



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
02.11.2011 Bulletin 2011/44

(51) Int Cl.:
A44C 5/10 (2006.01)

(21) Application number: **11163969.6**

(22) Date of filing: **27.04.2011**

(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
Designated Extension States:
BA ME

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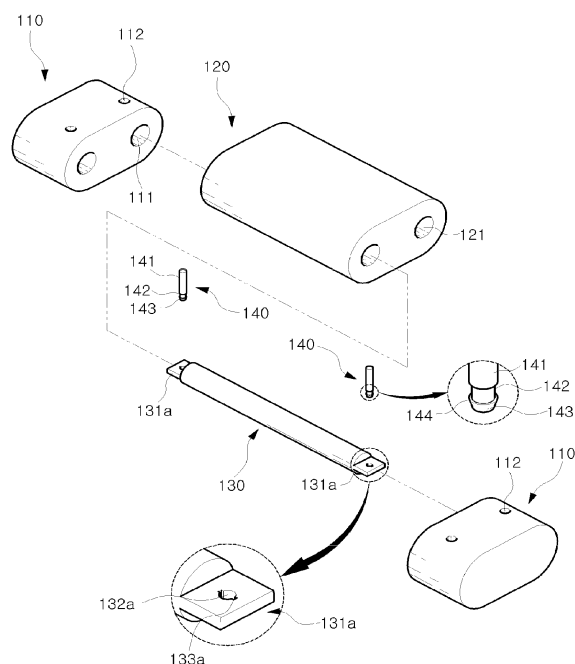
(30) Priority: **28.04.2010 KR 20100039600**

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(54) **Watch strap having permanent assembly structure based on characteristics of ceramics**

(57) The present invention relates to a watch strap, which is made of a special material such as ceramics to have high strength and a smooth surface and includes a permanent assembly structure allowing easy securing of fastening pins (140) through press-fitting of the fastening pins while providing high fastening force. The watch strap includes outer connecting pieces (110), each including a pair of pin grooves (111) formed at one side thereof and a pair of insertion grooves (112) formed at a back side thereof to communicate with the corresponding pin grooves, a central connecting piece (120) having a pair of pin holes (121) penetrating the central connecting piece to correspond to the pin grooves of the outer connecting pieces, connecting pins (130) each including a fastening part (131a) having fastening holes (132a) formed at opposite ends of the fastening part, and a fastening pin having a latching step (144) formed at one end of the fastening pin. The fastening part of each of the connecting pins is inserted into the pin groove of the outer connecting piece through the pin hole of the central connecting piece, and the fastening pin is press-fitted into the fastening hole of the connecting pin through the insertion groove of the outer connecting piece and supported on the connecting pin by the latching step.

[Figure 3]



Description

1. Field of the Invention

[0001] Embodiments of the invention relate to watch straps having a permanent assembly structure based on characteristic of ceramics and, more particularly, to a watch strap which is made of a special material such as ceramics to have high strength and a smooth surface, and includes a permanent assembly structure allowing easy securing of fastening pins through press-fitting of the fastening pins while providing high fastening force.

2. Description of the Related Art

[0002] Generally, watch straps for wrist watches may be categorized into a rubber band type watch strap and a metal chain type watch strap.

[0003] The rubber band type watch strap has a simple structure to allow easy manufacture and is made of a light material to provide good wearing sensation. However, the rubber band type watch strap has inferior appearance to the metal chain type watch strap and is not suitable for some watches, such as luxury watches, which require not only functionality but also a polished design and quality.

[0004] The metal chain type watch strap may be fabricated in a variety of shapes and has a substantially semi-permanent lifespan due to characteristics of the metallic material.

[0005] In addition to the rubber band type and the metal chain type watch straps, hard materials such as ceramics have recently been used to fabricate a chain-type watch strap. Particularly, since zirconia is not scratched due to high strength approaching that of diamond, and can maintain excellent gloss, a zirconia watch strap has attracted attention in the art.

[0006] However, since the ceramic material has high strength and a smooth surface, a chain type watch strap made of a special material such as ceramics has a problem of abrasion of pins used for connection of the chain structure, causing difficulty in permanent securing of the pins and allowing only very restrictive use of the pin connection structure.

[0007] For example, Figures 1 and 2 are an exploded perspective view and a cross-sectional view of a conventional ceramic watch strap.

[0008] Referring to Figures 1 and 2, the conventional ceramic watch strap 200 is composed of three components in each node of the watch strap, that is, an outer connecting piece 50 at one side of the strap, a middle connecting piece 60 at the middle thereof, and an outer connecting piece 50 at the other side thereof. Each of the outer connecting pieces 50 is formed at an inner side thereof with pin grooves 51, which are separated from each other by a predetermined distance. The outer connecting piece 50 further includes through holes 52 which are located at a back side thereof to communicate with

the pin grooves 51. Each of the middle connecting pieces 60 is formed with pin holes 61, which are separated a predetermined distance from each other and penetrate the middle connecting piece 60. Each of the pin holes 61 of the middle connecting piece 60 is connected to the pin grooves 51 of the outer connecting pieces 50 at both sides of the watch strap via a connecting pin 70, which is inserted into the pin hole of the middle connecting piece 60. The connecting pin 70 is formed at opposite sides thereof with screw holes 71. Screws 80 are coupled to the screw holes 71 of the connecting pin 70 through the through-holes 52 of the outer connecting piece 50.

[0009] In such a conventional ceramic watch strap, however, since the screws are made of steel which is in turn worn down by the high strength ceramics, there is a problem in that the watch strap may fall apart when used for a long period of time.

[0010] Since such a phenomenon of the watch strap falling apart causes the watch strap to have an unpleasant appearance and deteriorates product reliability, there is a need for an improved watch strap which can prevent such a problem. Furthermore, since there is no reason to disassemble nodes of the watch strap except for nodes for length adjustment, application of a screw fastening structure to a fixed node which does not require assembly/disassembly of a pin results in extended manufacturing time and high component costs, thereby causing an increase of manufacturing costs.

