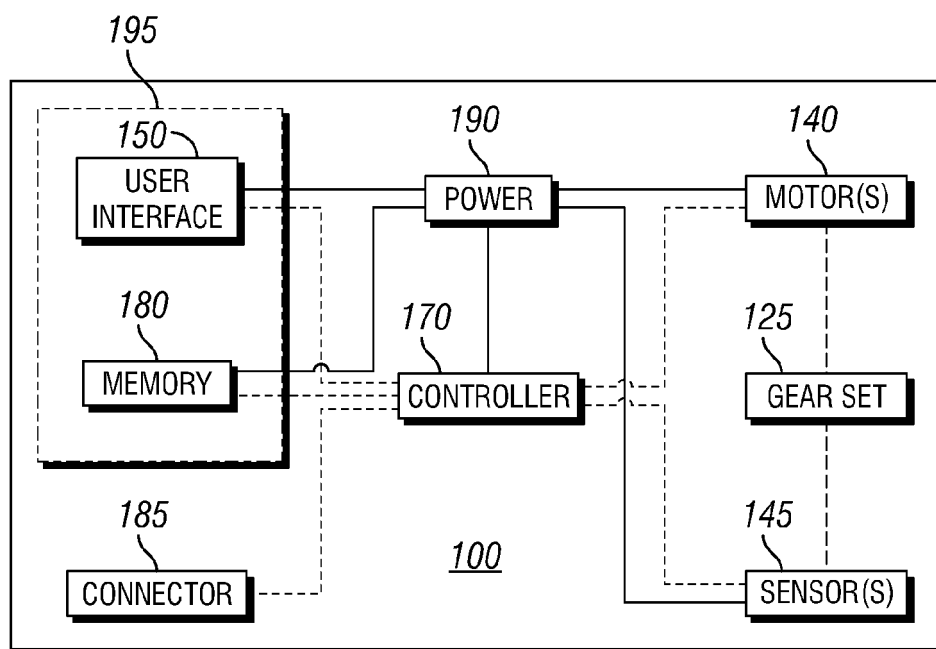


FIG. 1

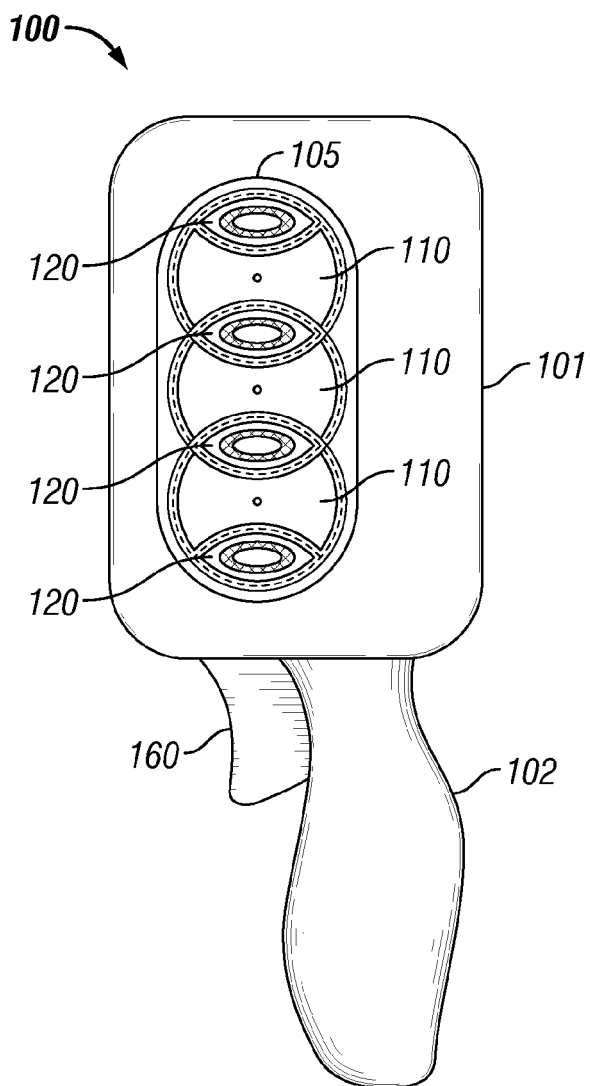


FIG. 2A

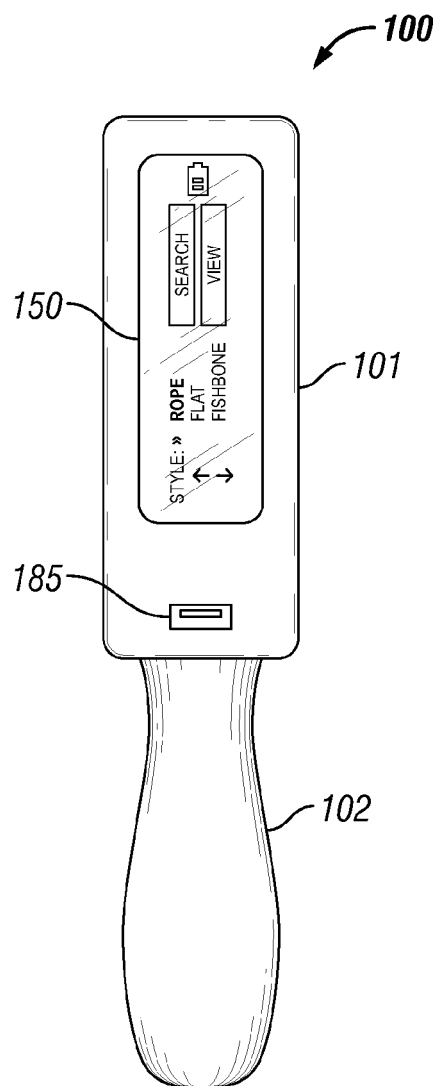


FIG. 2B

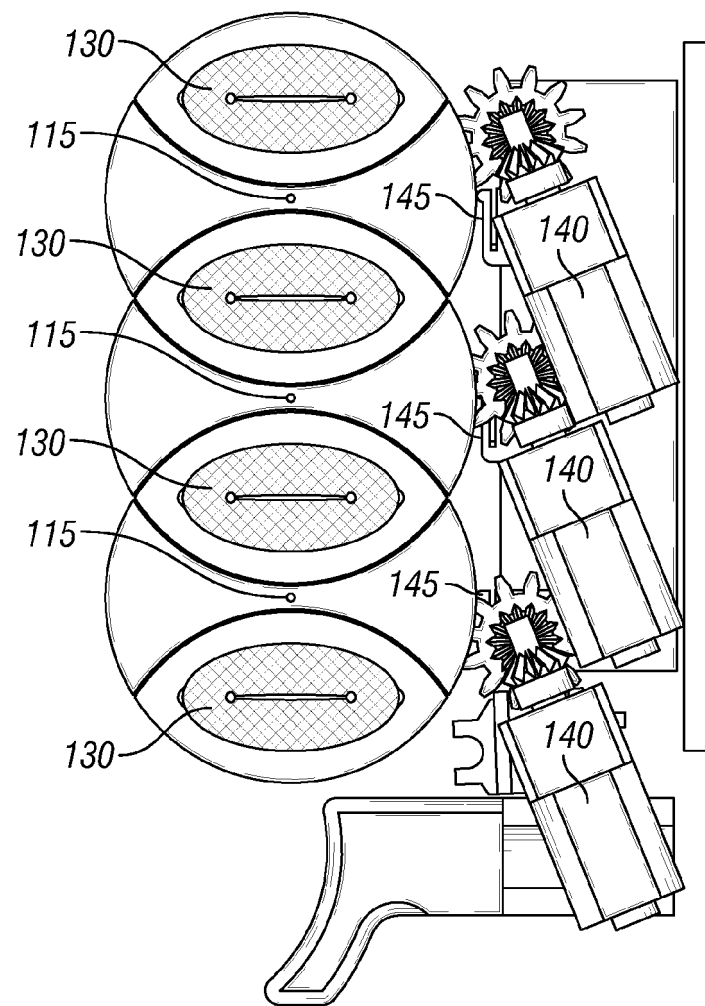


