US 20190053778A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2019/0053778 A1**

LIN (43) **Pub. Date: Feb. 21, 2019**

(54) **AUSCULTATION DEVICE WITH MODULAR CHEST PIECE AND ECG MODULE**

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(21) Appl. No.: **16/104,147**

(22) Filed: **Aug. 17, 2018**

Related U.S. Application Data

(60) Provisional application No. 62/546,694, filed on Aug. 17, 2017.

Publication Classification

(51) **Int. Cl.**

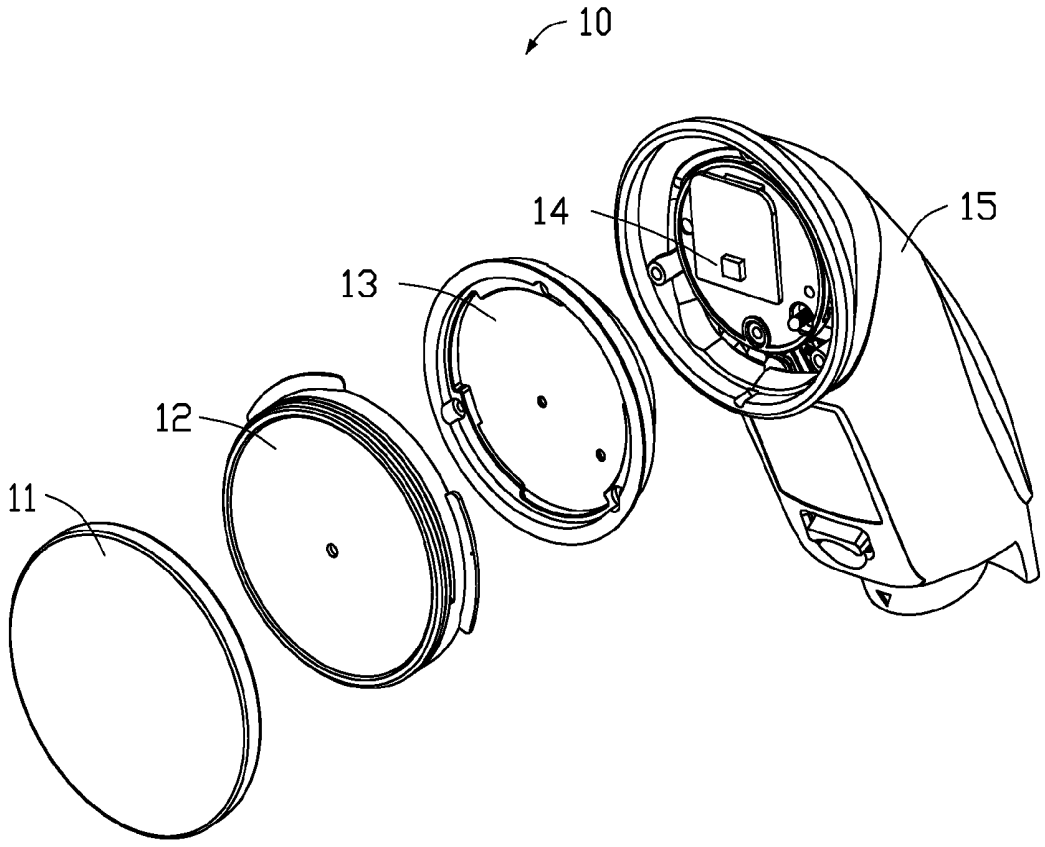
A61B 7/04	(2006.01)
A61B 5/00	(2006.01)
A61B 5/0408	(2006.01)
A61B 5/0205	(2006.01)

(52) **U.S. Cl.**

CPC ***A61B 7/04*** (2013.01); ***A61B 5/0002*** (2013.01); *A61B 2560/0443* (2013.01); ***A61B 5/0205*** (2013.01); ***A61B 5/0408*** (2013.01)

(57) **ABSTRACT**

The present disclosure provides an auscultation device. The auscultation device comprises a sound capturing element, a chest piece holder, and a connecting structure. The chest piece holder is disposed on a distal end of the auscultation device, coupled to the sound capturing element, and includes a connecting structure. The chest piece comprises a dislocating structure removably coupled to the connecting structure of the chest piece holder.



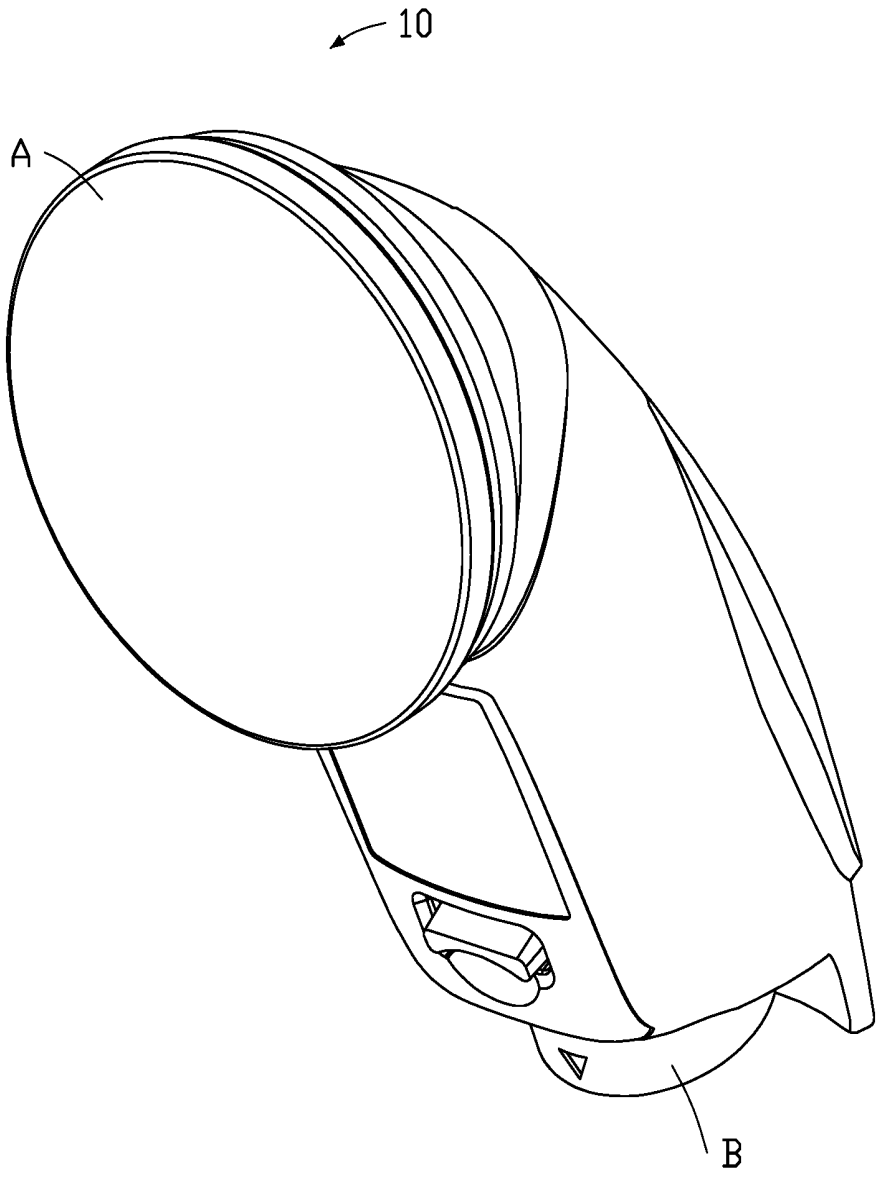


FIG. 1

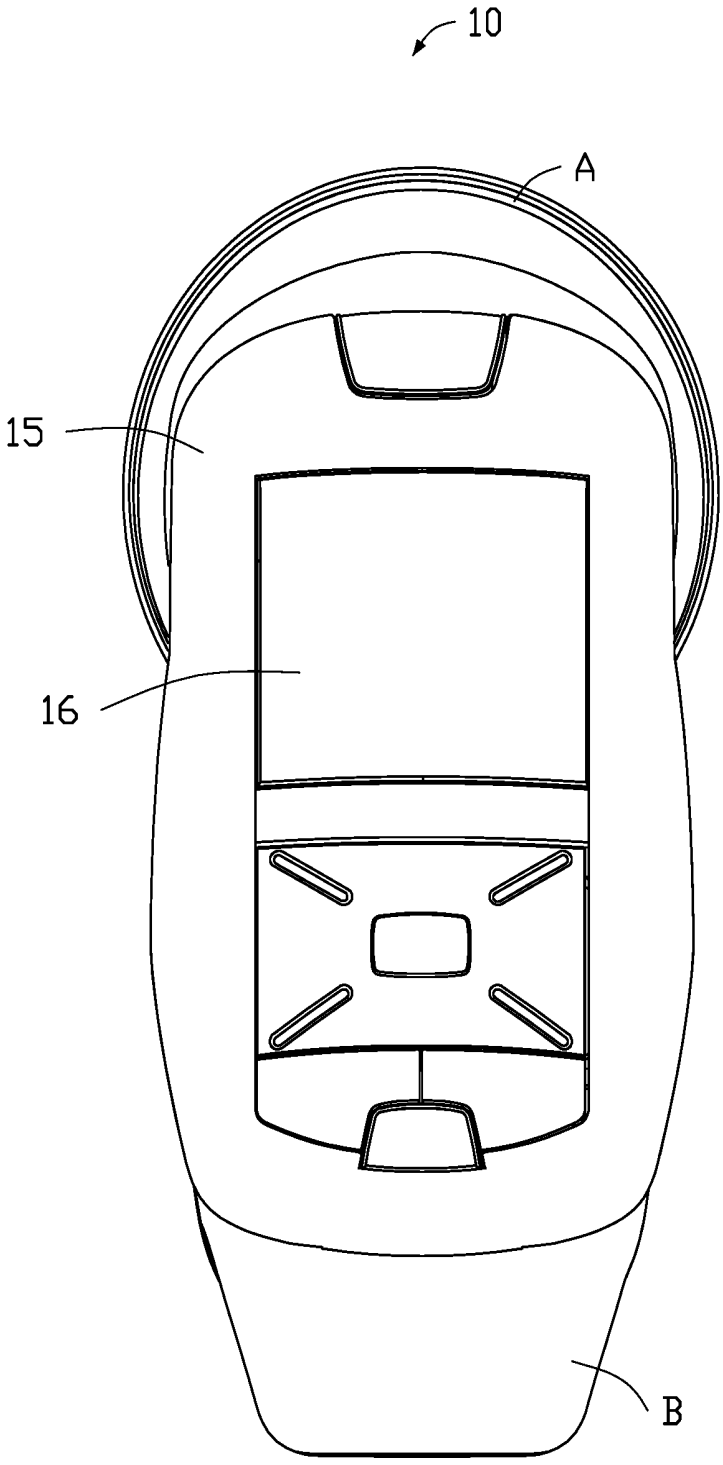


FIG. 2

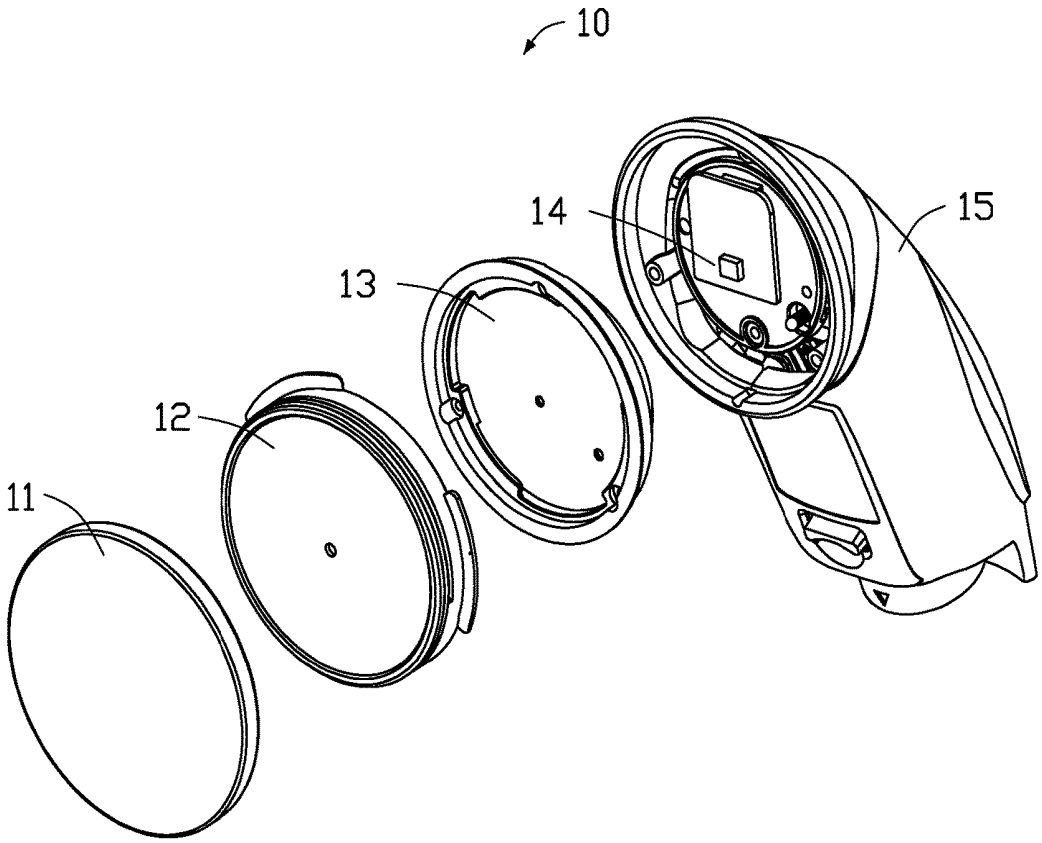


FIG. 3

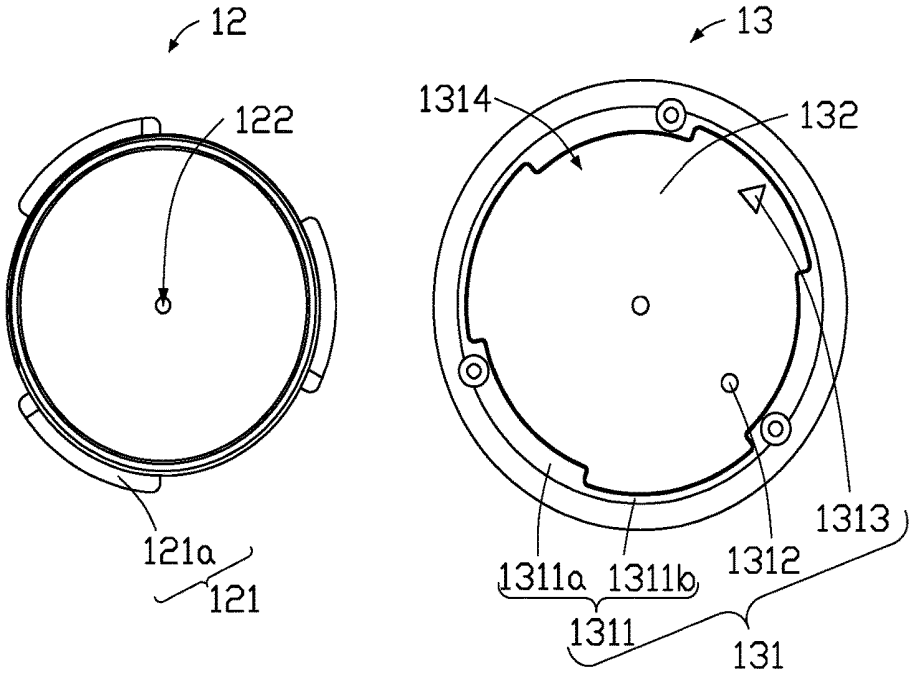

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FIG. 4A

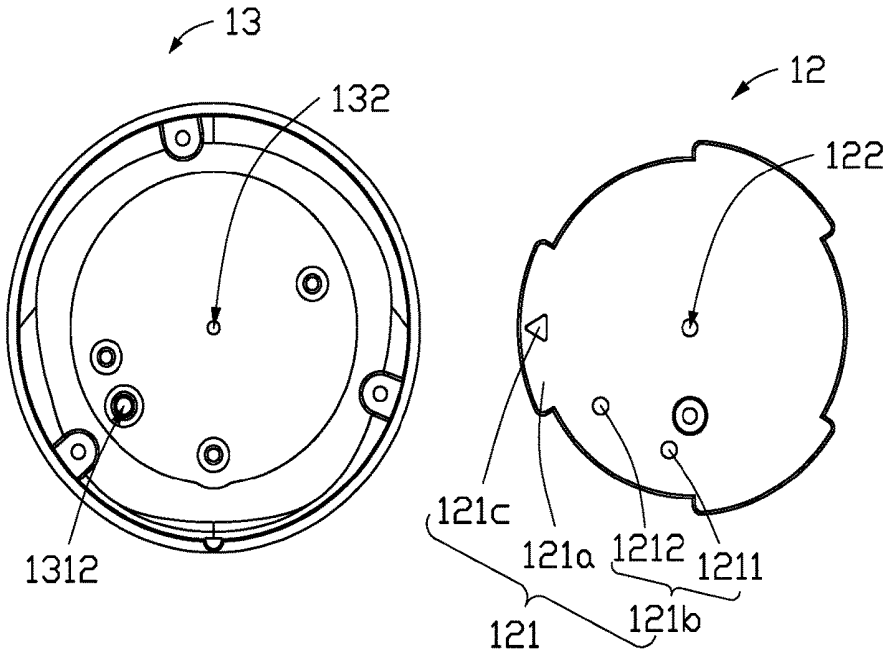
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FIG. 4B