SUMMARY OF THE INVENTION

[0011] Embodiments of the invention are conceived to solve the problems of the related art, and an aspect of the invention is to provide a watch strap, which is made of a special material such as ceramics to have high strength and a smooth surface and includes a permanent securing structure allowing easy securing of a fastening pin while providing high fastening force.

[0012] In accordance with one embodiment of the invention, a ceramic watch strap includes: outer connecting pieces, each including a pair of pin grooves formed at one side thereof and a pair of insertion grooves formed at a back side thereof to communicate with the corresponding pin grooves; a central connecting piece having a pair of pin holes penetrating the central connecting piece to correspond to the pin grooves of the outer connecting pieces; connecting pins each including a fastening part having fastening holes formed at opposite ends of the fastening part; and fastening pins having a latching step formed at one end of the fastening pin, wherein the fastening part of each of the connecting pins is inserted into the pin groove of the outer connecting piece through the pin hole of the central connecting piece, and the fastening pin is press-fitted into the fastening hole of the connecting pin through the insertion groove of the outer connecting piece and supported on the connecting pin by the latching step.

[0013] At least the outer connecting pieces and the

central connecting piece may be composed of a ceramic material.

[0014] The fastening pin may have a diameter to be inserted into the insertion groove and include a fastening hole-engaging portion having a predetermined length and a depression formed around a circumference thereof to form upper and lower latching jaws.

[0015] The fastening pin may include a tail extending from a lower side of the fastening hole-engaging portion and having a gradually decreasing diameter.

[0016] The fastening part of the connecting pin may have a plate shape and may be formed at a center thereof with the fastening hole.

[0017] The fastening part of the connecting pin may be provided with at least one guide aperture extending from the fastening hole to communicate therewith.

[0018] The fastening part of the connecting pin may have a plate shape extending to a distal end of the fastening part, and may include the fastening hole formed at a center of the fastening part and a slit extending along the fastening hole to the distal end of the fastening part.

[0019] The fastening part may be formed at both sides of the distal end thereof with jaws, and the pin groove of the outer connecting piece may be formed at both inner sides thereof with receiving grooves to receive the jaws of the fastening part.

[0020] The fastening part of the connecting pin may have a plate shape having a predetermined length and depressed at upper and lower sides thereof to form steps on the fastening part.

[0021] The connecting pin may have a polygonal cross-section.

[0022] The connecting pin may have a polygonal cross-section at either end thereof.

[0023] The connecting pin and the fastening pin may be made of stainless steel.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] The above and other aspects, features and advantages of the invention will become apparent with reference to the following embodiments in conjunction with the accompanying drawings;

Figure 1 is an exploded perspective view of a conventional ceramic watch strap;

Figure 2 is a cross-sectional view of the conventional ceramic watch strap;

Figure 3 is an exploded perspective view of a ceramic watch strap in accordance with a first embodiment of the present invention;

Figure 4 is a cross-sectional view of the ceramic watch strap in accordance with the first embodiment of the present invention;

Figure 5 is an exploded perspective view of a ceramic watch strap in accordance with a second embodiment of the present invention;

Figure 6 is a cross-sectional view of an upper part

of the ceramic watch strap in accordance with the second embodiment of the present invention;

Figure 7 is a cross-sectional view of the ceramic watch strap in accordance with the second embodiment of the present invention;

Figure 8 is an exploded perspective view of a ceramic watch strap in accordance with a third embodiment of the present invention; and

Figure 9 is a cross-sectional view of the ceramic watch strap in accordance with the third embodiment of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0025] Embodiments of the present invention will now be described in detail with reference to the accompanying drawings.

[0026] Figures 3 and 4 are an exploded perspective view and a cross-sectional view of a ceramic watch strap in accordance with a first embodiment of the present invention.

[0027] Referring to Figures 3 and 4, the ceramic watch strap according to the first embodiment includes a plurality of strap nodes, each of which is composed of outer connecting pieces 110 disposed at opposite sides thereof, a central connecting piece 120 disposed at the center thereof, a connecting pin 130 and fastening pins 140, which are fastened to the strap node. Here, the outer connecting pieces 110 and the central connecting piece 120 are made of a ceramic material, and the connecting pin 130 and the fastening pins 140 are made of stainless steel.

[0028] The ceramic material for the outer connecting pieces 110 and the central connecting piece 120 is a non-metallic inorganic solid subjected to sintering at high temperature and generally refers to glass, pottery, cement, refractory materials, and the like. According to the embodiment, the ceramic material is zirconia. Zirconia is generally used for knives, scissors, tools, watch straps, and the like, which require high toughness and high strength, as known in the art, and a detailed description thereof will be omitted herein.

[0029] The ceramic watch strap is a chain type watch strap composed of a plurality of strap nodes, which are connected in a line and each includes three components, that is, the outer connecting piece 110 disposed at one side thereof, the central connecting piece 120 disposed at the center thereof, and the outer connecting piece 110 disposed at the other side thereof.

[0030] In the watch strap, each of the outer connecting pieces 110 is formed at an inner side thereof with a pair of pin grooves 111, which are separated from each other to be parallel to each other and have a predetermined depth. The pin grooves 111 are configured to receive both ends of the connecting pin 130. Specifically, as shown in Figures 3 and 4, each of the outer connecting pieces 110 has two pin grooves 111 formed in parallel to each other on the inner side thereof to engage with

two different central connecting pieces 120, respectively.

[0031] Further, each of the outer connecting pieces 110 is formed with a pair of insertion grooves 112 to communicate with the pin grooves 111 while facing a back side of the outer connecting piece 110. The insertion groove 112 is configured to receive the fastening pin 140. As shown in the drawings, the insertion groove 112 and the pin groove 111 are configured to communicate with each other inside the outer connecting piece 110, such that either end of the connecting pin 130 is located at a position where the insertion groove 112 meets the pin groove 111.

[0032] On the other hand, the central connecting piece 120 is formed with a pair of pin holes 121, which penetrate the connecting piece 120 and are separated from each other and disposed in parallel. The pin holes 121 are configured to receive the corresponding connecting pins 130. Here, a fastening part 131a is formed at either side of the connecting pin 130 to be exposed outside the central connecting piece 120 when the connecting pin 130 is inserted into the corresponding pin hole 121. Then, the exposed fastening part 131a is inserted into the pin groove 111 of the outer connecting pieces 110.