FIG. 2C

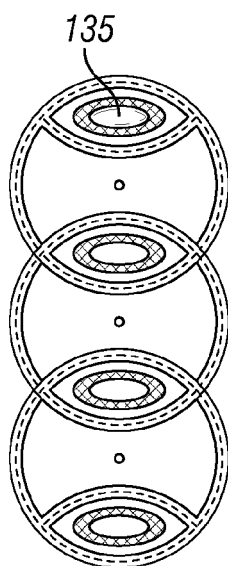


FIG. 3A

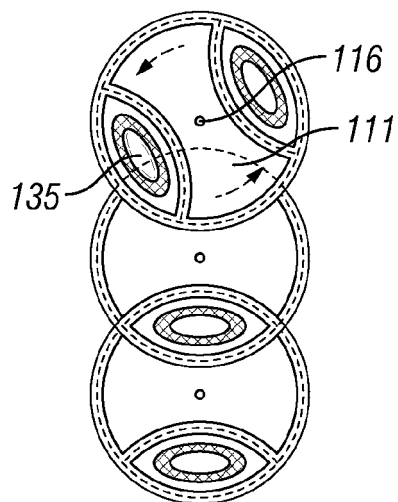


FIG. 3B

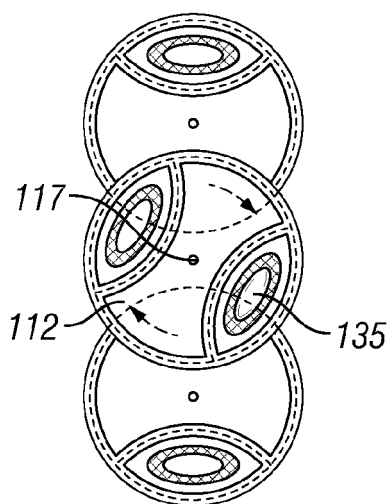


FIG. 3C