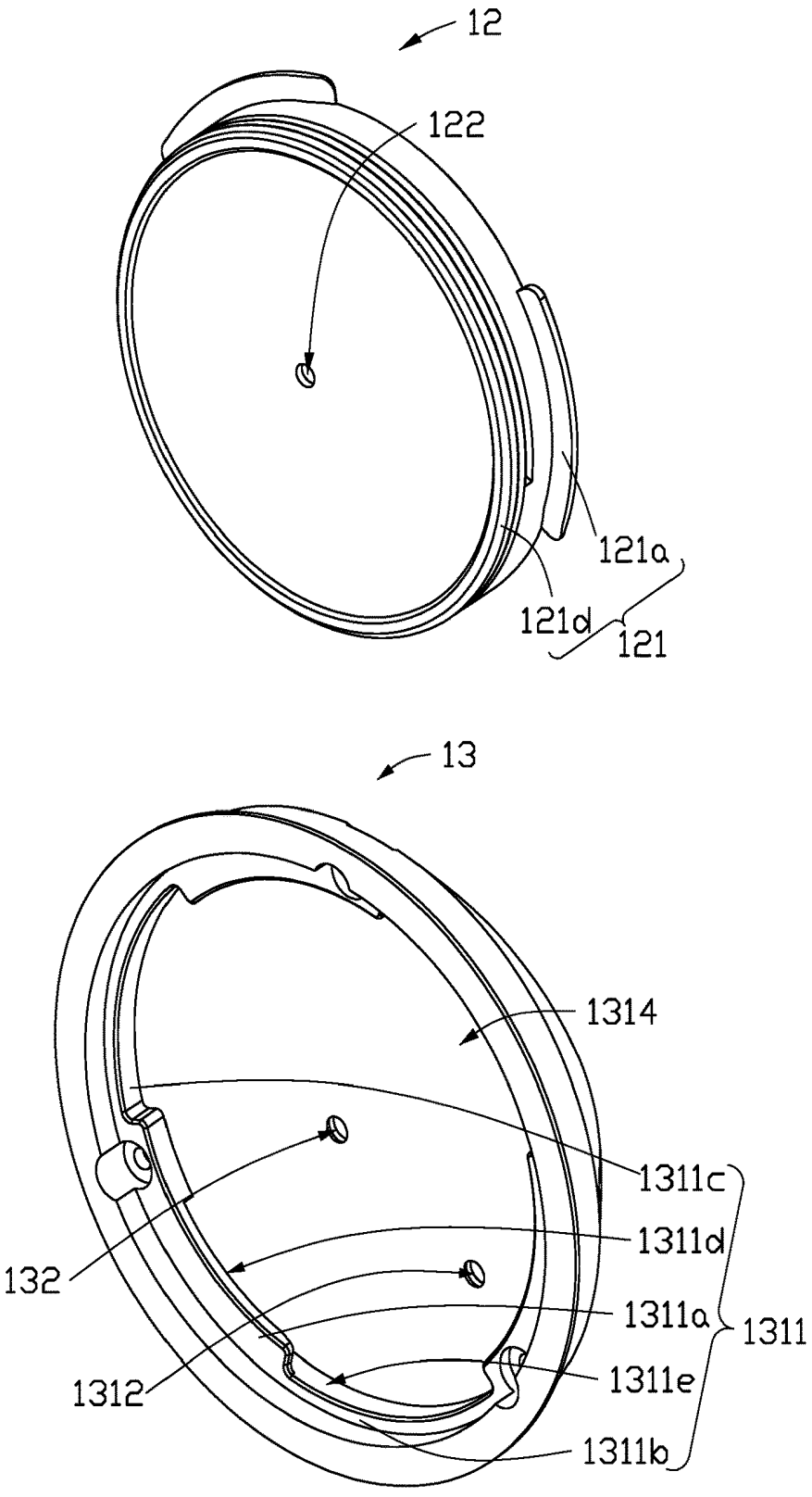
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FIG. 4C

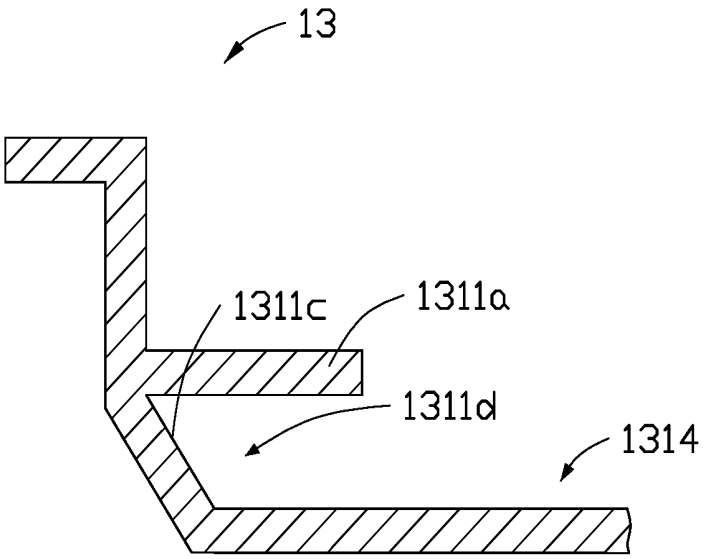

FIG. 4D

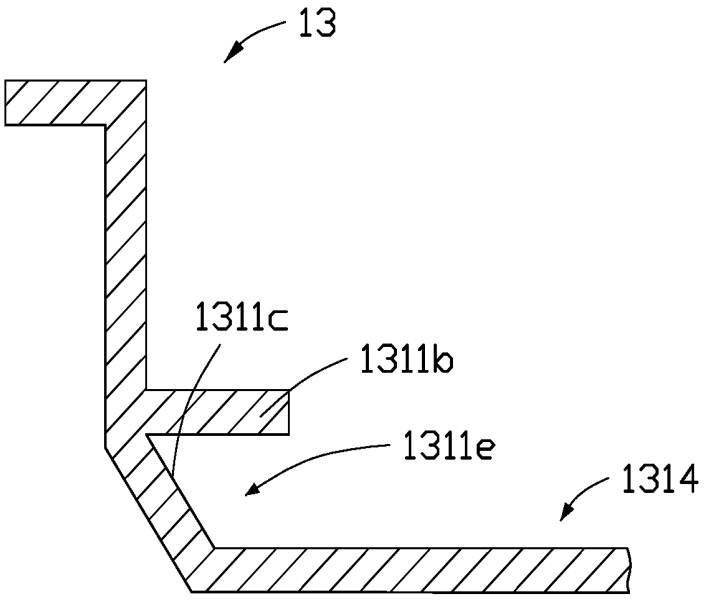

FIG. 4E

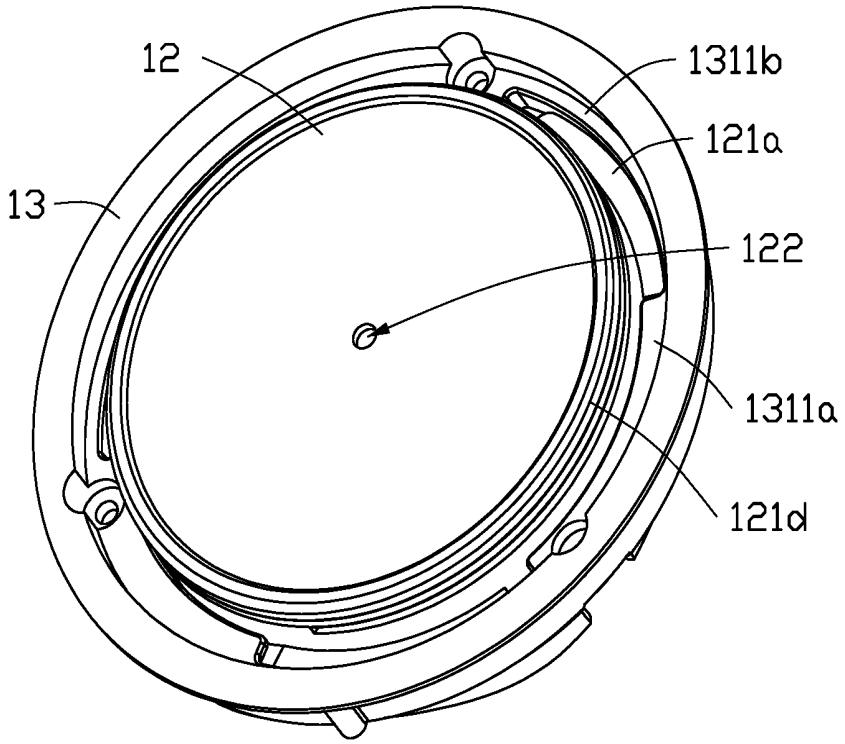
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FIG. 5A

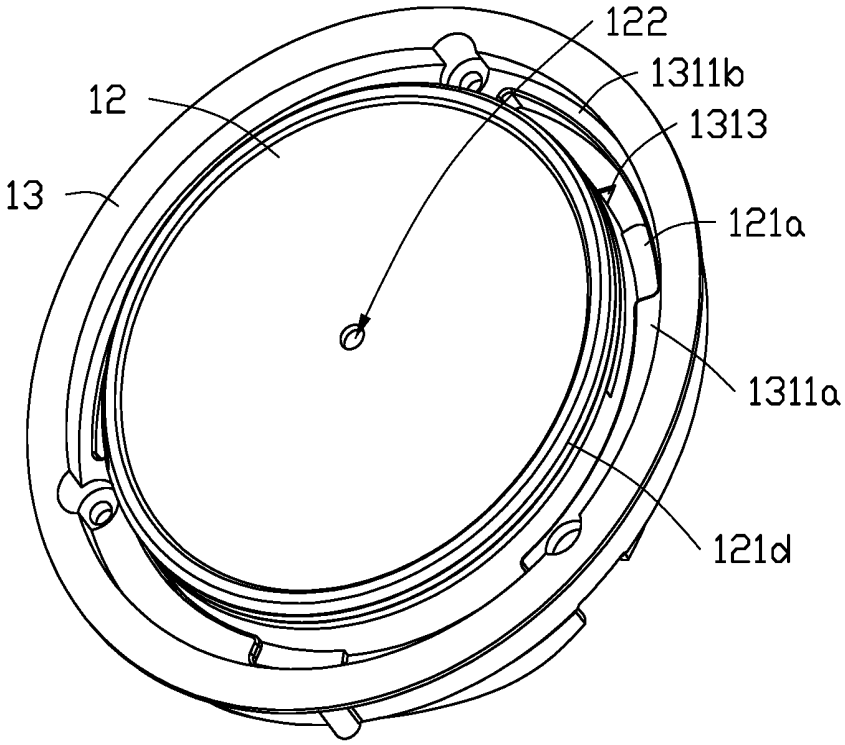
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FIG. 5B

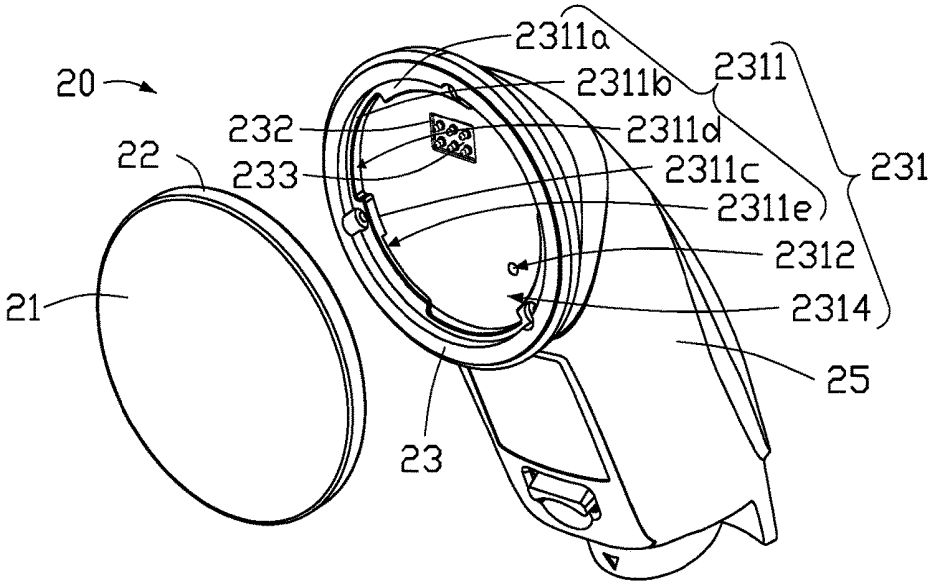
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FIG. 6A