[0033] Here, the connecting pin 130 is connected to the pin grooves 111 of the outer connecting pieces 110 at both sides of the watch strap through the pin hole 121 of the central connecting piece 120 and has the fastening parts 131a formed at both sides of the connecting pin 130 for engaging with the fastening pins 140.

[0034] In this embodiment, the fastening part 131a has a planar plate shape and is formed at the center thereof with a fastening hole 132a and guide apertures 133a. The fastening hole 132a and the guide apertures 133a are through-holes and communicate with each other. The fastening hole 132a has a predetermined diameter and the guide apertures 133a communicating with the fastening hole 132a extend from both sides of the fastening hole 132a such that the fastening pin 140 having an arrowhead shape can be press-fitted into the fastening hole 132a and the guide apertures 133a can be securely fastened to the fastening part 131a.

[0035] As such, the fastening pin 140 is inserted into the insertion groove 112 of the outer connecting piece 110 and fastened to the fastening part 131a of the connecting pin 130 which is inserted into the pin groove 111. The fastening pin 140 is divided into a head 141, a fastening hole-engaging portion 142, and a tail 143. The head 141 has a diameter, which allows the head 141 to be inserted into the insertion groove 112, and has a length so as not to be exposed outside of the insertion groove 112 when fastened thereto.

[0036] The fastening hole-engaging portion 142 has a smaller diameter than the head 141 and the fastening hole 132a of the connecting pin 130, so that the fastening hole-engaging portion 142 is maintained in a state of being inserted into the fastening hole 132a when the fastening pin 140 is fastened to the fastening part 131a. That is, the fastening hole-engaging portion 142 constitutes a

depression around the circumference of the fastening pin 140 to form upper and lower latching jaws.

[0037] The tail 143 has a larger diameter than the fastening hole-engaging portion 142 to form an arrowhead shape. Further, the tail 143 has a larger diameter than the fastening hole 132a and is formed with a latching step 144 which prevents the tail 143 from being released from the fastening hole 132a when the fastening pin 140 is fastened to the fastening part 131a. The tail 143 has a diameter gradually decreasing downwards.

[0038] Generally, the fastening pin 140 has a stepped structure wherein the fastening hole-engaging portion 142 is depressed as compared with the head 141 and the tail 143. When the fastening pin 140 is inserted into the fastening part 131a through the fastening hole 132a and the guide apertures 133a, the head 141 passes through the fastening hole 132a and the guide apertures 133a while being compressed. Then, when the fastening hole-engaging portion 142 is located at the same position as that of the fastening hole 132a and the guide apertures 133a, the fastening pin 140 is maintained in a state of being fastened to the fastening part 131a by the head 141 and the tail 143, which have larger diameters than the fastening hole 132a. Here, the head 140 of the fastening pin 140 exposed through the insertion groove 112 of the outer connecting piece 110 may be covered with a finishing material such as an epoxy or the like.

[0039] At this time, the guide apertures 133a are formed to provide an effect of expanding the diameter of the fastening hole 132a upon insertion of the head 141 of the fastening pin 140 into the fastening part 131a. In the drawings, two guide apertures 133a extend from opposite sides of the fastening hole 132a to adjoin the fastening hole 132a, but more than two or a single guide aperture 133a may also provide the same effect as the two guide apertures.

[0040] Generally, in order to connect the central connecting piece 120 to the outer connecting pieces 110 at both sides of the watch strap, the connecting pin 130 is inserted into the corresponding pin groove 111 of the outer connecting piece 110 at one side of the wrist watch and into the corresponding pin groove 111 of the outer connecting piece 110 at the other side of the watch strap through the pin hole 121 of the central connecting piece 120, and the fastening pins 140 are fastened to the fastening parts 131a of the connecting pin 130 through the insertion grooves 112 formed at the rear sides of the outer connecting pieces 110.

[0041] As a result, the fastening parts 131a at the opposite sides of the connecting pin 130 are respectively inserted into the pin grooves 111 of the outer connecting pieces 110 and secured by the fastening pins 140 in the insertion grooves 112, and the central connecting piece 120 is coupled to the outer connecting pieces 110 to rotate on the connecting pin 130.

[0042] Since it is substantially impossible to disassemble such a connection structure once the fastening pin 140 is fastened to the fastening part 131a, it is desirable that

the connection structure be applied to fixing strap nodes, which do not require detachable attachment of pins, except for a strap node for length adjustment.

[0043] Accordingly, it is possible to increase the length of the watch strap by alternately coupling the outer connecting pieces 110 and the central connecting piece 120 to each other using the connecting pins 130 and the fastening pins 140 at both sides of the watch strap to increase the number of strap nodes.

[0044] Next, a ceramic watch strap according to a second embodiment of the invention will be described in detail with reference to Figures 5 to 7.

[0045] Figure 5 is an exploded perspective view of the ceramic watch strap in accordance with the second embodiment of the invention, Figure 6 is a cross-sectional view of an upper part of the ceramic watch strap in accordance with the second embodiment, and Figure 7 is a cross-sectional view of the ceramic watch strap in accordance with the second embodiment of the invention.

[0046] The watch strap according to the second embodiment will be described with reference to the components of the first embodiment and a detailed description of the same components as those of the first embodiment will be omitted herein.

[0047] Referring to Figures 5 to 7, as in the first embodiment, the ceramic watch strap according to the second embodiment also includes a plurality of strap nodes, each of which is composed of outer connecting pieces 110 disposed at opposite sides thereof, a central connecting piece 120 disposed at the center thereof, a connecting pin 130, and fastening pins 140 which are fastened to the strap node. In this embodiment, the outer connecting pieces 110 and the central connecting piece 120 are also made of a ceramic material, and the connecting pin 130 and the fastening pins 140 are made of stainless steel.