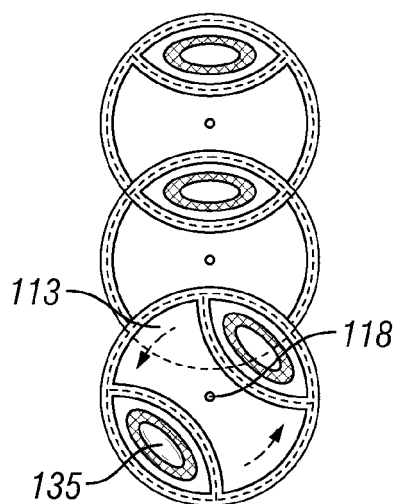


FIG. 3D

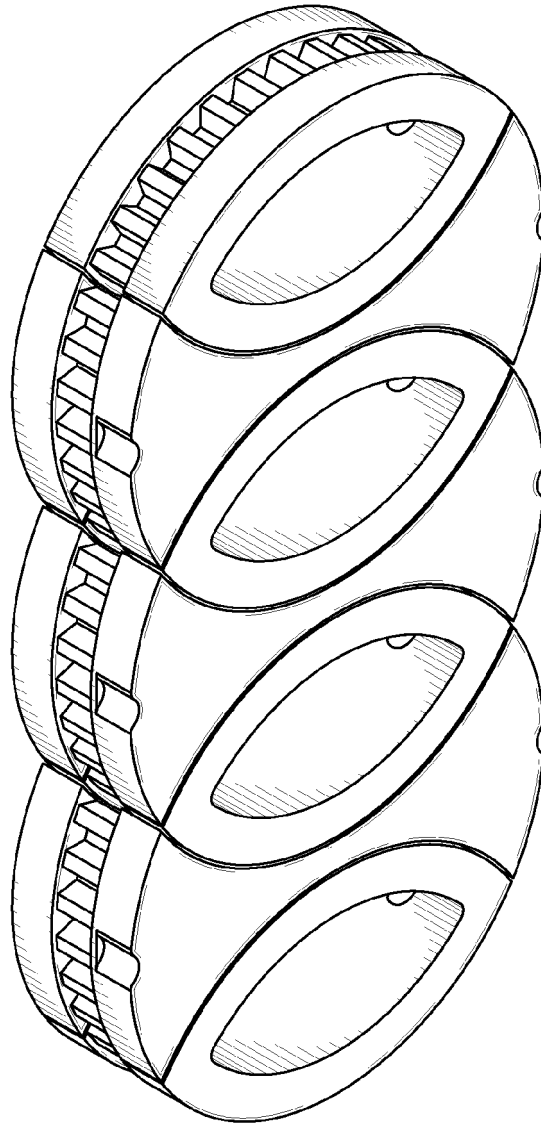


FIG. 3E

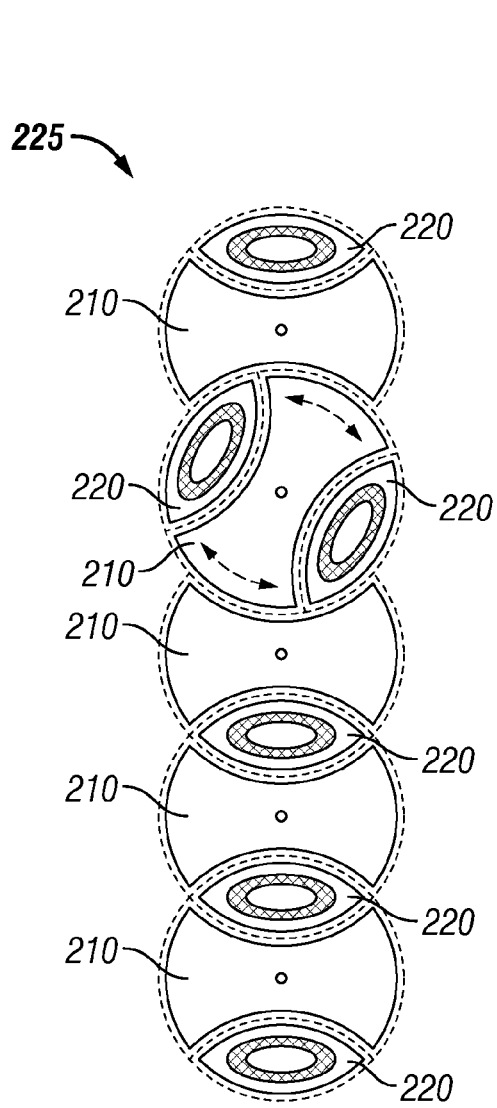


FIG. 4A

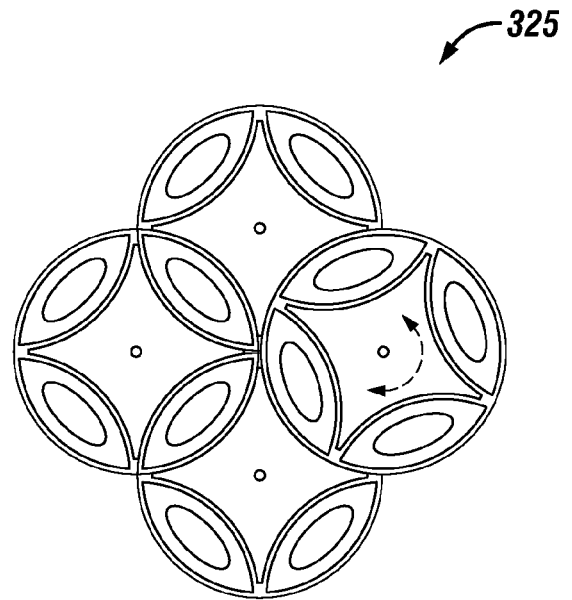