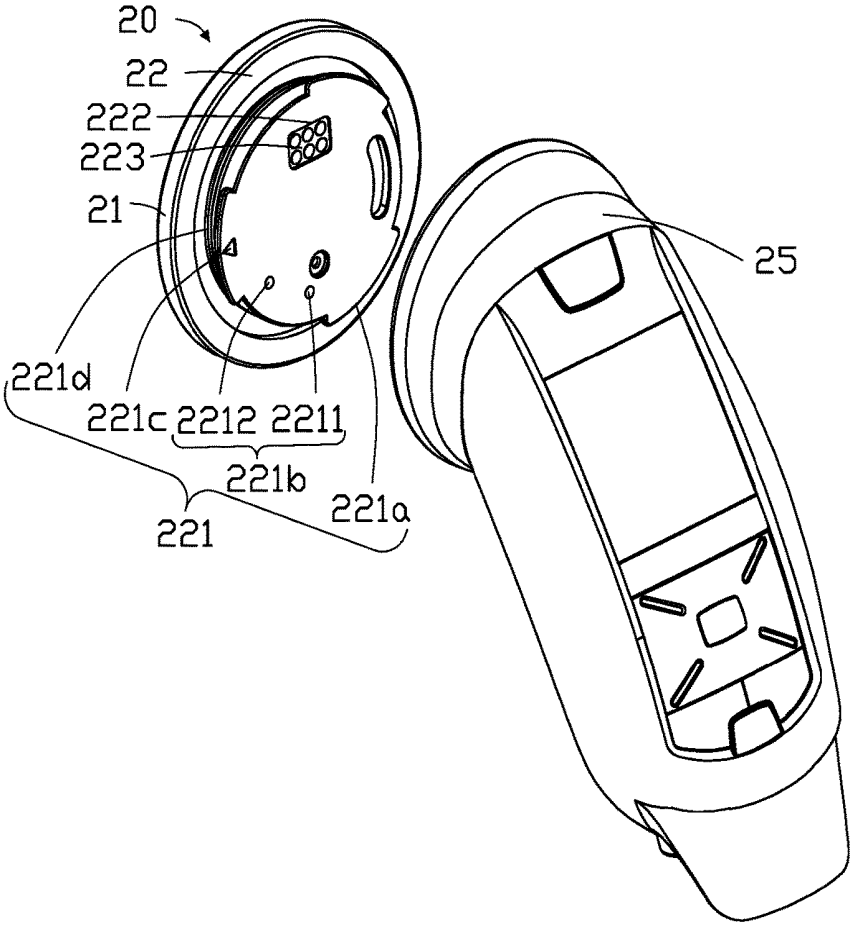
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FIG. 6B

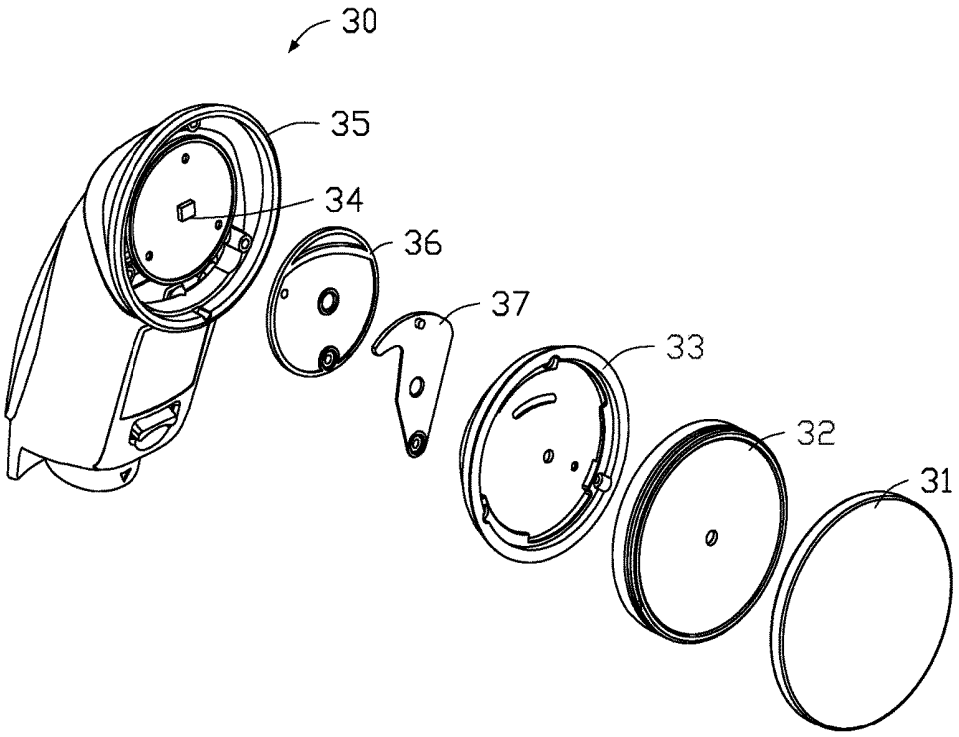

FIG. 7

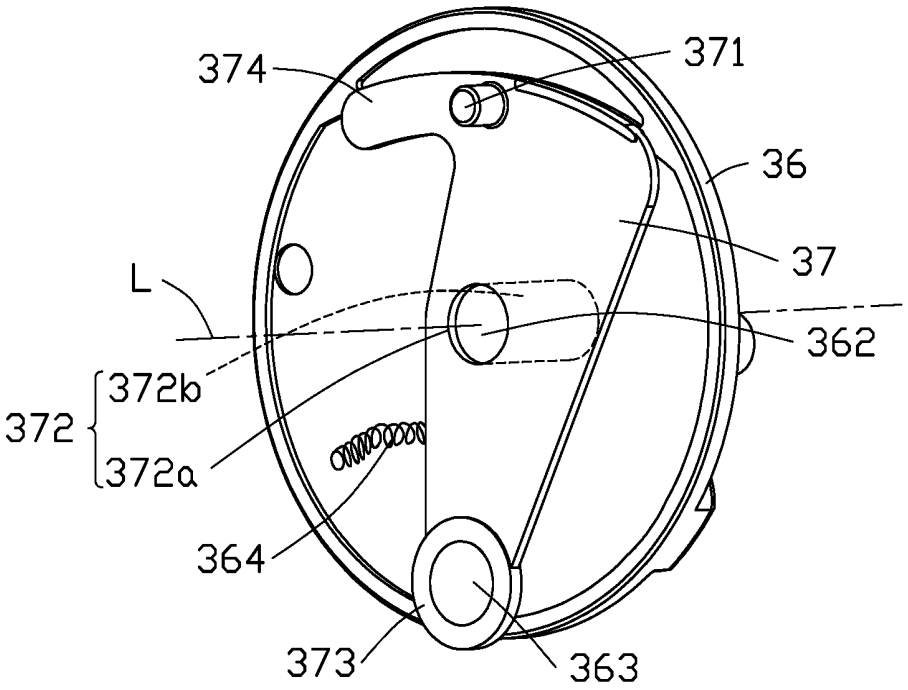
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FIG. 8A

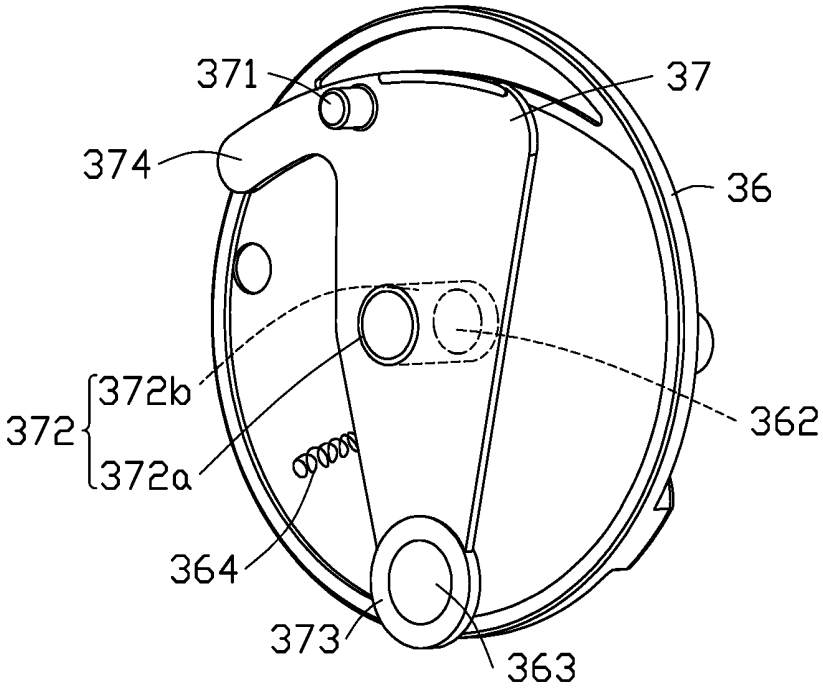
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FIG. 8B

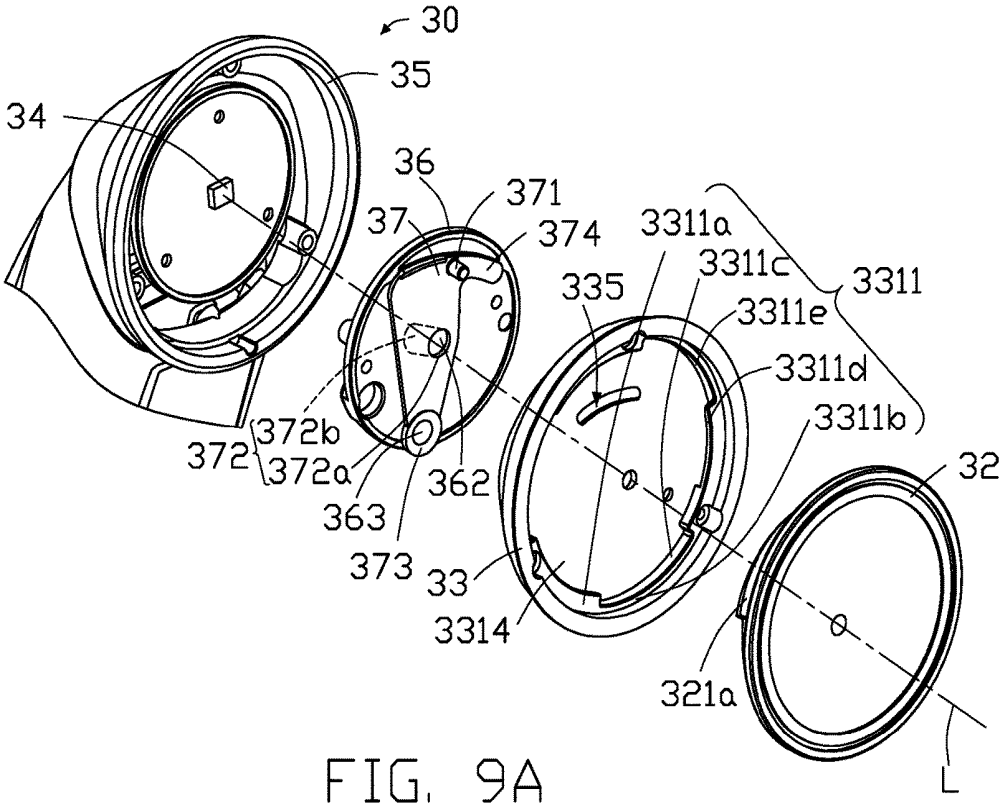
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FIG. 9A

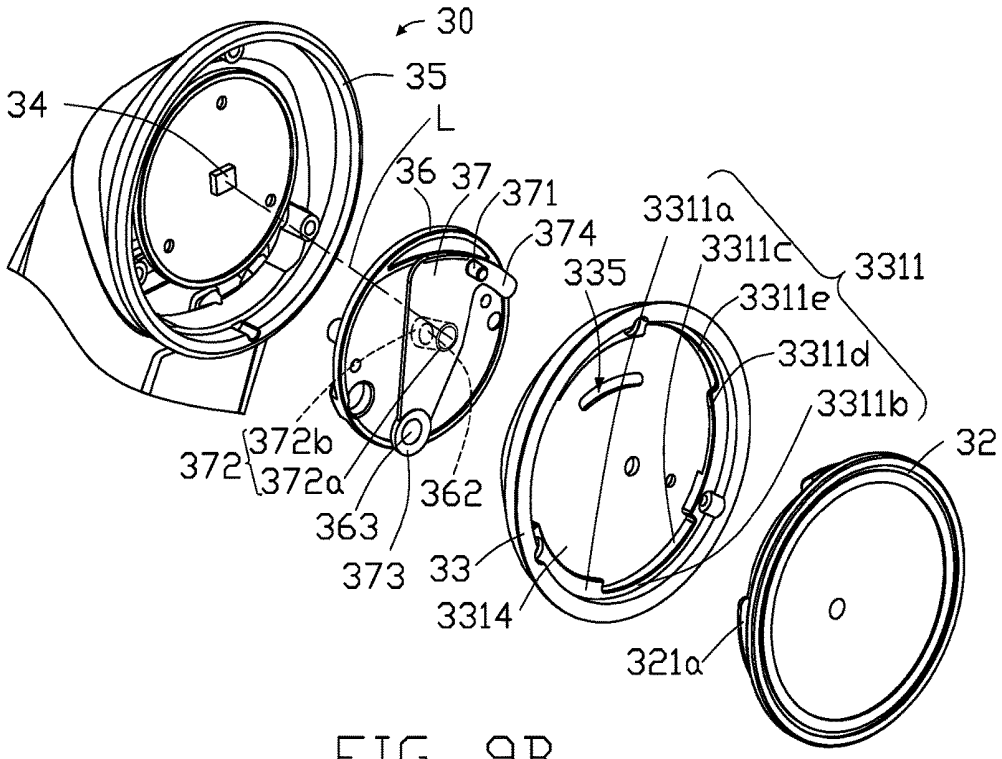
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FIG. 9B