[0048] Here, the connecting pin 130 is connected to the pin grooves 111 of the outer connecting pieces 110 at both sides of the watch strap through the pin hole 121 of the central connecting piece 120 and has fastening parts 131b formed at both sides of the connecting pin 130 for engagement with the fastening pins 140.

[0049] In this embodiment, the fastening part 131b has a planar plate shape. The fastening part 131b has a fastening hole 132b formed at the center thereof, a guide aperture 133b formed towards the center of the fastening pin while extending along the fastening hole 132b, and a slit 134b formed at a side of the fastening hole 132b opposite the guide aperture 133b while extending along the fastening hole 132b.

[0050] Further, the fastening part 131b is formed at opposite sides thereof with jaws 136b, which prevent the fastening part 131b from being separated from the pin grooves 111 of the outer connecting pieces 110 after being inserted into the pin grooves 111.

[0051] Further, each of the pin grooves 111 of the outer connecting piece 110 receiving the fastening part 131b is formed at opposite inner sides thereof with receiving

grooves 111b to receive the jaws 136b of the fastening part 131b described above.

[0052] Accordingly, while the fastening part 131b is inserted into the pin groove 111, the slit 134b is narrowed, and when the jaws 136b reach the receiving grooves 111b of the pin groove 111, the jaws 136b spread to allow the fastening part 131b to be completely secured into the pin groove 111.

[0053] Then, as the fastening pin 140 having an arrow-head shape is forcibly inserted into the fastening hole 132b, the slit 134b can be outwardly widened to increase the diameter of the fastening hole 132b, and when the fastening pin 140 is completely inserted into the fastening hole 132b to allow the depressed fastening hole-engaging portion 142 to be placed in the fastening hole 132b, the slit 134b naturally returns to an original shape, thereby preventing the fastening pin 140 from being separated from the fastening hole 132b once the fastening pin 140 is inserted into the fastening hole 132b.

[0054] At this time, the guide aperture 133b serves to allow slight expansion of the diameter of the fastening hole 132 upon insertion of the head 141 of the fastening pin 140. In this embodiment, the fastening part has a single guide aperture 133b formed towards the center of the connecting pin along the fastening hole 132, as shown in the drawings, but the fastening part may include two or more guide apertures 133.

[0055] Next, a ceramic watch strap according to a third embodiment of the invention will be described in detail with reference to Figures 8 to 9.

[0056] Figures 8 and 9 are an exploded perspective view and a cross-sectional view of the ceramic watch strap in accordance with the third embodiment of the present invention

[0057] The watch strap of the third embodiment will be described with reference to the components of the first and second embodiments and a detailed description of the same components as those of the first and second embodiments will be omitted herein.

[0058] Referring to Figures 8 to 9, as in the first and second embodiments, the ceramic watch strap according to the third embodiment also includes a plurality of strap nodes, each of which is composed of outer connecting pieces 110 disposed at opposite sides thereof, a central connecting piece 120 disposed at the center thereof, a connecting pin 130, and fastening pins 140, which are fastened to each of the nodes. In this embodiment, the outer connecting pieces 110 and the central connecting piece 120 are also made of a ceramic material, and the connecting pin 130 and the fastening pins 140 are made of stainless steel.

[0059] Here, the connecting pin 130 is connected to the pin grooves 111 of the outer connecting pieces 110 at both sides of the watch strap through the pin hole 121 of the central connecting piece 120 and has fastening parts 131c formed at both sides of the connecting pin 130 for engaging with the fastening pins 140.

[0060] In this embodiment, the fastening part 131c

generally has the same cross-section as that of the connecting pin 130. The fastening part 131c has a step portion 135c, which is depressed at upper and lower sides of the fastening part 131c to form a flat plate shape. The step portion 135c has a predetermined length and is composed of upper and lower depressions.

[0061] The step portion 135c is formed at the center thereof with a fastening hole 132c and guide apertures 133c. The fastening hole 132c and the guide aperture 133c communicate with each other and are formed to penetrate the step portion 135c. The fastening hole 132c has a predetermined diameter and the guide apertures 133c communicating therewith are formed at both sides of the fastening hole 132c, so that the fastening pin 140 having an arrowhead shape can be forcibly inserted into the fastening hole 132c and fastened to the fastening part 131c.

[0062] As shown in Figure 8, the connecting pin 130 including the fastening part 131c according to this embodiment generally has a cylindrical cross-section except for the step portion 135c, but may have a rectangular or pentagonal cross-section. The connecting pins 130 having such a polygonal cross-section cannot be rotated when inserted into the central connecting piece 120 and the outer connecting pieces 110, differing from the other embodiments described above.

[0063] Further, the connecting pin 130 may be configured to have a polygonal cross-section only at a portion thereof to be inserted into the central connecting piece 120, or alternatively, only the fastening part 131c is configured to have a polygonal cross-section, thereby allowing the watch strap to be formed in various streamlined structures, in which the number of rotatable components of the watch strap having three components in each node of the watch strap are set as needed

[0064] According to the embodiments of the invention, the watch strap is made of a special material such as a ceramic material to have high strength and a smooth surface and includes a permanent securing structure, thereby allowing easy securing of fastening pins while providing high fastening force.

[0065] Further, according to the embodiments of the invention, the watch strap provides a pleasing appearance based on characteristics of ceramics, thereby improving the value of final products.

[0066] Exemplary embodiments are disclosed in the specification and drawings. It should be understood that the terms used in the embodiments are provided for the purpose of illustration and are not intended to limit the scope of the invention set forth in the accompanying claims. Therefore, it will be apparent to those skilled in the art that various modifications, changes, alterations, and equivalent embodiments can be made without departing from the spirit and scope of the invention. The scope of the invention should be limited only by the accompanying claims.

Claims

1. A ceramic watch strap, **characterized by** comprising:

outer connecting pieces, each including a pair of pin grooves formed at one side thereof and a pair of insertion grooves formed at a back side thereof to communicate with the corresponding pin grooves;

a central connecting piece having a pair of pin holes penetrating the central connecting piece to correspond to the pin grooves of the outer connecting pieces;

connecting pins each including a fastening part having fastening holes formed at opposite ends of the fastening part; and

fastening pins having a latching step formed at one end of the fastening pin,

wherein the fastening part of each of the connecting pins is inserted into the pin groove of the outer connecting piece through the pin hole of the central connecting piece, and the fastening pin is press-fitted into the fastening hole of the connecting pin through the insertion groove of the outer connecting piece and is supported on the connecting pin by the latching step.