FIG. 4B

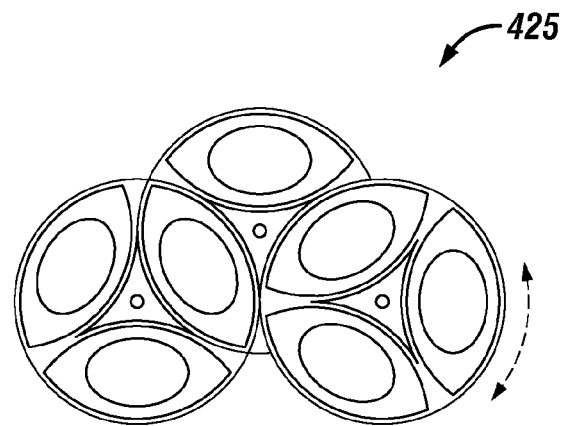


FIG. 4C

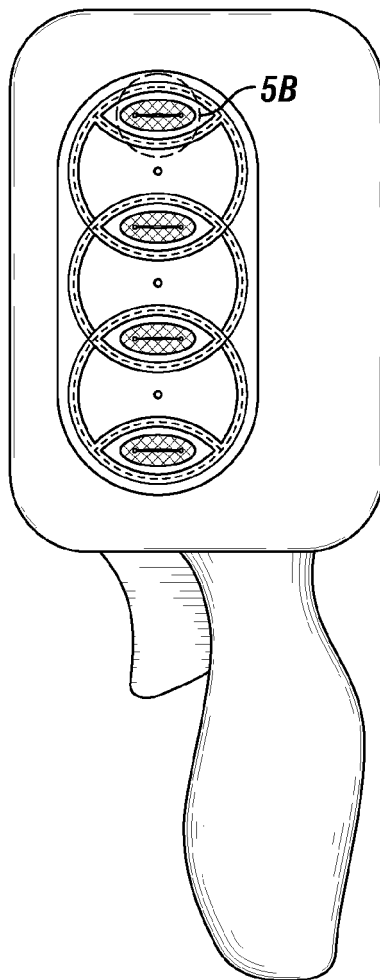


FIG. 5A

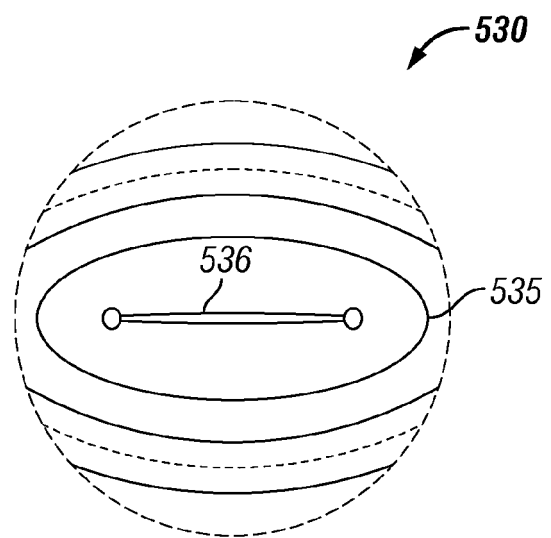


FIG. 5B

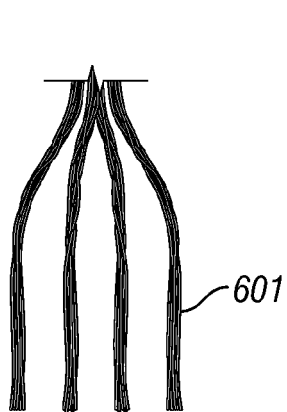