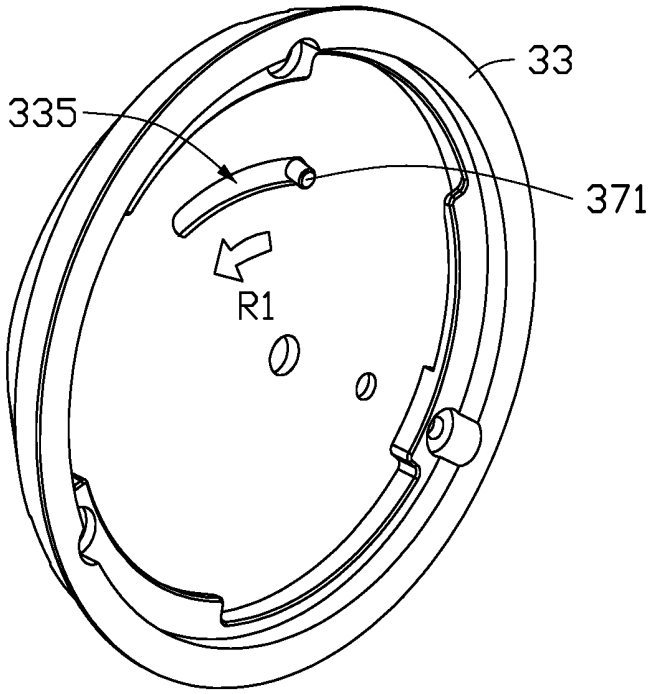


FIG. 9C

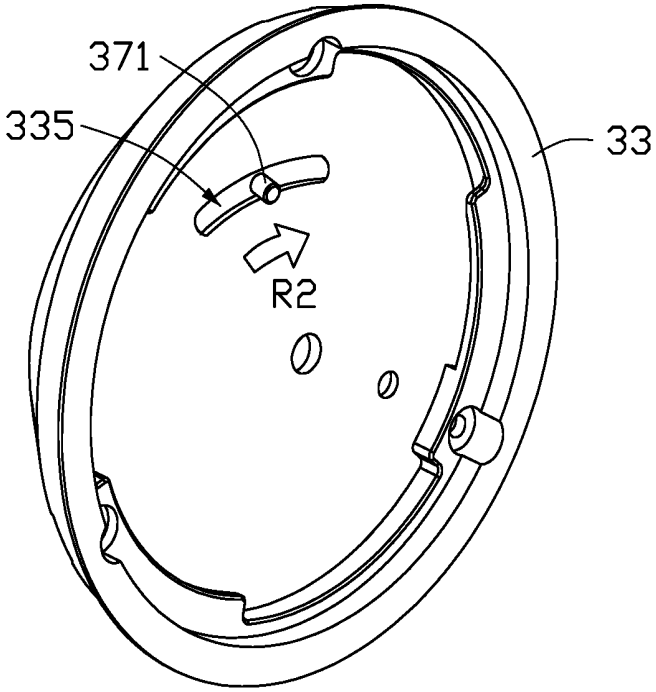


FIG. 9D

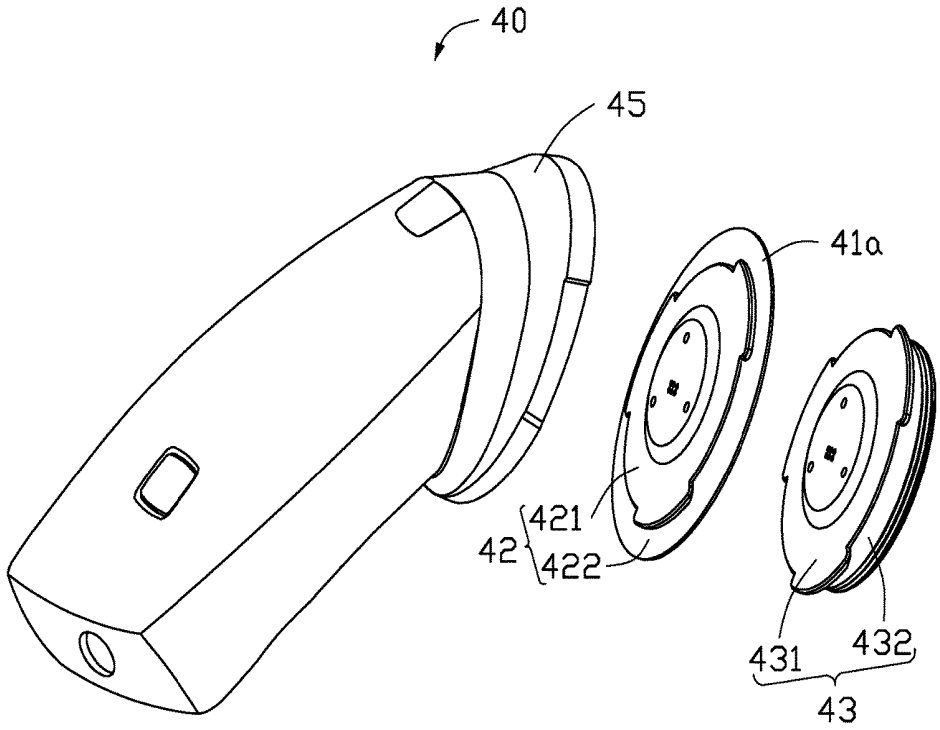


FIG. 10

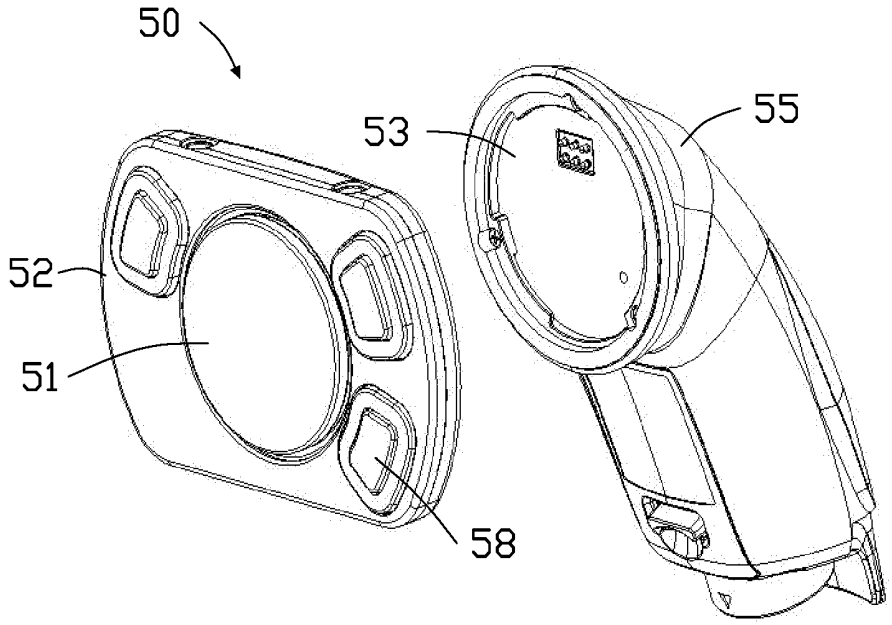


FIG. 11A

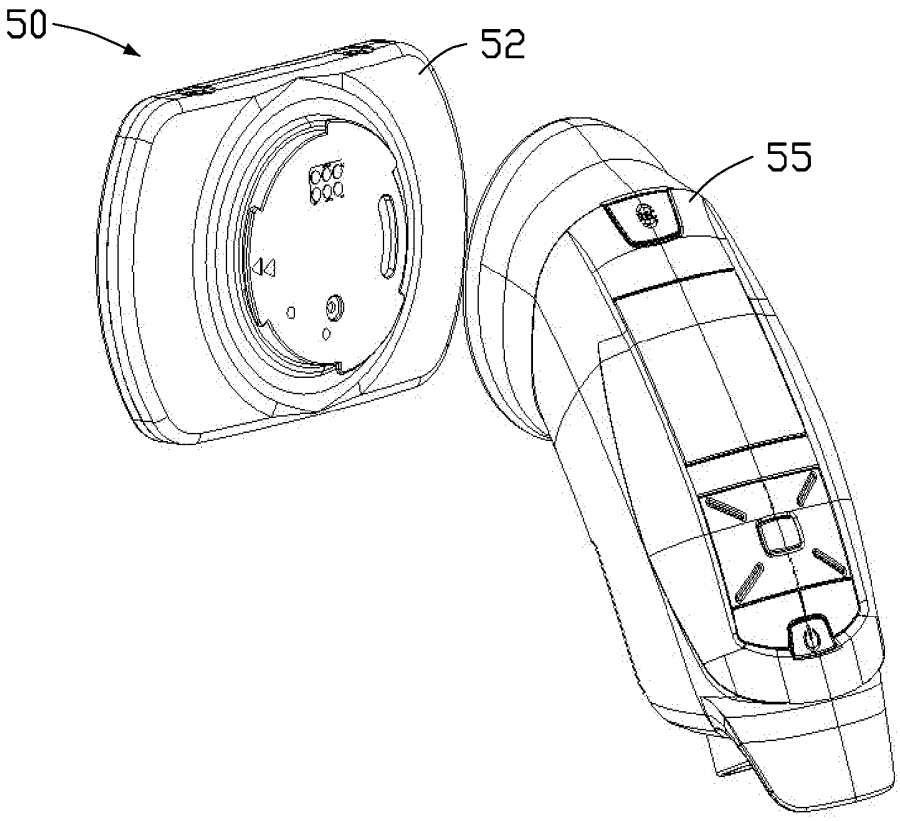


FIG. 11B

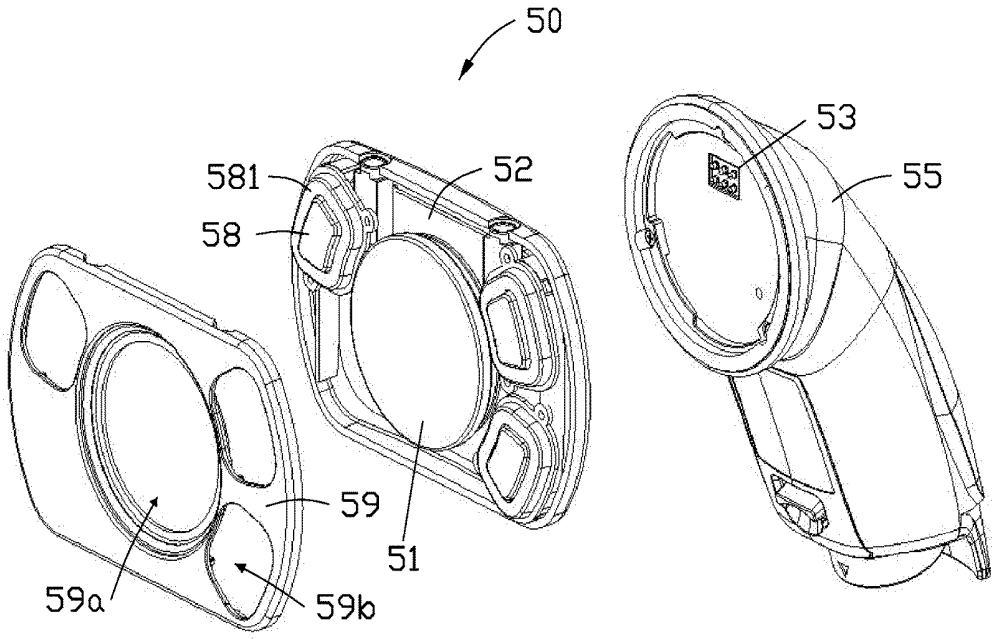


FIG. 12

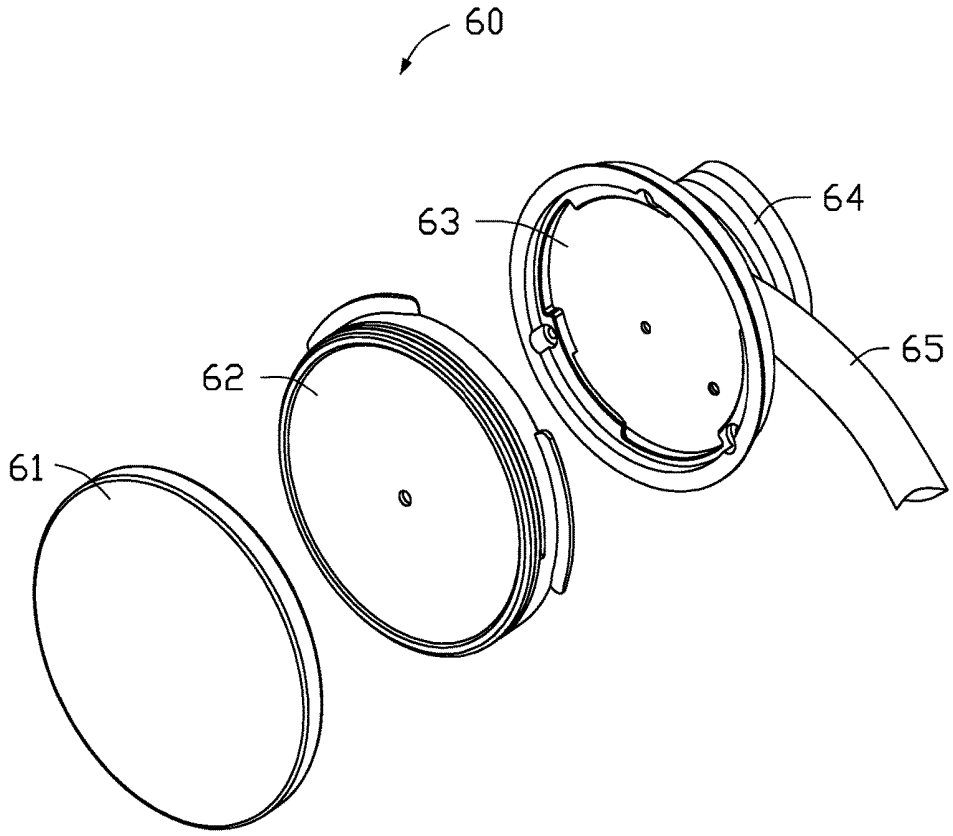


FIG. 13

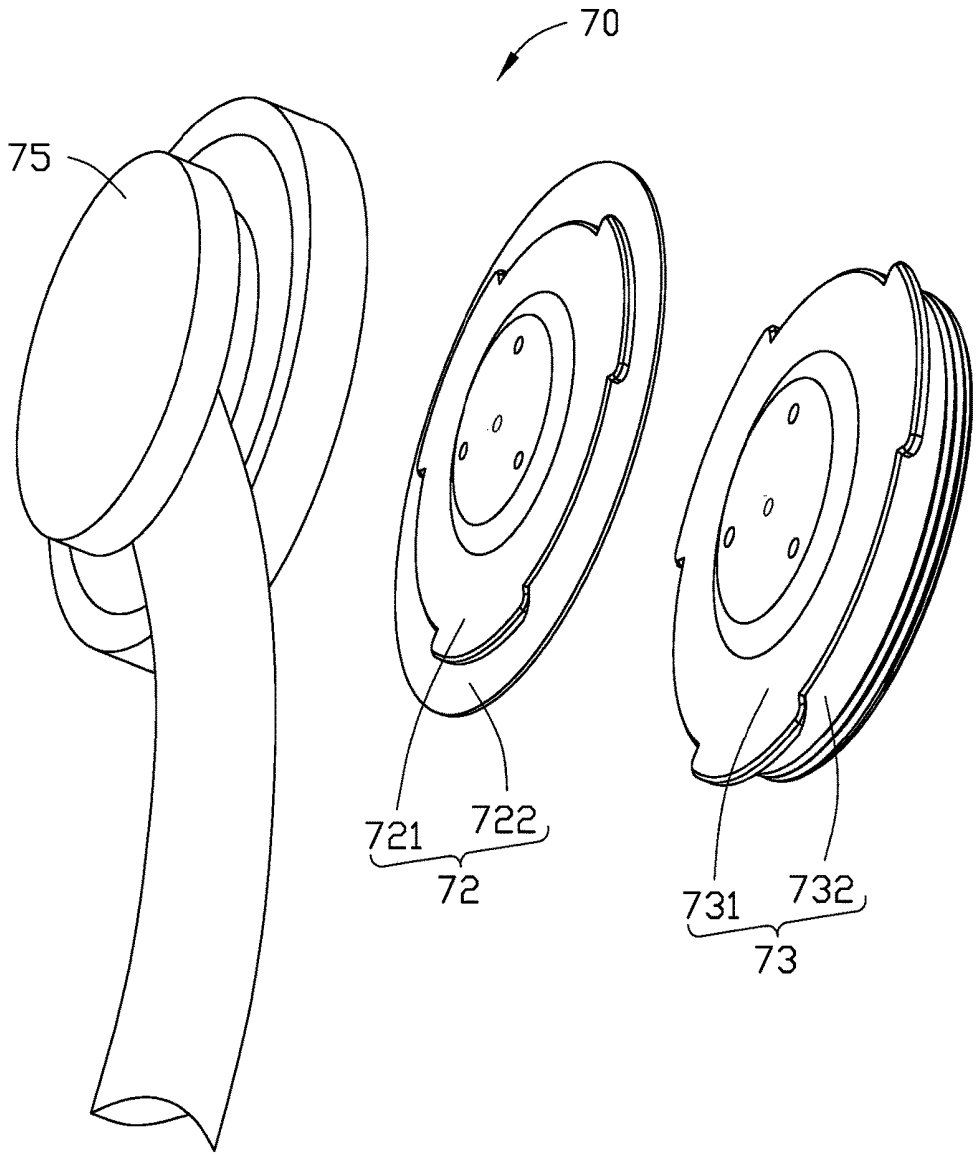


FIG. 14

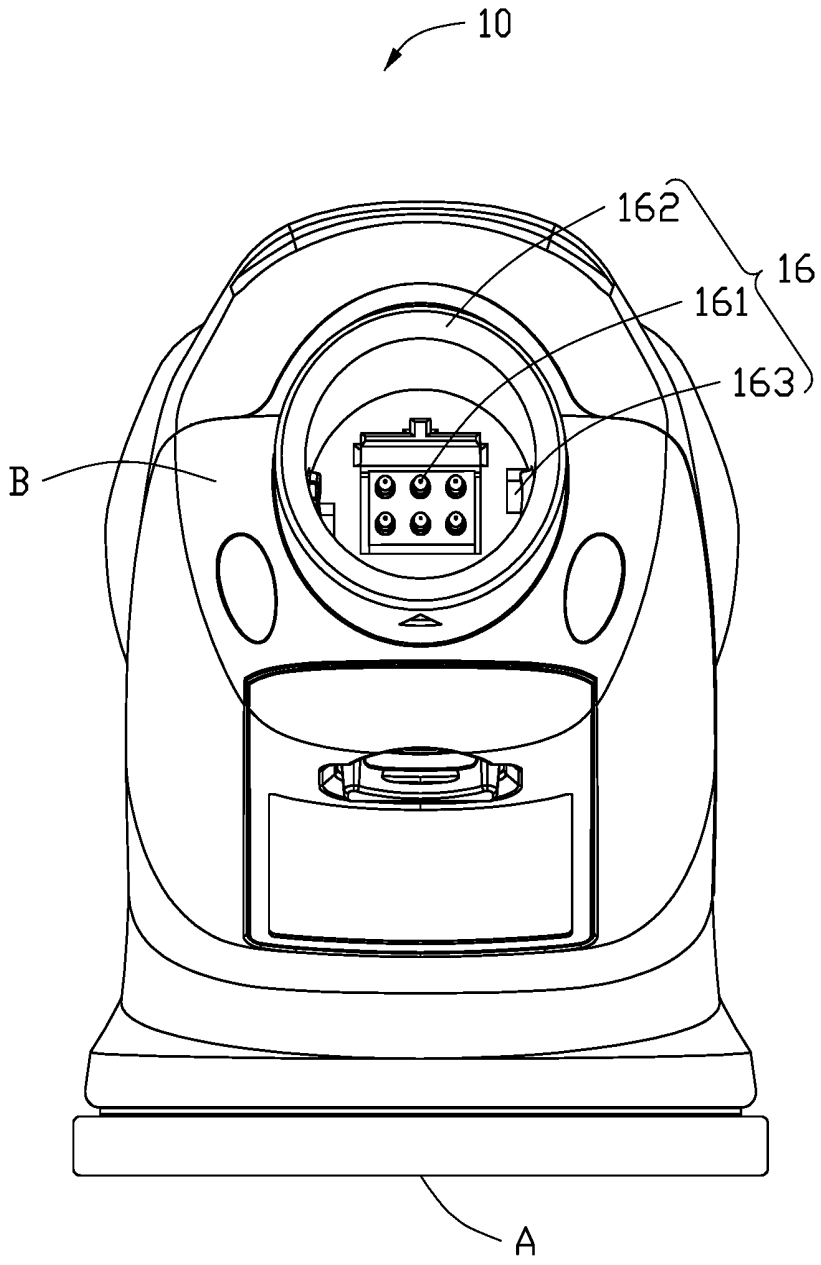
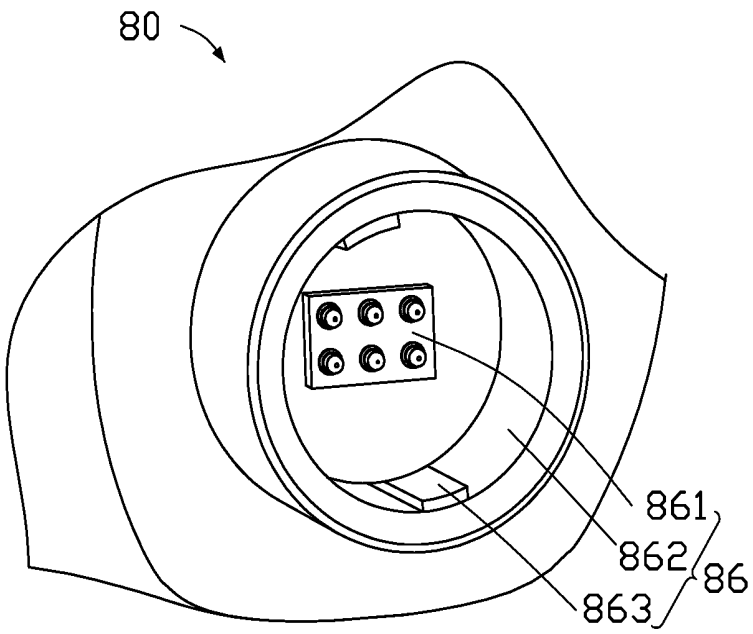


FIG. 15



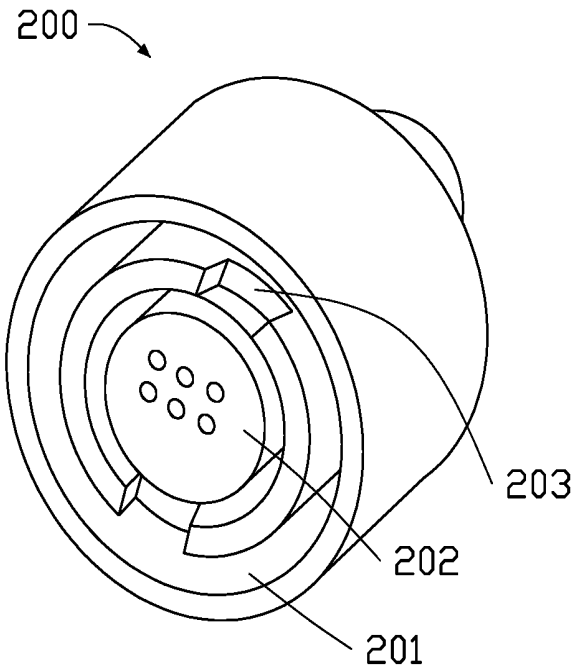


FIG. 16

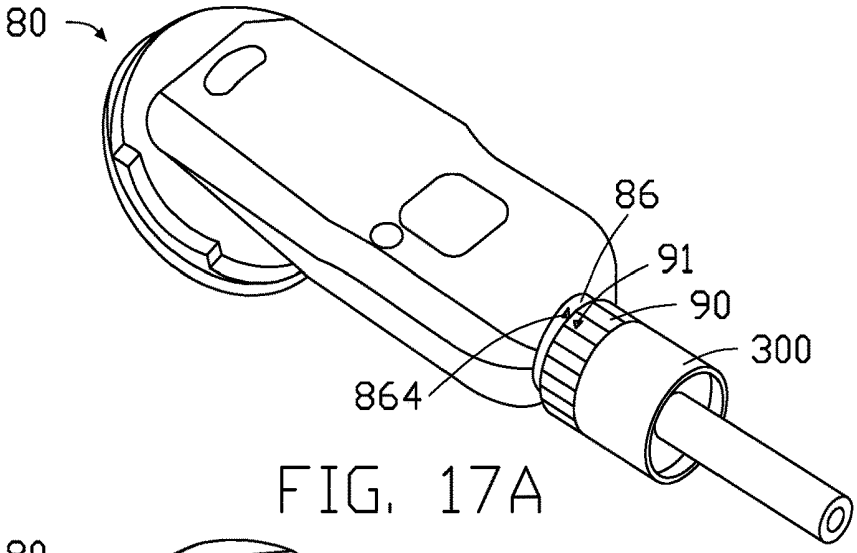


FIG. 17A

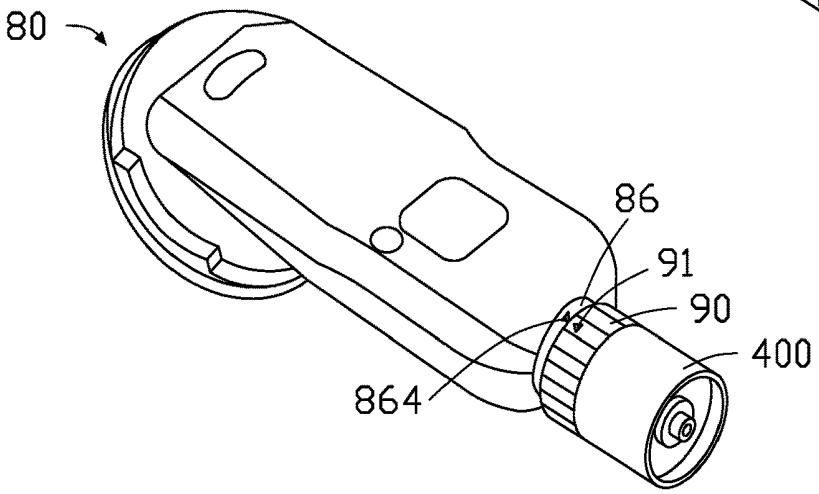


FIG. 17B

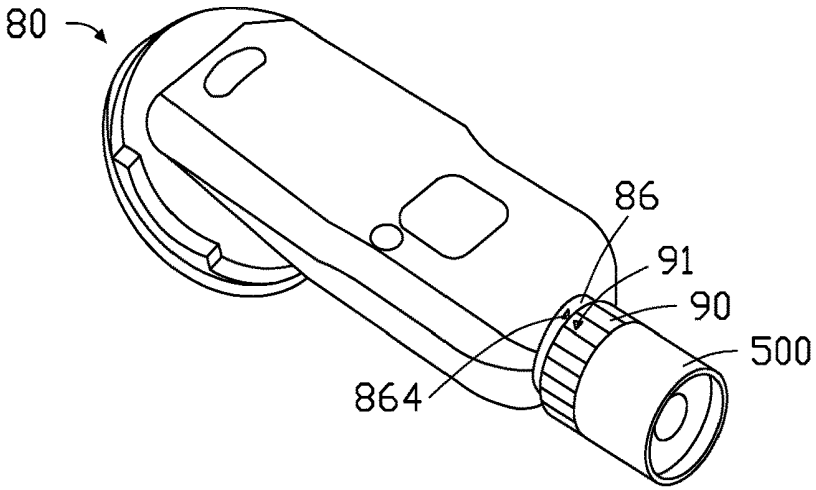


FIG. 17C

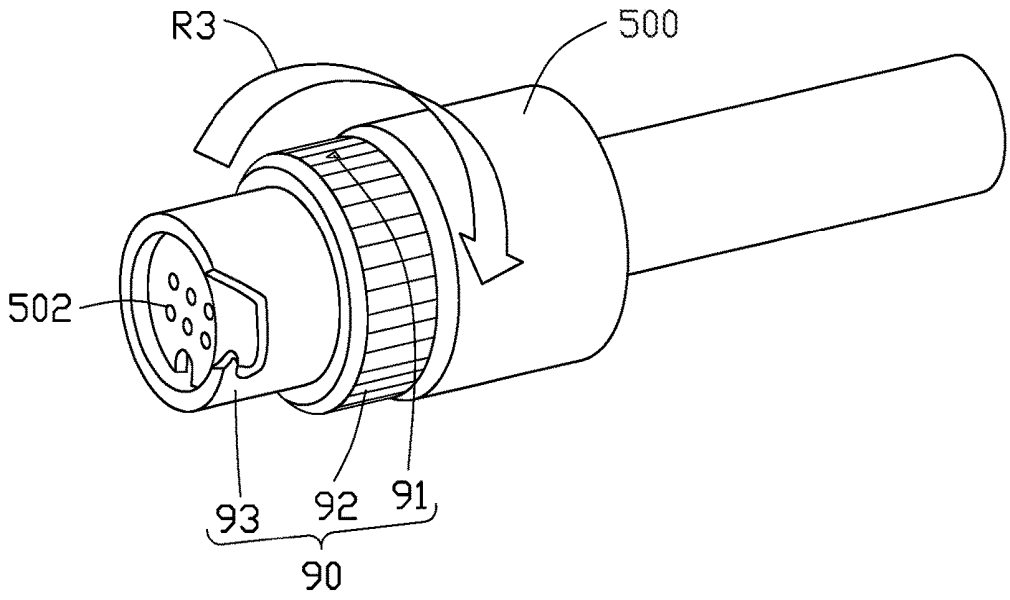


FIG. 18

AUSCULTATION DEVICE WITH MODULAR CHEST PIECE AND ECG MODULE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. provisional patent application No. 62/546,694, filed on Aug. 17, 2017, which is hereby incorporated by reference in its entirety.

FIELD

[0002] The invention pertains to the field of auscultation. More particularly, the invention pertains to auscultation devices with modular chest piece that can he replaceably removed.

BACKGROUND

[0003] The heart and body produce hundreds of specific sounds, including heart, king, bowel, circulatory system, and Korotkoff sounds. These sounds and combinations thereof are indicative of normal and abnormal conditions. Knowledge of these sounds provides valuable diagnostic information to the physician. The art of listening to, these sounds and using them as diagnostic aids is known as auscultation. The tool that physicians use to perform auscultation is referred to as a ausculation device.

[0004] The design of auscultation device has not changed much since the original invention of auscultation devices by the French physician Rene Laennec about 200 years ago. The auscultation device has been the main diagnostic tool for generations of physicians and other health practitioners. However the sound collected by conventional auscultation device cannot be easily recorded, captured, digitized, and analyzed. The physicians would need to analyze the sound instantly while the sound is received by the conventional auscultation device.