2. The ceramic watch strap of claim 1, **characterized in that** at least the outer connecting pieces and the central connecting piece comprise a ceramic material.

3. The ceramic watch strap of claim 1, **characterized in that** the fastening pin has a diameter allowing insertion into the insertion groove and comprises a fastening hole-engaging portion having a length and a depression formed around a circumference thereof to form upper and lower latching jaws.

4. The ceramic watch strap of claim 3, **characterized in that** the fastening pin comprises a tail extending from a lower side of the fastening hole-engaging portion and having a gradually decreasing diameter.

5. The ceramic watch strap of claim 1, **characterized in that** the fastening part of the connecting pin has a plate shape and is formed at a center thereof with the fastening hole.

6. The ceramic watch strap of claim 1, **characterized in that** the fastening part of the connecting pin is provided with at least one guide aperture extending from the fastening hole to communicate therewith.

7. The ceramic watch strap of claim 1, **characterized in that** the fastening part of the connecting pin has

a plate shape extending to a distal end of the fastening part, and comprises the fastening hole formed at a center of the fastening part and a slit extending along the fastening hole to the distal end of the fastening part.

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8. The ceramic watch strap of claim 7, **characterized in that** the fastening part is formed at both sides of the distal end thereof with jaws, and the pin groove of the outer connecting piece is formed at both inner sides thereof with receiving grooves to receive the jaws of the fastening part. 10
9. The ceramic watch strap of claim 1, **characterized in that** the fastening part of the connecting pin has a plate shape having a predetermined length and depressed at upper and lower sides thereof to form steps on the fastening part. 15
10. The ceramic watch strap of claim 1, **characterized in that** the connecting pin has a polygonal cross-section. 20
11. The ceramic watch strap of claim 1, **characterized in that** the connecting pin has a polygonal cross-section at either end thereof. 25
12. The ceramic watch strap of claim 1, **characterized in that** the connecting pin and the fastening pin are made of stainless steel. 30