FIG. 6A

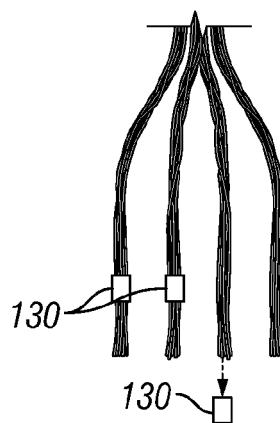


FIG. 6B

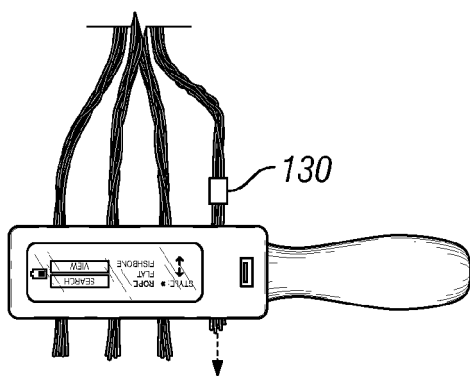


FIG. 6C

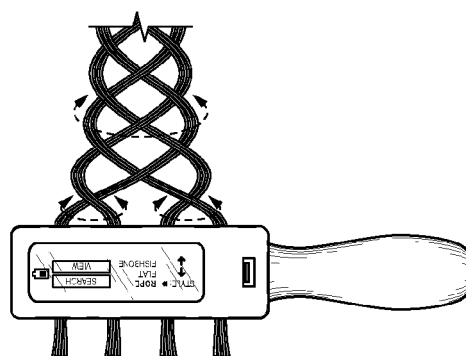


FIG. 6D