[0005] Recently, a number of digital auscultation devices have finally found their way to the market. The sound of auscultation can be recorded, captured, digitized, or analyzed by commercially available digital auscultation devices. Each of the commercially available digital auscultation devices, or conventional digital ausculation devices, is generally consisted of a chest piece and a diaphragm to contact the body and collect the sounds, an acoustic sensor to capture the sounds collected by the chest piece and the diaphragm, and a control module to digitize, analyze, or record the sounds captured by the microphone. These digital auscultation devices may be configured to detect Korotkoff sounds, or sounds from heart, lung, bowel, or circulatory system.

[0006] However, most commercially available digital auscultation devices are designed to be coupled to one specific signal input component The signal input component can be an Y-tube with ear pieces, an audio output jack, a phone jack, or a wireless signal transmission component. They do not offer much flexibility to allow modular addition or integration of other functionalities. The application and function of the conventional digital auscultation device are thus limited by the single-output design.

[0007] Additionally, different chest pieces may be required when auscultating for sounds generated by different organs or by different subjects, such as chest piece for adults or for children. Nevertheless, the chest pieces in both the conventional auscultation devices or the digital auscultation devices are not interchangeable. After using a conventional auscultation device or a digital auscultation device on one subject, the user would have to switch to another auscultation device when an auscultation subject or a target organ is changed.

[0008] Furthermore, a major setback when changing the chest pieces is exposing the acoustic sensor in the digital auscultation device to the surrounding environment. Because the acoustic sensor in the digital auscultation device is not shielded by the chest piece during the changeover, the acoustic sensor may be prone to damage. Another setback when changing the chest piece is the scrubbing sound or noise caused by the changeover. The user may unintentionally change the chest piece without realizing one is still wearing an earpiece of a Y-tube coupled with the digital auscultation device, in this case, the noise generated will be magnified and cause irritation to the user.

[0009] Therefore, it is desirable to provide an improved auscultation device with an interchangeable chest piece.

[0010] It is also desirable to provide an in auscultation device design that are modular and capable of integrating other signal input components.

[0011] It is also desirable to provide an improved auscultation device that blocks the sound transmission route and shield the acoustic sensor during the chest piece changeover.