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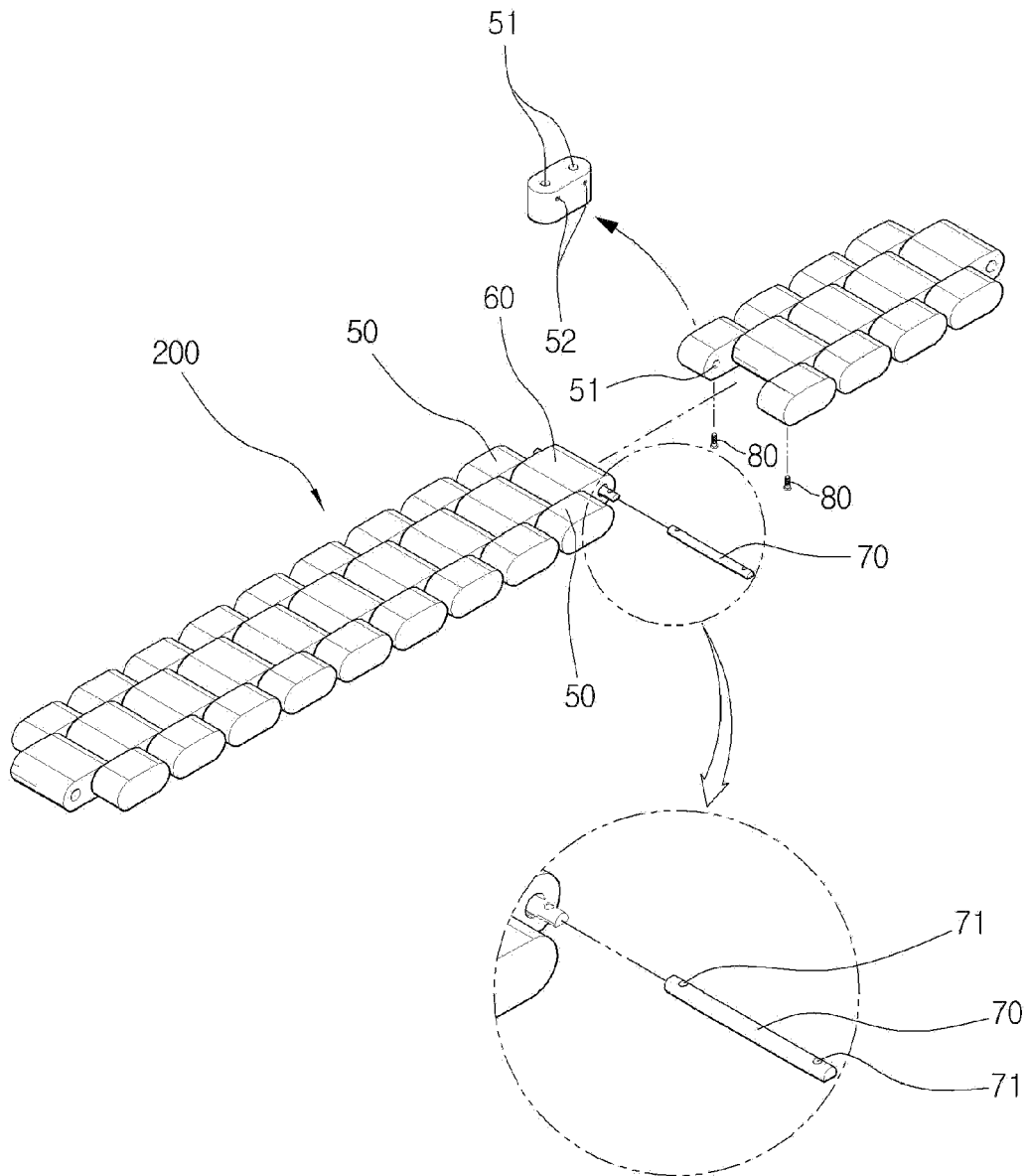
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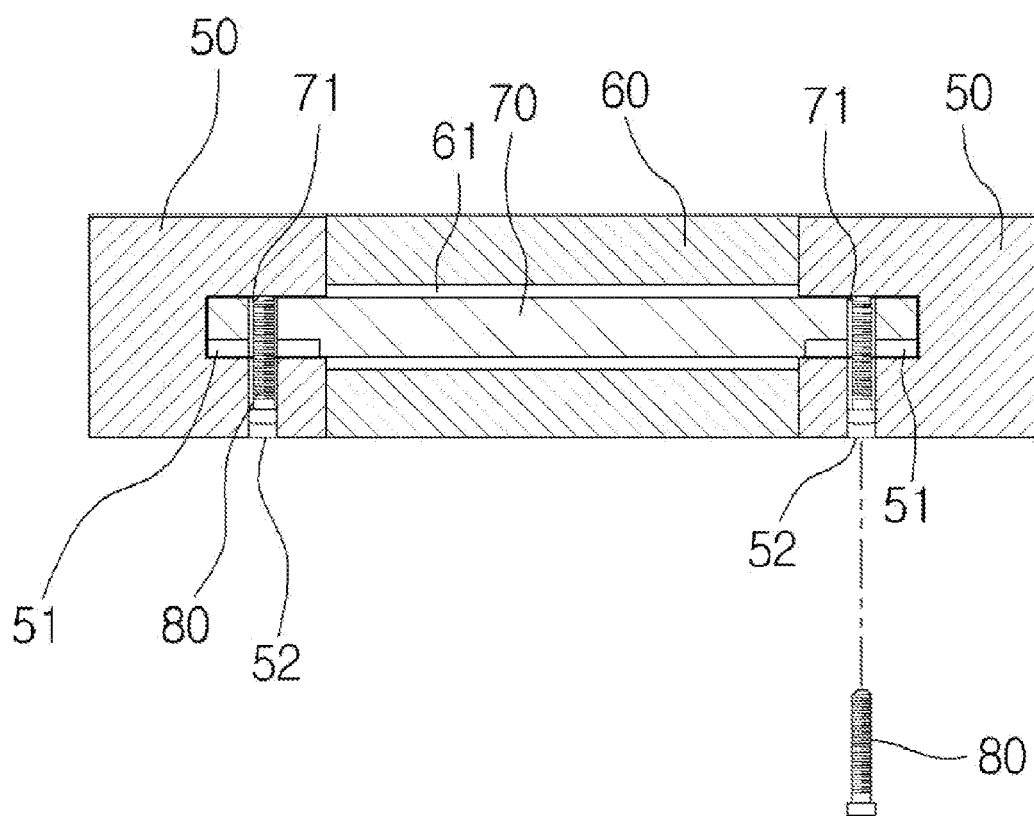
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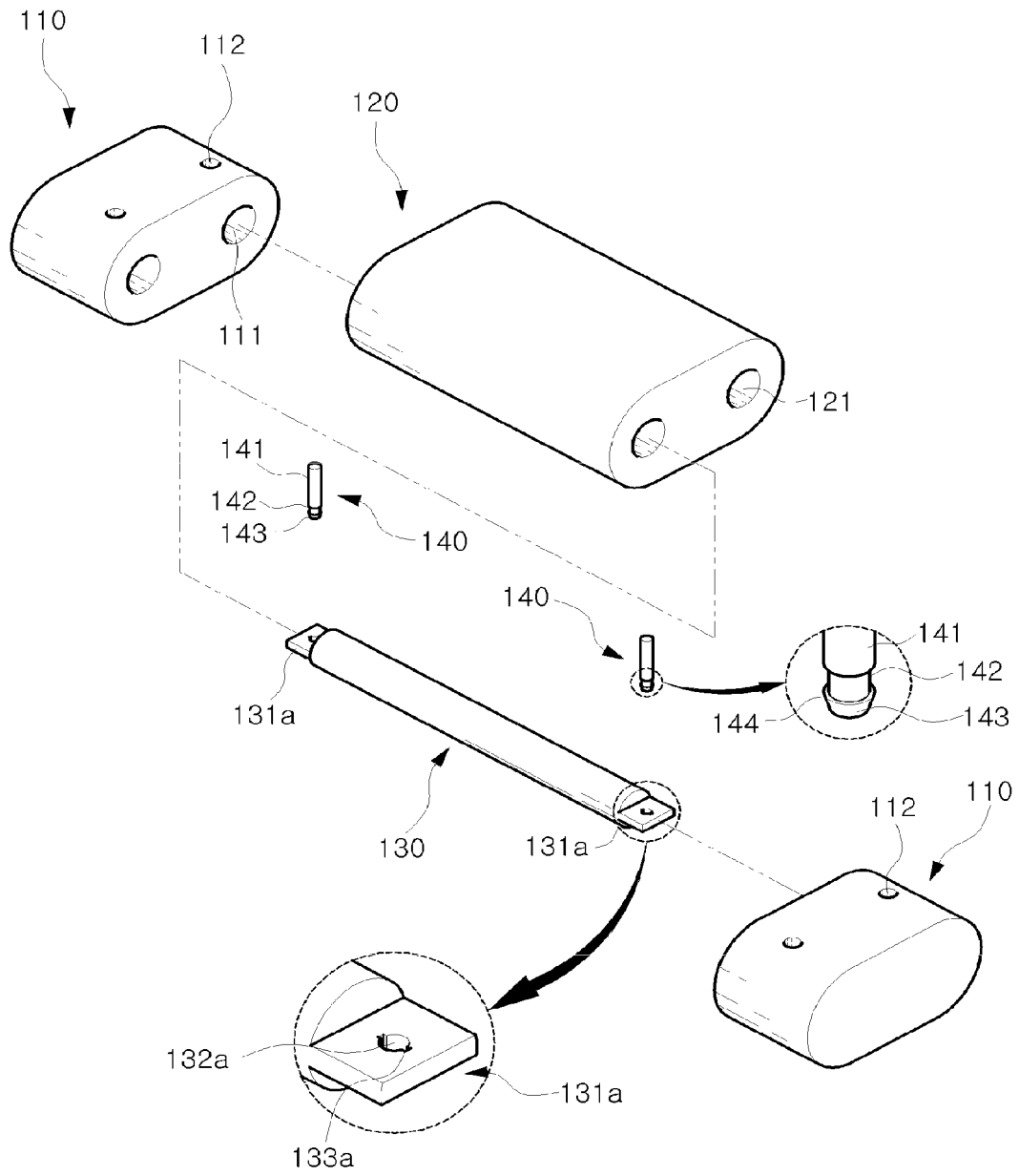
[Figure 1]