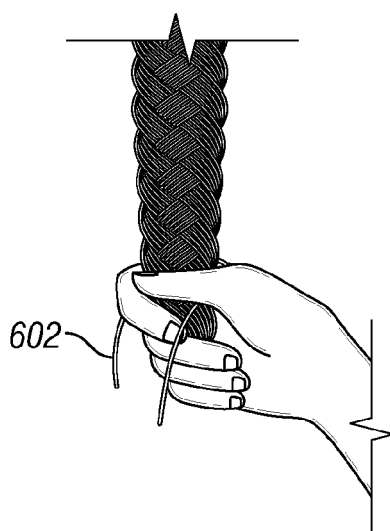


FIG. 6E

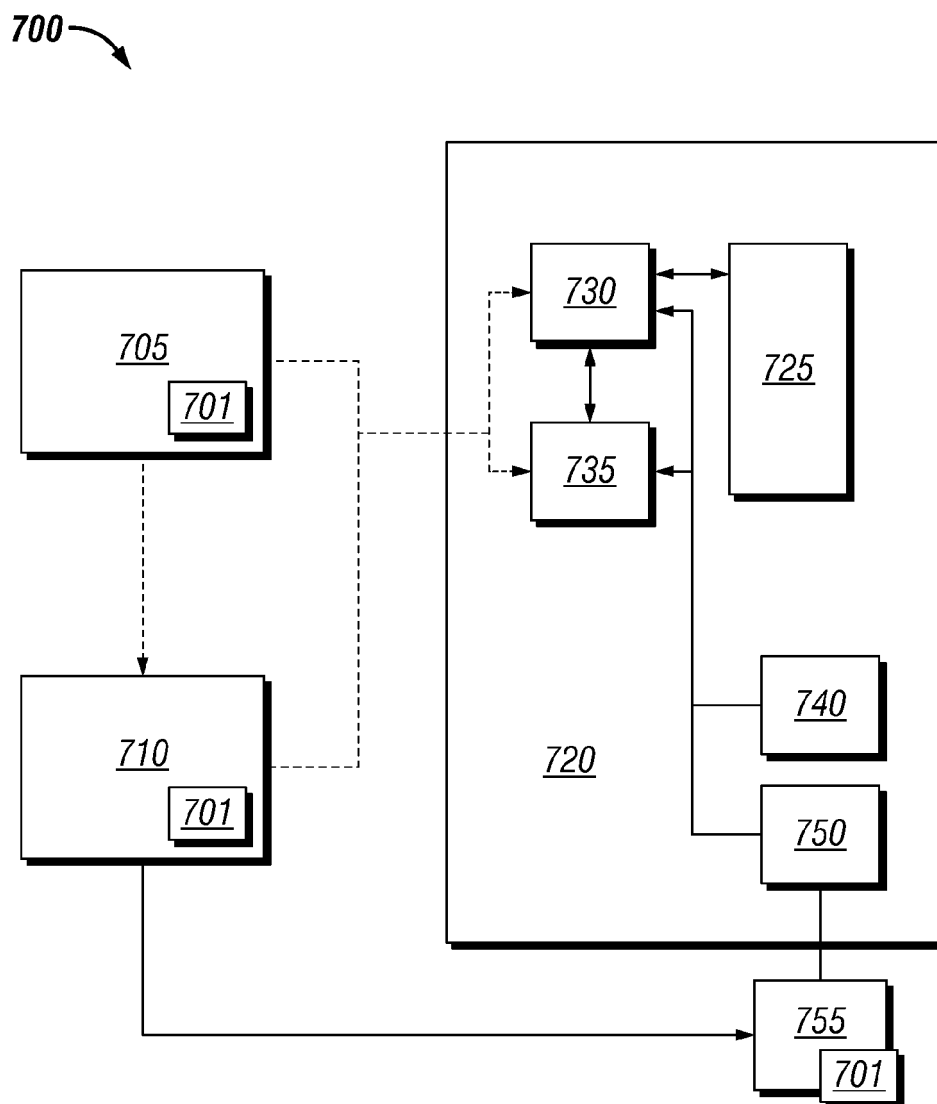


FIG. 7

REFERENCES CITED IN THE DESCRIPTION

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