SUMMARY OF THE INVENTION

[0012] In view of the shortcomings in the art, it is an object of the present invention to provide a modular auscultation device with interchangeable chest pieces or diaphragms having varying sizes, geometry, material, and other structural configurations that may be beneficial to the operation or performance of the auscultation device under different circumstances.

[0013] It is another object of the present invention to provide a modular digital auscultation device that is capable of working with and operatively connecting to a variety of signal input components.

[0014] It is another object of the invention to provide a modular auscultation device capable of working with additional sensor module.

[0015] It is another object of the invention to provide a protective mechanism for the acoustic sensor during the changeover of the chest pieces.

[0016] An embodiment of the present disclosure provides an auscultation device. The auscultation device comprises a sound capturing element, a chest piece holder disposed on a distal end of the auscultation device, coupled to the sound capturing element, and comprising a connecting structure and a chest piece comprising a dislocating structure removably coupled to the connecting structure of the chest piece holder.

[0017] In a preferred embodiment, the dislocating structure comprises a plurality of projections. The connecting structure comprise a flange having a plurality of notches, a plurality of wings, and a sidewall. The notches and the wings are alternatingly arranged around the flange. The notches and the sidewall form a plurality of notch receiving spaces, and the wings and the sidewall form a plurality of wing receiving spaces.

[0018] In a preferred embodiment, each of the projection of the dislocating structure being received by each of the notch receiving spaces of the flange corresponds a first state of the auscultation device.

[0019] In a preferred embodiment, each of the projections of the dislocating structure being at least partially received by each of the wing receiving spaces of the flange corresponds a second state of the auscultation device.

[0020] In a preferred embodiment, the auscultation device further comprises a partition plate between the sound capturing element and the chest piece holder. The partition plate comprises a central hole and a pivot.

[0021] In a preferred embodiment, the auscultation device further comprises a switching piece between the partition plate and the chest piece holder. The switching piece comprises a door being rotatable about the pivot.

[0022] In a preferred embodiment, the door of the switching piece is not blocking the central hole of the partition plate, corresponding to a third state of the switching piece and the partition plate.

[0023] In a preferred embodiment, the door of the switching piece is at least partially blocking the central hole of the partition plate, corresponding to a fourth state of switching piece and the partition plate.

[0024] In a preferred embodiment, the switching piece further comprises a protrusion rotatable about the pivot. The chest piece further comprises a ditch, and the protrusion is m contact with the chest piece through the ditch.

[0025] In a preferred embodiment, the digital auscultation device is in the third state when the protrusion of the switching piece is at a first position.

[0026] In preferred embodiment, the digital auscultation device is in the fourth state when the protrusion of the switching piece is at a second position.

[0027] In a preferred embodiment, the auscultation device is in the first state when the switching piece and the partition plate are in the fourth state for at least partially blocking a sound transmission route from passing through the central hole to the microphone. A rotation of the switching piece is triggered by a rotation of the chest piece through the protrusion and transforms the switching piece and the partition plate from the fourth state into the third state. The auscultation device is in the second state when the switching piece and the partition plate are in the third state for unblocking the sound transmission route from passing through the central hole to the sound capturing element.

[0028] In a preferred embodiment, the auscultation device further comprises a diaphragm, and the diaphragm can be of different sizes.

[0029] In a preferred embodiment, the chest piece further comprises an extended surface not covered by the diaphragm, and one or more ECG plates disposed on the extended surface.

[0030] In a preferred embodiment, the auscultation device further comprises a housing having a digital part and a proximal part, a control module in the housing, a microphone coupled to the control module, and an output module connectable with a signal input component and disposed on the proximal part of the housing.

[0031] In a preferred embodiment, the output module comprises a first latch, a first pogo pin and a first male screw thread for connecting with different signal input components.

[0032] In a preferred embodiment, each of the different signal input component comprises a first female screw thread, a first pogo pin connector, and a first latch groove.

[0033] In a preferred embodiment, the output module comprises a second latch groove, a second pogo pin connector, and a second female screw thread for connecting with different signal input components.

[0034] In a preferred embodiment, each of the different signal input component comprises, a second male screw thread, a second pogo pin connector, and a second latch.

[0035] In a preferred embodiment, the digital auscultation device further comprises a rotary clasp for connecting the signal output and the output module.

[0036] An embodiment of the present disclosure provides a digital auscultation device. The digital auscultation device comprises a housing having a digital part and a proximal part, a control module in the housing, a microphone coupled to the control module, an output module connectable with an signal input component and disposed on the proximal part of the housing, a chest piece holder disposed on the distal part of the housing and comprising a connecting structure, a chest piece comprising a dislocating structure removably coupled to the connecting structure of the chest piece holder, and a diaphragm removably coupled to the chest piece.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037] Implementations of the present technology will not be described, by way of example only, with reference to the attached figures.

[0038] FIG. **1** is a perspective view of a digital auscultation device in accordance with an exemplary embodiment of the present disclosure.

[0039] FIG. **2** is another perspective view of the digital auscultation device in accordance with an exemplary embodiment of the present disclosure.

[0040] FIG. **3** is an exploded view of the digital auscultation device in accordance with an exemplary embodiment of the present disclosure.

[0041] FIGS. **4**A and **4**B are front side and rear side views of a chest piece and a chest piece holder; FIG. **4**C is a perspective view of the chest piece and the chest piece holder; FIGS. **4**D and **4**E are cross-sectional views of the chest piece holder, in accordance with an exemplary embodiment of the present disclosure.

[0042] FIGS. **5**A and **5**B are perspective views of the chest piece and the chest piece holder different states, in accordance with an exemplary embodiment of the present, disclosure.

[0043] FIGS. **6**A and **6**B are exploded views of another digital auscultation device, in accordance with an exemplary embodiment of the present disclosure.

[0044] FIG. **7** is an exploded view of another digital auscultation device, in accordance with an exemplary embodiment of the present disclosure.

[0045] FIGS. **8**A and **8**B are perspective views of a partition plate and a switching piece in different states, in accordance with an exemplary embodiment of the present disclosure.

[0046] FIGS. **9**A and **9**B are exploded views of the digital auscultation device in different states; FIGS. **9**C and **9**D are perspective views of the digital auscultation device in different states, in accordance with an exemplary embodiment of the present disclosure.

[0047] FIG. **10** is an exploded view of another digital auscultation device, in accordance with an exemplar embodiment of the present disclosure.

[0048] FIGS. **11**A and **11**B are perspective views of another digital auscultation device, in accordance with an exemplary embodiment of the present disclosure.

[0049] FIG. **12** is an exploded view of the digital auscultation device of FIGS. **11**A and **11**B, in accordance with an exemplary embodiment of the present disclosure.

[0050] FIG. **13** is an exploded view of a non-digital auscultation device, in accordance with an exemplary embodiment of the present disclosure.

[0051] FIG. **14** is an exploded view of another non-digital auscultation device, in accordance with an exemplary embodiment of the present disclosure.

[0052] FIG. **15** is a perspective view on a proximal part of the digital auscultation device, in accordance with an exemplary embodiment of the present disclosure.

[0053] FIG. **16** is a perspective view of a signal input component and the proximal part of a digital auscultation device, in accordance with an exemplary embodiment of the present disclosure.

[0054] FIG. **17**A-**17**C are perspective views of the signal input components, the digital auscultation devices, and a plurality of rotary clasps, in accordance with an exemplary embodiment of the present disclosure.

[0055] FIG. **18** is a perspective view of the rotary clasp and the signal input component in accordance with an exemplary embodiment of the present disclosure.

DETAILED DESCRIPTION

[0056] The present disclosure will now be described more filly hereinafter with reference to the accompany drawings, in which exemplary embodiments of the disclosure are shown. This disclosure may, however, be embodied in many different forms and should not he construed as limited to the exemplary embodiments set forth herein. Rather, these exemplary embodiments are provided so that, this disclosure will be thorough and complete, and will fully convey the scope of the disclosure to those skilled in the art. Like reference numerals refer to like elements thought the present disclosure.

[0057] Referring to FIG. **1**, a digital auscultation device **10** is provided in accordance with an exemplary embodiment of the present disclosure. The digital auscultation device **10** comprises a distal part A and a proximal part B. When using the digital auscultation device **10**, the distal part A is closer to a surface of an auscultation subject, and the proximal part B is closer to a user. The tem "user" refers to the individual conducting auscultation on the subject. The uses may hold the proximal, part B to conduct auscultation, and one or more components on the distal part A may be in contact with the surface of the subject hen using the digital auscultation device **10**.

[0058] Referring to FIG. **2**, an perspective view of the digital auscultation device **10** is provided in accordance with an exemplary embodiment of the present disclosure. A housing **15** generally forms an exterior of the digital auscultation device **10** and provides protection for interior components. A user interface **16** is on the exterior of the digital auscultation device **10**, and may be located on a substantially middle location with respect to the distal part A and the proximal part B. The user interface **16** comprises one or more of screens or buttons, and the user may input commands to the digital auscultation device **10** through the user interface **16**. The user may also receive instructions, advices, or auscultation results from the user interface **16**.

[0059] Referring to FIG. **3**, an exploded view of the digital auscultation device **10** is provided in accordance with an exemplary embodiment of the present disclosure. A microphone **14** is inserted in the housing **15** and located on the distal part A. The microphone **14** is a sound capturing element in the digital auscultation device **10** that captures analog signals and transmit the analog signals to a control module (not shown) in the housing **15**. The control module may receive instructions or commands from the user from the user interface **16**, instruct the microphone **14** to capture one or more wavelength ranges of analog signals, receive the analog signals from the microphone **14**, convert the analog signals into digital signals, record the digital signals, analyze the digital signals, and then transmit auscultation results to signal input components. The control module may comprise a converter for analog-digital conversion, a processor for analyzing or processing signals, a memory for storing data or instructions, and an **110** unit. A chest piece holder **13** is disposed on the distal part A for receiving a chest piece **12**. The chest piece **12** is removably coupled to the chest piece holder **13**. A diaphragm **11** is composed of a soft and flexible material, and is removably coupled onto the chest piece **12**. A diameter of the diaphragm is about 30 to 50 mm. Preferably, the diameter of the diaphragm is 47 mm for auscultation of adult subjects, or 35 mm for pediatric auscultation. The diaphragm **11** and the chest piece **12** collect auscultation sounds from the surface of the subject when using the digital auscultation device **10**. When conducting auscultation on different subjects, the user may change the diaphragm **11** between the subjects for hygiene.

[0060] Referring to FIG. **4**A, a front side view of the chest piece **12** and the chest piece holder **13** is provided in accordance with an exemplary embodiment of the present disclosure. The term "front side" refers to a side facing or toward the subject when conducting auscultation. The chest piece **12** comprises a dislocating structure **121** and a central hole **122**. The dislocating structure **121** comprises a plurality of projections **121***a* being integral with and protruded outwardly from the chest piece **12**. Each projection **121***a* is separate from another projection **121***a*. The chest piece holder **13** comprises a central hole **132** and a connecting structure **131**. The connecting structure **131** comprises a flange **1311**, a positioning aperture **1312**, an indication **1313**, and a concave space **1314** (not shown in FIG. **4**A, but illustrated in FIG. **4**C-**4**E). The flange **1311** is a flange structure extends inwardly on the front side of the chest piece holder **13**, and comprises a plurality of wings **1311***a* and a plurality of notches **1311***b*. The wings **1311***a* are inwardly protruding pans of the flange **1311**, and the notches **1311***b* are parts of the flange **1311** other than the wings **1311***a*. The notches **1311***b* and the wings **1311***a* are alternatingly arranged around the flange **1311**. Therefore, each of the wing **1311***a* is next to one of the notch **1311***b*, and the amount of the wings **1311***a* and the notches **1311***b* is always the same. The amount of the notches **1311***b* and the projections **121***a* is also the same. There are at least 2 notches **1311***b* in the chest piece holder **13**, and the amount of the notches **1311***b* and the projections **121***a* can be as many as they are structurally and geometrically plausible in the chest piece holder **13** and the chest piece **12**. The concave space

1314 is defined by and surrounded by the flange **1311** on the front side of the chest piece holder **13**, will be described further below.

[0061] Referring to FIG. **4**B, a rear side view of the chest piece **12** and the chest piece holder **13** is provided in accordance with an exemplary embodiment of the present disclosure. The term "rear side" refers to a side that is opposite to the front side, and can be the side facing the user when conducting auscultation. The dislocating structure **121** of the chest piece **12** further comprises a plurality of positioning apertures **121***b* for aligning with the positioning aperture **1312**, and an indication **121***c* on the rear side for aligning with the indication **1313** of the chest piece holder **13**, this alignment makes an insert of the chest piece **12** into the chest piece holder **13** easier. The positioning aperture **121***b* comprises a positioning aperture **1211** and a positioning aperture **1212**.

[0062] Referring FIG. **4**C, a perspective view of the chest piece **12** and the chest piece holder **13** is provided in accordance with an exemplary embodiment of the present disclosure. The dislocating structure **121** of the chest piece **12** may further comprise a screw **121***d* on the side. The flange **1311** further comprises a sidewall **1311***c*. The concave space **1314** is structurally complementary to the chest piece **12**.

[0063] Referring to FIG. **4**D, a cross-sectional views of the wings **1311***a* of the chest piece holder **13** are provided in accordance with an exemplary embodiment of the present disclosure. The sidewall **1311***c* and the plurality of the wings **1311***a* form a plurality of wing receiving spaces **1311***d* at an edge of the concave space **1314**. Referring to FIG. **4**E, a cross-sectional views of the notches **1311***b* of the chest piece holder **13** are provided in accordance with an exemplary embodiment of the present disclosure. The notches **1311***b* is shorter than the wings **1311***a*. The sidewall **1311***c* and the plurality of the notches **1311***b* form a plurality of notch receiving spaces **1311***e* at another edge of the concave space **1314**.

[0064] The chest piece **12** can be removably coupled to the chest piece holder **13**. The dislocating structure **121** of the chest piece **12** can be removably coupled to the connecting structure **131** of the chest piece holder **13**. Referring to FIGS. **5**A and **5**B, perspective views of a combination of the chest piece **12** and the chest piece holder **13** is provided in accordance with an exemplary embodiment of the present disclosure in FIGS. **5**A and **5**B, the rear side of the chest piece **12** contacts the front side of the chest piece holder **13**.

[0065] FIG. **5**A illustrates a first state of the digital auscultation device **10**. The first state is defined by each of the projections **121***a* being received by each of the notch receiving spaces **1311***e* (shown on FIG. **4**E). The height of the projection **121***a* is smaller than the height of the notch receiving space **1311***e* and the wing receiving space **1311***d*, therefore the projections **121***a* of the dislocating structure **121** generally lit the spaces formed by the sidewall **1311***c*, the notches **1311***b*, and the wings **1311***a*. Thus, the user is able to insert the chest piece **12** into the concave space **1314** of the chest piece holder **13**. The indication **121***c* (not shown) of the chest piece **12** corresponds to the location of the indication **1313** (not shown) of the chest piece holder **13**. With markings provided by the indication **121***c* and the indication **1313**, the user may position the chest piece **12** and the chest piece holder **13** accurately. In the first state, the positioning aperture **1211** (not shown in FIG. **5**A, but illustrated in FIG. **4**B) on the rear side of the chest piece **12** matches the positioning aperture **1312** (not shown in FIG. **5**A, but illustrated in FIG. **4**A) on the front side of the chest piece holder **13**. A ball (not shown) can be disposed in the positioning aperture **1312** to assist the matching between the positioning aperture **1211** and the positioning aperture **1312**. In the first state, the ball is accommodated in both the positioning aperture **1211** and the positioning aperture **1312**, therefore the user would be notified that the chest piece **12** is adequately received by the chest piece holder **13**.