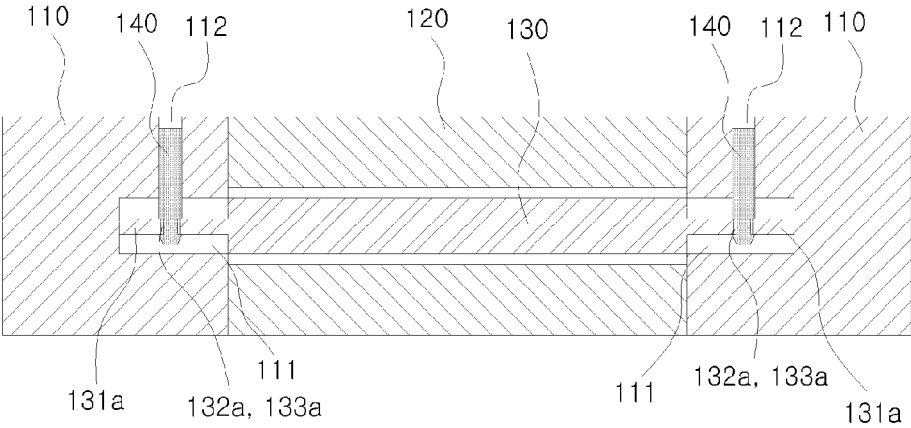
[Figure 2]



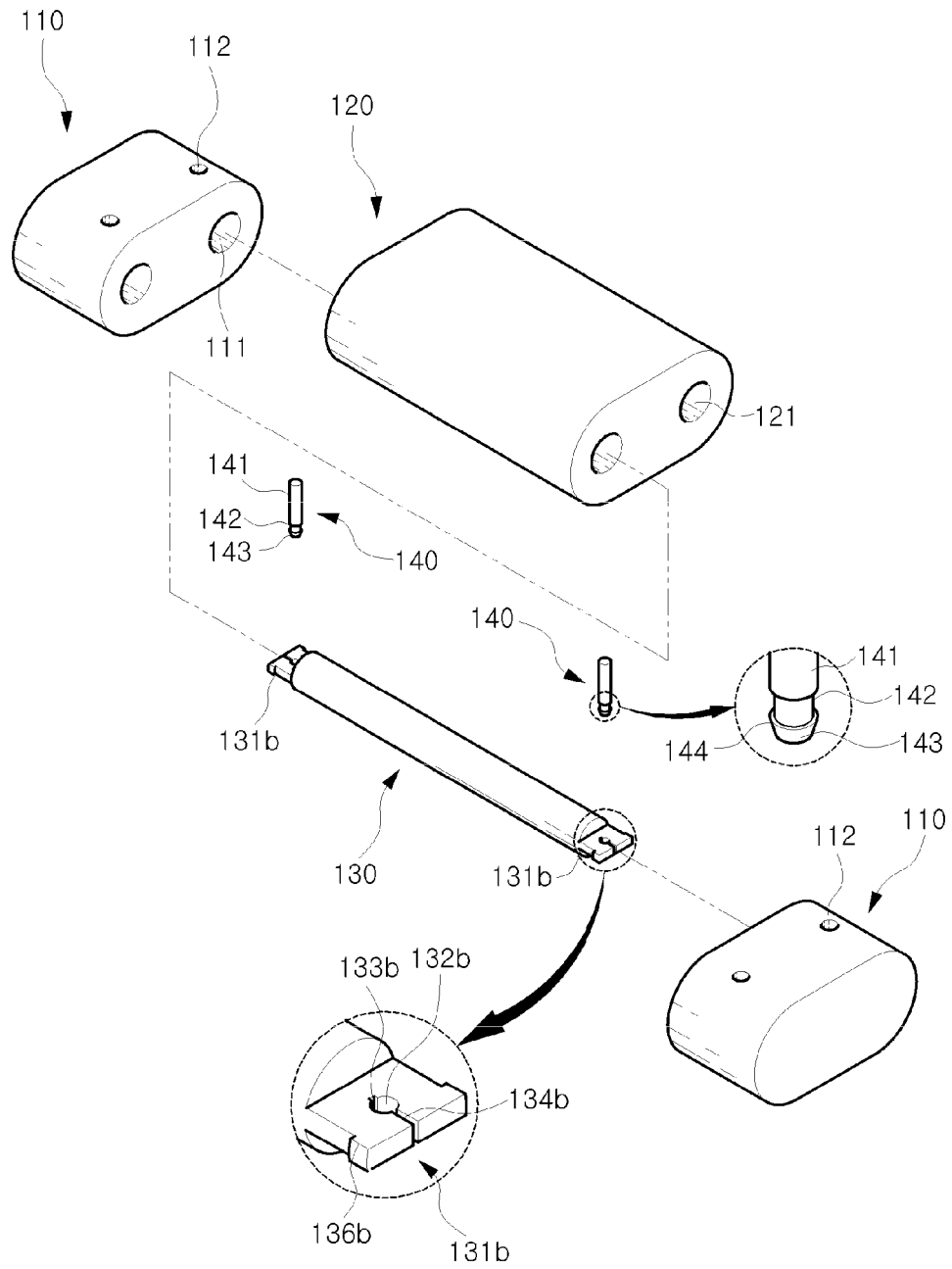
[Figure 3]



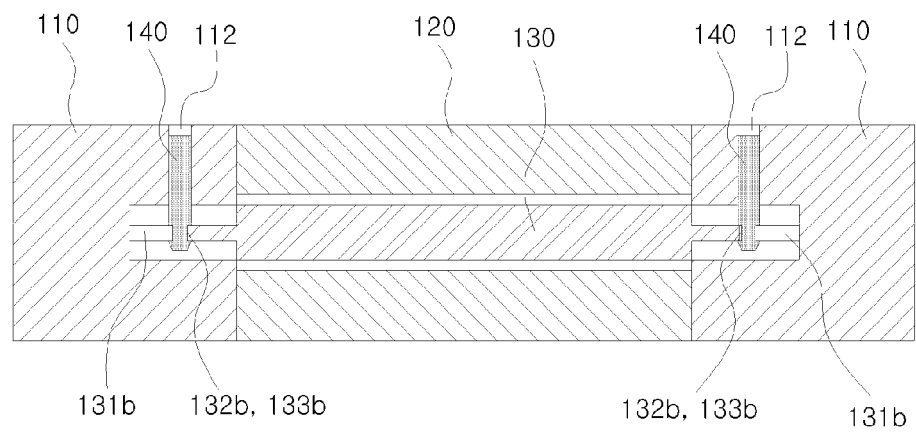
[Figure 4]



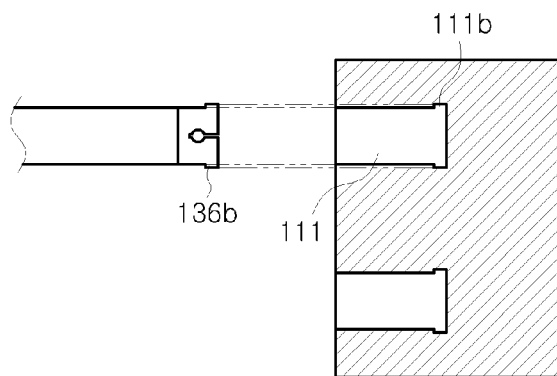
[Figure 5]



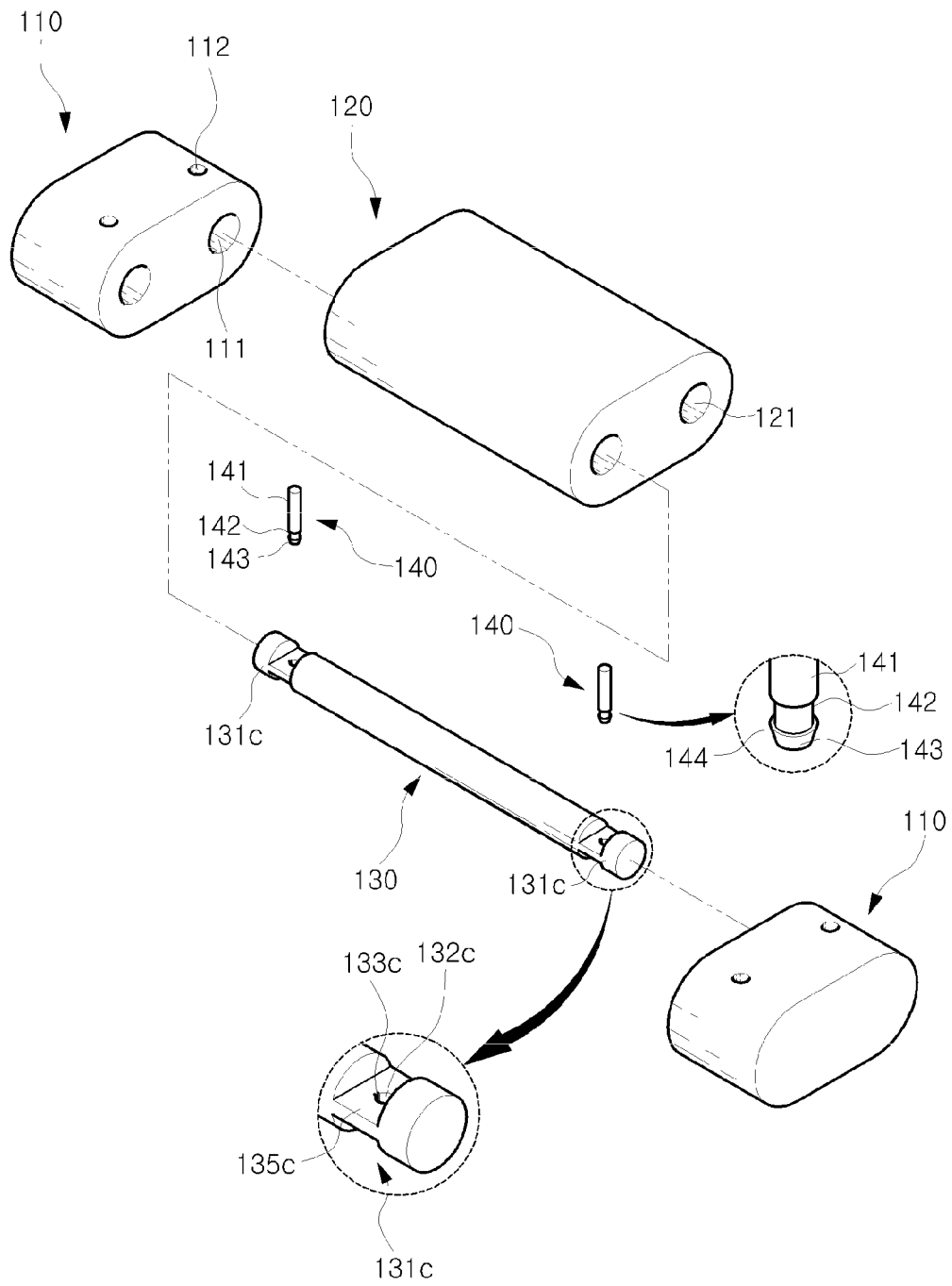
[Figure 6]



[Figure 7]



[Figure 8]



[Figure 9]