[0066] FIG. **5**B illustrates a second state of the digital auscultation device **10**. The second state is defined by each of the projections **121***a* being at least partially received by each of the wing receiving spaces **1311***d* (shown on FIG. **4**D). The projection **121***a* can be partly or entirely received by the wing receiving space **1311***d*. In other words, a part of the projection **121***a* can be seen from the front side during the second state when the projection **121***a* is only partially received by the, wing receiving space **1311***d*. The central hole **122** of the chest piece **12** is located above the central hole **132** of the chest piece holder **13**. In the second state, the indication **1313** of the chest piece holder **13** may be seen from the front side, and the positioning aperture **1212** (not shown on FIG. **5**B, but illustrate in FIG. **4**B) on the rear side of the chest piece **12** matches the positioning aperture **1312** (not shown in FIG. **5**B, but illustrated in FIG. **4**A) of the chest piece holder **13**. The ball (not shown) disposed in the positioning aperture **1312** can assist the matching between the positioning aperture **1212** and the positioning aperture **1312**, therefore the user would be notified that the chest piece **12** and the chest piece holder **13** is accurately coupled. The user may attach the diaphragm **11** onto the chest piece **12** to prepare for the auscultation.

[0067] Referring to FIGS. **6**A and **6**B, perspective views of another digital auscultation device **20** is provided in accordance with an exemplary embodiment of the present disclosure. The digital, auscultation device **20** comprises a diaphragm **21**, a chest piece **22**, a chest piece holder **23**, and a housing **25**. In FIGS. **6**A and **6**B, the diaphragm **21** and the chest piece **22** are already coupled before the chest piece **22** being combined with the chest piece holder **23**. The housing **25** comprises a control module (not shown) disposed in the housing **25**. The chest piece **22** comprises a dislocating structure **221**, a window **222**, a microphone (not shown), a converter (not shown), and a pogo pin connector **223**. The microphone is disposed in the chest piece **22**, captures analog signals and transmit the analog signals to a converter. The converter is also disposed in the chest piece **22**, converts the analog signals into digital signals and transmits the digital signals to the pogo pin connector **223**. The dislocating structure **221** comprises a plurality of projections **221***a* protruding outwardly from the chest piece **22**, a plurality of positioning apertures **221***b*, and a indication **221***c* extending rearwardly from the chest piece **22**. The chest piece holder **23** comprises a connecting structure **231**, a window **232** and a pogo pin **233**. The pogo pin **233** is coupled to the control module in the housing **25**. The connecting structure comprises a flange **2311** extending inwardly on the front side of the chest piece holder **23**, a positioning aperture **2312**, and a concave space **2314** defined by and surrounded by the flange **2311**, wherein the flange **2311** comprises a plurality of wings **2311***a*, a plurality of notches **2311***b*, and a sidewall **2311***c*. The wings **2311***a* are inwardly protruding parts of the flange **2311**, and the notches **2311***b* are parts of the flange

2311 other than the wings 2311*a*. The notches 2311*b* and the wings 2311*a* are alternatingly arranged around the flange 2311. Therefore, each of the wing 2311*a* is next to one of the notch 2311*b*, and the amount of the wings 2311*a* and the notches 2311*b* is always the same. A plurality of wing receiving spaces 2311*d* is formed by the wings 2311*a* and the sidewall 2311*c*, and a plurality of notch receiving spaces 2311*e* is thrilled by the notches 2311*b* and the sidewall 2311*c*.

[0068] The chest piece **22** can be removably coupled to the chest piece holder **23**. The concave space **2314** and the rear side of the chest piece **22** is complementary to each other. The dislocating structure **221** can be removably coupled to the connecting structure **231**. During a first state, each of the projections **221***a* is received by each of the notch receiving space **2311***e*, and the positioning aperture **2211** on the rear side of the chest piece **22** matches the positioning aperture **2312** on the front side of the chest piece holder **23**. A ball (not shown) can be disposed in the positioning aperture **2312** to assist the matching between the positioning aperture **2211** and the positioning aperture **2312**. In the first state, the ball is accommodated in both the positioning aperture **2211** and the positioning, aperture **2312**.

[0069] During a second state, each of the projections **221***a* is at least partially received by each of the wing receiving space **2311***d*. When the window **222** matches the window **232**, the pogo pin connector **223** matches the location of the pogo pin **233**, thereby the digital signals is able to be transmitted from the pogo pin connector **222** to the pogo pin **233**, and further be transmitted to the control module for analysis and recording. During the second state, the positioning aperture **2211** of the chest piece **22** matches the positioning aperture **2312** of the chest piece holder **23**. The ball (not shown) disposed in the positioning aperture **2312** can assist the matching between the positioning aperature **2212** and the positioning aperature **2312**, therefore the user would he notified that the chest piece **22** and the chest piece bolder **23** is accurately coupled. The coupling between the pogo pin connector **223** and the pogo pin **233**, and the matching between the positioning aperture **2212** and the positioning aperture **2312** suggest the digital auscultation device **20** is readily usable.

[0070] Referring to FIG. **7**, an exploded view of a digital auscultation device **30** is provided in accordance with an exemplary embodiment of the present disclosure. The digital auscultation device **30** comprises a diaphragm **31**, a chest piece **32**, a chest piece holder **33**, a microphone **34**, a housing **35**, a partition plate **36**, and a switching piece **37**. The microphone **34** is inserted in the housing **35** and facing the partition plate **36** on the trout side. The partition plate **36** and the switching piece **37** are disposed between the chest piece holder **33** and the microphone **34**, and the partition plate **36** is between the switching piece **37** and the microphone **34**. The chest piece **32** is removably coupled to the chest piece holder **33**, and the diaphragm **31** is removably coupled to the chest piece **32**.

[0071] Referring to FIGS. **8**A and **8**B, perspective views of the partition plate **36** and the switching piece **37** are provided in accordance with an exemplary embodiment of the present disclosure. The partition plate **36** comprises a central hole **362** and an pivot **363**. The central hole **362** corresponds to the position of the microphone **34** (not shown) of the digital auscultation device **30**, and a sound transmission route L may pass through the central hole **362** to the microphone **34**. The switching piece **37** comprises a protrusion **371**, a door **372**, an pivot-complementary structure **373**, and a process **374**. The protrusion **371** and the door **372** are rotatable about the pivot **363** of the partition plate **36**. The door **372** comprise an opening **372***a* and a blocking portion **372***b*. The pivot-complementary structure **373** is coupled to the pivot **363**, and the shape of the pivot-complementary structure **373** is complementary to the pivot **363**. The pivot-complementary structure **373** can be a ring structure if the pivot **363** is a pole, whereas the pivot-complementary structure **373** can be a pole structure if the pivot **363** is an aperture or a recess.

[0072] FIG. **8**A illustrates a third state of the partition plate **36** and the switching piece **37**. The door **372** of the switching piece **37** does not block the central hole **362** of the partition plate **36**. The opening **372***a* is corresponded to the central hole **362**, and the sound transmission route L passes through the central hole **362** to the microphone **34** (not shown) is unblocked. The protrusion **371** is in a first position and the process **374** is in a third position during the third state of the switching piece **37** and partition plate **36**. In the third state, a channel is formed by the opening **372***a* and the central hole **362**, and the auscultation sound can pass through the opening **372***a* and the central hole **362** by air. The auscultation sound could come from the chest piece holder **33** (not shown), the chest piece **32** (not shown), or the diaphragm **31** (not shown).

[0073] FIG. **8**B illustrates a fourth state of the partition plate **36** and the switching piece **37**. The door **372** of the switching piece **37** at least partially or completely blocks the central hole **362** of the partition plate **36**. The opening **372***a* does not correspond to the central hole **362** and is correspond to other portions of the partition plate **36**. The protrusion **371** is in a second position and the process **374** is in a fourth position during the fourth state of the switching piece **37** and partition plate **36**. The sound transmission route L passes through the central hole **362** to the microphone **34** (not shown) is at least partially or completely blocked by the blocking portion **372***b* of the door **372**. In the fourth state, the auscultation sound would encounter obstacles, and the auscultation sound may not reach the microphone **34** by air.

[0074] A spring **364** may be disposed on the partition piece **36** and in contact with the door **372**, The spring **364** is relaxed in the fourth state, and is stretched in the third state. During the fourth state, when the protrusion **372** is in a first position and the door **372** corresponds to the central hole **362**, the spring **364** is stretched. During the third state, when the protrusion **372** is in a second position and the door **372** at least partially blocks the central hole **362**, the spring **364** is relaxed. Therefore, the spring **364** is used to recover the position of the switching piece **37**. The spring **364** can also be in contact with the process **374**, or other portions of the switching piece **37** that is rotatable about the pivot **363**.

[0075] Although configurations of the switching piece **37** and the partition plate **36** in FIGS. **8**A and **8**B are for the digital auscultation device, they could also be applied to non-digital auscultation devices. When these configuration applied in the non-digital auscultation device, the sound transmission route L passes through the central hole to a sound capturing element of the non-digital auscultation device in FIG. **8**A, and the sound transmission route L is at least partially or completely blocked by the blocking portion **372***b* of the door **372** in FIG. **8**B, therefore the auscultation

sound may not reach the sound capturing element in the non-digital auscultation device.

[0076] Referring to FIGS. **9**A and **9**B, exploded views of the digital auscultation device **30** are provided in accordance with an exemplary embodiment of the present disclosure. The chest piece **32** comprises a plurality of projections **321***a* protruding on the rear side. The chest piece holder **33** comprises a flange **3311**, a concave space **3314**, and a ditch **335**. The flange **3311** comprises a plurality of wings **3311***a* protruding inwardly, a plurality of notches **3311***b*, and a sideman **3311***c*, The plurality of notches **3311***b* are parts on the flange **3311** that are not wings **3311***a*. According to similar configurations in FIGS. **4**D and **4**E, a plurality of wing receiving space **3311***d* are formed by the sidewall **3311***c* and the wings **3311***a*, and a plurality of notch receiving spaces **3311***e* are formed by the sidewall **3311***c* and the notches **3311***b*. The concave space **3314** is complementary to the rear side of the chest piece **32**. The ditch **335** is an arc-shaped ditch.

[0077] FIG. **9**A illustrates an exploded view of the second state of the digital stethoscope **30** and the third state of the partition plate **36** and the switching piece **37**. In FIG. **9**A, the distance between the chest piece **32**, the chest piece holder **33**, the switching piece **37**, and the housing **35** are enlarged in order to demonstrate the spatial relationship between the components of the digital auscultation device **30** during the second state and the third state. The protrusion **371** is in a first position and corresponded within a location in the ditch **335**. The projections **321***a* are disposed on a position that is corresponded to the wings **3311***a*. The sound transmission route L is established by combining a center of the chest piece **32**, a center of the chest piece holder **33**, the opening **372***a*, the central hole **362**, and the microphone **34**.

[0078] FIG. **9**B illustrates an exploded view of the first state of the digital stethoscope **30** and the fourth state of the partition plate **36** and the switching piece **37**. In FIG. **9**B, the distance between the chest piece **32**, the chest piece holder **33**, the switching piece **37**, and the housing **35** are enlarged in order to demonstrate the spatial relationship between the components of the digital auscultation device **30** during the first state and the third state. The protrusion **371** is in a second position and corresponded within another location in the ditch **335**. The projections **321***a* are disposed on another position that is corresponded to the notches **3311***b*. The sound transmission route L is blocked by the blocking portion **372***b* of the switching piece **37**, therefore the auscultation sound would be difficult to travel to the microphone **34** by air.

[0079] The protrusion **371** is in contact with the chest piece **32**, and the rotation of the protrusion **371** is triggered by the rotation of the chest piece **32**. Referring to FIG. **9**C, a perspective view of the chest piece holder **33** and the switching piece **37** when in the fourth state, and the digital auscultation device **30** when in the first state is provided in accordance with an embodiment of the present disclosure. The protrusion **371** is in the second position within the ditch **335**. The configuration of the switching piece **37** and the partition plate **36** in the fourth state provides a protective mechanism for the acoustic sensor during the changeover or replacement of the chest piece **32**.

[0080] From FIG. **9**C to **9**D, a transformation from the first state to the second state of the digital auscultation device **30**, and the fourth state to the third state of the switching piece **37** and the partition plate **36** is triggered by a rotation R**1** of the switching piece **37**. In FIG. **9**C, the chest piece **32** (not shown) is in the first state wherein each of the projections **321***a* are received by each of the notch receiving, spaces **3311***e* (not shown). The chest piece **32** (not shown) is already in contact with the protrusion **371**, and a rotation of the chest piece **32** triggers the rotation R**1** of the protrusion **371** of the switching piece **37**. The is of the chest piece **32** from FIG. **9**C to **9**D can be initiated by the user for coupling the chest piece **32** to the chest piece holder **33**.

[0081] Referring to FIG. **9**D, a perspective view of the chest piece holder **33** and the switching piece **37** when in the third state, and the digital auscultation device **30** when in the second state is provided in accordance with an embodiment of the present disclosure. The protrusion **371** is in the first position within the ditch **335**. The sound transmission route L (as illustrated in FIG. **9**B) is established and the auscultation sound can reach the microphone **34** by air. In FIG. **9**D, the digital auscultation device **30** is in the second state, each of the projections **321***a* of the chest piece **32** is received by the wing receiving spaces **3311***d*. The configuration of the protections **321***a* and the wing receiving spaces **3311***d* during the second state of the digital auscultation device **30** are similar to the configuration of the projections **121***a* and the wing receiving spaces **1311***d* in FIG. **5**B.

[0082] From FIG. **9**D to **9**C, a transformation from the second state to the first state of the digital auscultation device **30**, and the third state to the fourth state of the switching piece **37** and the partition plate **36** is triggered by a rotation R**2** of the switching piece **37**. The rotation R**2** of the protrusion **371** of the switching piece **37** is triggered by another rotation of the chest piece **32** (not shown). The rotation of the chest piece **32** from FIG. **9**D to **9**C can be initiated by the user for changing the chest piece **32** into another chest piece, or simply for uncoupling the chest piece **32**.

[0083] Referring to FIG. **10**, an exploded view of a digital auscultation device **40** is provided in accordance with an exemplary embodiment of the present disclosure. The digital auscultation device **40** comprises a housing **45**, a microphone (not shown), a chest piece holder (not shown), two interchangeable chest pieces **42** and **43**. The chest piece holder of the digital auscultation device **40** is complementary to both the chest piece **42** and **43**. The chest piece **42** comprises a platform **421** complementary to the chest piece holder of the digital auscultation device **40**, and a diaphragm plane **422** for coupling with a diaphragm (not shown). The chest piece **43** comprises a platform **431** complementary to the chest piece holder of the digital auscultation device **40**, and a diaphragm plane **432** for coupling with another diaphragm (not shown). The diaphragm of the chest piece **42** is larger than the diaphragm of the chest piece **43**, in order for conducting auscultation on different subjects. For instance, the chest piece **41** is for pediatric auscultation because of the diaphragm of the chest piece **41** is smaller. The digital auscultation devices **10**, **20**, **30**, and **40** of the present disclosure have removably-coupling configurations between the chest pieces and the chest piece holders, thus they are able to have chest pieces wherein the diaphragms on the chest pieces are of different sizes. The interchangeable chest piece design enables the digital auscultation device **10**, **20**, **30**, and **40** of the present disclosure to be applied in different auscultation scenarios. The chest pieces and the diaphragms may have various sizes, geometry, material, or

other structural configuration that may be beneficial to the operation or performance of the auscultation device under different circumstances.

[0084] Referring to FIGS. **11**A and **11**B, perspective views of a digital auscultation device **50** are provided in accordance with an exemplary embodiment of the present disclosure. The digital auscultation device **50** comprises a diaphragm **51**, a chest piece **52**, a chest piece holder **53**, a housing **55**, and a plurality of ECG plates **58**. The chest piece **52** can be removably coupled to the chest piece holder **53**. The ECG plates **58** can be disposed on an extended surface on the front side of the chest piece **52**, and is coupled with the chest piece **52** through lose logical coupling, tied physical coupling, or fully integrated with the chest piece **52**. In FIG. **11**A, the extended area is an area not covered by the diaphragm **51**, or the auscultation module **51** when viewed from the front side. Multiple ECG plates **58** can be arranged corresponding to a lead arrangement in the conventional ECG instrument. In the digital auscultation device **50**, two of the ECG plates **58** are disposed on one side of the chest piece **52** and one of the ECG plate **58** is disposed on another side of the chest piece **52**. The digital auscultation device **50** is capable to conduct auscultation and ECG measurement at the same time, or switching between auscultation mode and ECG mode.

[0085] Referring to FIG. **12**, an exploded view of the digital auscultation device **50** is provided in accordance with an embodiment of the present disclosure. The digital auscultation device **50** further comprises a cover **59** being coupled to the chest piece **52** on the front side. Because the ECG plates **58** measures electricity, therefore some circuits (not shown) may be arranged inside the chest piece **52** for transmitting the ECG signals captured by the ECG plates **58**. The cover **59** protects the circuits from exposure, thus prevents short circuiting. The cover **59** comprises an opening **59***a* for the auscultation module **51**, and a plurality of openings **59***b* for the ECG plates **58**. The openings **59***a* and **59***b* conform the shape of the auscultation module **51** and the ECG plates **58**, respectively. The ECG plates **58** may further comprise a rubber edge **581** for insulating the ECG plates **58** from the surrounding components, such as the cover **59** or the diaphragm **51**.

[0086] Referring to FIG. **13**, an exploded view of a non-digital auscultation device **60** is provided in accordance with an exemplary embodiment of the present disclosure. The non-digital auscultation device **60** comprises a diaphragm **61**, a chest piece **62**, a chest piece holder **63**, a bell **64**, and a tube **65**. When using the non-digital auscultation device **60**, a distal end is closer to a surface of the auscultation subject, and a proximal end is closer to the user. The diaphragm **61** is removably coupled to the chest piece **62**. The chest piece holder **63** is disposed on the distal end of the Don-digital auscultation device **60** and coupled to the bell **64**, and the bell **64** is coupled to the tube **65**. The bell **64** can be the sound capturing element of the non-digital auscultation device **60**. The sound capturing element can also be a structure formed inside the non digital auscultation device that captures auscultation sounds. The chest piece **62** and the chest piece holder **63** can be removed, therefore the chest piece **62** in the non-digital auscultation device **60** is interchangeable. The removal and coupling, of the chest piece **62** and the chest piece holder **63** are similar to mechanisms illustrated in FIGS. **5**A and **5**B and respective descriptions therein. The configurations of the switching piece **37** and the partition plate **36** can be inserted between the chest piece holder **63** and the bell **64** for forming blocked or unblocked sound transmission routes.

[0087] Referring to FIG. **14**, an exploded view of a non-digital auscultation device **70** is provided in accordance with an embodiment of the present disclosure. The non-digital auscultation device **70** comprises a bell **75**, a chest piece holder (not shown), two interchangeable chest pieces **72** and **73**. The chest piece holder of the non-digital auscultation device **70** is complementary to both the chest piece **72** and **73**. The chest piece **72** comprises a platform **721** complementary to the chest piece holder of the non-digital auscultation device **70**, and a diaphragm plane **722** for coupling with a diaphragm (not shown). The chest piece **73** comprises a platform **731** complementary to the chest piece holder of the non-digital auscultation device **70**, and a diaphragm plane **732** for coupling with a diaphragm (not shown). The diaphragm of the chest piece **72** is larger than the diaphragm of the chest piece **73**, in order for conducting auscultation on different subjects. The interchangeable chest piece design enables the non-digital auscultation devices **60** and **70** of the present disclosure to be applied in different auscultation scenarios.

[0088] Referring to FIG. **15**, a perspective view of the digital auscultation device **10** is provided in accordance with an embodiment of the present disclosure. The proximal part B of the digital auscultation device **10** is shown in FIG. **13**. The digital auscultation device **10** comprises an output module **16** disposed on the proximal part B. The output module **16** can be connected to signal input components (not shown), and comprises a pogo pin connector **161** for electrically coupled to the signal input component and transferring the digital signals or other horn the digital auscultation device **10**, a male screw thread **162** surrounding the pogo pin connector **161**, and one or more latches **163** disposed in the inner side of the male screw thread **162**.

[0089] Referring to FIG. **16**, a perspective view of a digital auscultation device **80** and a signal input component **200** is provided in accordance with an embodiment of the present disclosure. FIG. **16** illustrates only the proximal part B of the digital auscultation device **80** and a distal part of the signal input component **200**. The digital auscultation device **80** comprises an output module **86** on the proximal part B, the output module **86** comprises a first pogo pin **861** for electrically coupled to the signal input component **200** and transferring the digital signals or other data from the digital auscultation device **80**, a first male screw thread **862** surrounding the first pogo pins **61**, and a first latch **863** disposed in the inner side of the first male screw thread **862**. The signal input component **200** is an interface for transferring the digital signals or the auscultation results to other devices or to the user. The signal input component **200** comprises a first female screw thread **201**, a first pogo pin connector **202** surrounded by the first female screw thread **201**, and a first latch groove **203**. The signal input component **200** may be a Y-tube, an audio output jack, a phone jack, or a wireless signal transmission component. When connecting with the signal input component **200**, the first male screw thread **862** fits and is coupled with the first female screw thread **201** of the signal input component **200**, the first pogo pin **861** is in contact with the first pogo pin connector **202** surrounded by the first female screw thread **201**, and the first latch **863** is coupled to the first latch groove **203** of the signal input component **200**. The output module **86** and the distal part of

the signal input component **200** is complementary to each other. Therefore, alternative to configurations and elements in FIG. **16**, a second male screw thread (not shown) could be a part of the signal input component **200** and a second female screw thread (not shown) could be a part of the output module **86**; a second latch (not shown) could be a part of the signal input component **200** and a second latch groove (not shown) could be a part of the output module **86**; a second pogo pin connector (not shown) could be a part of the signal input component **200** and a second pogo pin (not shown) could be a part of the output module **86**.

[0090] Referring to FIG. **17**A-**17**C, perspective views of a plurality of modular digital auscultation devices **80** and various signal input components **300**, **400**, and **500** are provided in accordance with an embodiment of the present disclosure. With the output module **86**, the modular digital auscultation device **80** is capable of working with and operatively connected to a variety of signal input components. The signal input components **200**, **300**, **400**, and **500** are modules for transmitting the digital signals or the data to the user or other devices. The signal input components **200**, **300**, **400**, and **500** can be Y-tube, an audio output jack, a phone jack, or a wireless signal transmission component. The wireless signal transmission component can be a Bluetooth dongle, a Wifi antenna or the like. The output module **66** further comprises a mark **864**.

[0091] A rotary clasp **90** can be used to assist the respective coupling between the output module **86** and the signal input components **200**, **300**, **400**, and **500**. The rotary clasp **90** may cover at least a part of the output module **86**, or the signal input components **200**, **300**, **400**, and **500**. The rotary clasp **90** comprises a mark **91** and an inner structure (not shown). The inner structure can be a clip or a thread. The rotary clasp **90** can assist the coupling when the signal input components **200**, **300**, **400**, and **500** have complementary structures with respect to the output module **86**, and can also assist the coupling when the signal input components **300**, **400**, or **500** lacks complementary structures with respect to the output module **86**. For instance, if both the signal input component **500** and the output module **86** have male screw threads, they will not he able to be coupled; with the rotary clasp **90** between and combined with the two elements, the coupling of the output module **86** and the signal input component **500** is thus possible. The rotary clasp **90** may be coupled with the signal input component **200**, **300**, **400**, or **500** first and then be coupled with the output module **86**. The mark **91** is a marking for the user to accurately position the rotary clasp **90**, the signal input component **200**, **300**, **400**, or **500**, and the output module **86**. When coupling the rotary clasp **90** and the output module **86**, the user would need to align the mark **91** of the rotary clasp **90** with the mark **864** of the output module **86**. The rotary clasp **90** also could be a safety measure to prevent an accidental dislocation between the signal input components **200**, **300**, **400**, or **500** and the output module **86**. The accidental dislocation between the above components may occur if the subject has poor compliance during the auscultation. The user would have to unwind or un-clip the rotary clasp **90** on the modular digital auscultation device **80** before dislocating the output module **86** and the signal input components **200**, **300**, **400**, or **500**.

[0092] Referring to FIG. **18**, a perspective view of the rotary clasp **90** and the signal input component **500** is provided in accordance with an exemplary embodiment of the present disclosure. The signal input component **500** comprises a pogo ping connector **502**, and is already coupled with the rotary clasp **90**. The rotary clasp **90** comprises the mark **91**, a knob **92**, and a sleeve **93**. The sleeve **93** is a complementary structure to the output modules of the digital auscultation device **10**, **20**, **30**, **40**, **50**, or **80**. The sleeve **93** also covers the signal input component **500** and is able to assist a coupling between the signal input component **500** and the digital auscultation device **10**, **20**, **30**, **40**, **50**, or **80**. The coupling can be facilitated by the pogo pin connector **502** and the sleeve **93**, a clip mechanism may be sufficient for the coupling between the sleeve **93** and the output modules. However, to uncouple the signal input component **500**, the user would have to unwind the knob **91**, and a rotation R**3** is required to the knob **91**. The knob **91** is a safety measure to prevent the accidental dislocation.

[0093] The embodiments shown and described above are only examples. Many details are often found in the art such as the other features of a digital auscultation device. Therefore, many such details are neither shown nor described. Even though numerous characteristics and advantages of the present technology have been set forth in the foregoing description, together with details of the structure and function of the present disclosure, the disclosure is illustrative only, and changes may he made in the detail, especially in matters of shape, size, and arrangement of the parts within the principles of the present disclosure, up to and including the full extent established by the broad general meaning of the terms used in the claims. It will therefore be appreciated that the embodiments described above may be modified within the scope of the claims.

What is claimed is:

1. An auscultation device, comprising;

a sound capturing element;

a chest piece holder disposed on a distal end of the auscultation device, coupled to the sound capturing element, and comprising a connecting structure; and

a chest piece comprising a dislocating structure removably coupled to the connecting structure of the chest piece holder.

2. The auscultation device of claim **1**, wherein the dislocating structure comprises a plurality of projections; the connecting structure comprises a flange having a plurality of notches, a plurality of wings, and a sidewall; the notches and the wings are alternatingly arranged around the flange; the notches and the sidewall form a plurality of notch receiving spaces, and the wings and the sidewall form a plurality of wing receiving spaces.

3. The auscultation device of claim **2**, wherein

each of the projections of the dislocating structure being received by each of the notch receiving spaces of the flange corresponds a first state of the auscultation device; and

each of the projections of the dislocating structure being at least partially received by each of the wing receiving spaces of the flange corresponds a second state of the auscultation device.

4. The auscultation device of claim **3**, further comprising:

a partition plate between the sound capturing element and the chest piece holder, and comprising a central hole and a pivot; and

a switching piece between the partition plate and the chest piece holder, and comprising a door being rotatable about the pivot.

5. The auscultation device of claim 4, wherein

the door of the switching piece not blocking the central hole of the partition plate corresponds to a third state of the switching piece and the partition plate; and

the door of the switching piece at least partially blocking the central hole of the partition plate corresponds to a fourth state of the switching piece and the partition plate.

6. The auscultation device of claim 5, wherein the switching piece further comprises a protrusion: rotatable about the pivot, the chest piece holder further comprises a ditch, and the protrusion is in contact with the chest piece through the ditch.

7. The auscultation device of claim 6, wherein the auscultation device is in the third state when the protrusion of the switching piece is at a first position, and the auscultation device is in the fourth state when the protrusion of the switching piece is at a second position.

8. The auscultation device of claim 6, wherein

the auscultation device is in the first state when the switching piece and the partition plate are in the fourth state for at least partially blocking a sound transmission route from passing through the central hole to the sound capturing element;

a rotation of the switching piece is triggered by a rotation of the chest piece through the protrusion and transforms the switching piece and the partition plate from the fourth state into the third state; and

the auscultation device is in the second state when the switching piece and the partition plate are in the third state for unblocking the sound transmission route from passing through the central hole to the sound capturing element.

9. The auscultation device of claim 1, further comprising a diaphragm removably coupled to the chest piece, wherein the diaphragm can be of different sizes.

10. The auscultation device of claim 9, wherein the chest piece further comprises an extended surface not covered by the diaphragm, and one or more ECG plates disposed on the extended surface.

11. The auscultation device of claim 1, wherein the auscultation device further comprises:

a housing having a distal part and a proximal part;

a control module in the housing:

an output module connectable With a signal input component and disposed on the proximal part of the housing; and

wherein the sound capturing element coupled to the control module and is a microphone.

12. The auscultation device of claim 11 wherein the output module comprises a first latch, a first pogo pin, and a first male screw thread for connecting with different signal input components.

13. The auscultation device of claim 12, wherein each of the different signal input components comprises a first female screw thread, a first pogo pin connector, and a first latch groove.

14. The auscultation device of claim 11, further comprising a rotary clasp for connecting the signal input component and the output module.

15. The auscultation device of claim 11, wherein the output module comprises a second latch groove, a second pogo pin, and a second female screw thread for connecting with different signal input components.

16. The auscultation device of claim 15, wherein each of the different signal input components comprises a second male screw thread, a second pogo pin connector and a second latch.

17. The auscultation device of claim 11, wherein the signal input component is a Y-tube, an audio output jack, a phone jack, or a wireless signal transmission component.

18. A digital auscultation device, comprising:

a housing having a distal part and a proximal part;

a control module in the housing;

an output module connectable with an signal input component and disposed on the proximal part of the housing;

a chest piece holder disposed on the distal part of the housing and comprising a connecting structure; and

a chest piece comprising a dislocating structure removably coupled to the connecting structure of the chest piece holder.

19. The digital auscultation device of claim 18, wherein the chest piece further comprises an extended surface, and one or more ECG plates disposed on the extended surface.

* * * * *

专利名称(译)	带有模块化胸件和ECG模块的听诊装置		
公开(公告)号	US20190053778A1	公开(公告)日	2019-02-21
申请号	US16/104147	申请日	2018-08-17
[标]发明人	LIN TZU CHIH		
发明人	LIN, TZU-CHIH		
IPC分类号	A61B7/04 A61B5/00 A61B5/0408 A61B5/0205		
CPC分类号	A61B7/04 A61B5/0002 A61B5/0408 A61B5/0205 A61B2560/0443 A61B5/04085 A61B5/6823		
优先权	62/546694 2017-08-17 US		
外部链接	Espacenet USPTO		

摘要(译)

本公开提供了一种听诊装置。听诊装置包括声音捕获元件，胸件保持器和连接结构。胸件支架设置在听诊装置的远端，连接到声音捕获元件，并包括连接结构。胸件包括可拆卸地连接到胸件保持器的连接结构的脱位结构。