



(12)

EUROPEAN PATENT APPLICATION

- (43)

Date of publication:
10.04.2024 Bulletin 2024/15
- (21)

Application number: 22217003.7
- (22)

Date of filing: 28.12.2022
- (51)

International Patent Classification (IPC):
H01H 19/62 (2006.01) G04G 21/08 (2010.01)
H01H 19/63 (2006.01) H01H 25/06 (2006.01)
- (52)

Cooperative Patent Classification (CPC):
H01H 19/63; G04G 17/02; G04G 17/04;
G04G 21/00; G04G 21/08; H01H 19/62;
H01H 25/06; H01H 2231/028; H01H 2300/016

- (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 ME MK MT NL
NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN
- (71)

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Priority: 09.10.2022 CN 202211230706

(54)

SIGNAL ENTRY APPARATUS FOR ELECTRONIC DEVICE BASED ON MECHANICAL GEAR LINKAGE

- (57)

The present invention is applicable to the technical field of electronic devices, and provides a signal entry apparatus for an electronic device based on mechanical gear linkage, which is applied to an electronic device, the signal entry apparatus comprising: a rotating disk mounted on a bottom shell of the electronic device; a transmission mechanism arranged inside the bottom shell and rotatably connected to the rotating disk; and an encoder connected to the transmission mechanism, wherein the encoder converts a mechanical movement characteristic signal generated by the transmission mechanism into an electrical signal, which electrical signal is transmitted through a circuit to a circuit board arranged inside the bottom shell. Different electrical signals are generated from the mechanical information generated by the transmission mechanism and are transmitted to the circuit board, which can expand the way of information entry and improve the amount of information during information entry. The circuit board performs a corresponding operation based on the corresponding information, such that more characteristic signals can be encoded to better complete the information entry of the electronic device, improving the operability of the electronic device.

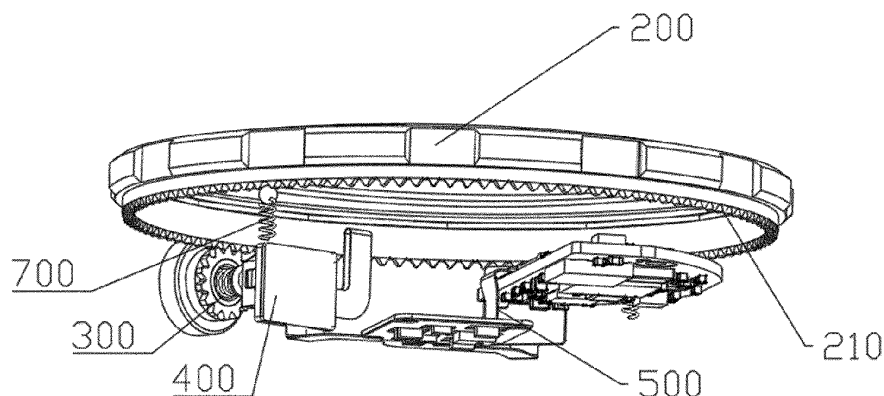


FIG. 3

Description

Technical Field

[0001] The present invention belongs to the technical field of electronic devices, and in particular relates to a signal entry apparatus for an electronic device based on mechanical gear linkage.

Background Art

[0002] Current electronic devices, such as smart toothbrushes, dental flossers, shavers, hair dryers, handheld vacuum cleaners and other home appliances, are limited by the small size of the electronic devices. As a result, mechanical switches of the electronic devices have a simple function, and signal input can only be performed by pressing or rotating buttons, which cannot meet the diversified signal input requirements of users.

Summary

[0003] The present invention provides a signal entry apparatus for an electronic device based on mechanical gear linkage, in order to solve the problem of the current electronic devices having a simple signal input mode which cannot meet the diversified signal input requirements.

[0004] The present invention is achieved by a signal entry apparatus for an electronic device based on mechanical gear linkage, which is applied to an electronic device, the signal entry apparatus comprising:

a rotating disk mounted on a bottom shell of the electronic device;
a transmission mechanism arranged inside the bottom shell and rotatably connected to the rotating disk; and
an encoder connected to the transmission mechanism, wherein the encoder converts a mechanical movement characteristic signal generated by the transmission mechanism into an electrical signal, which electrical signal is transmitted through a circuit to a circuit board arranged inside the bottom shell, and the operation of the electronic device is correspondingly adjusted by the circuit board according to the input electrical signal.

[0005] Preferably, the transmission mechanism comprises:

a rotating gear rotatably arranged on an outer knob shell of the bottom shell; and
a transmission shaft connected between the rotating gear and the encoder, wherein an outer edge of the rotating gear is rotatably connected to an end face gear arranged on the ro-

tating disk.

[0006] Preferably, a sliding rail provided on a curved outer wall of the rotating disk is slidably arranged inside a sliding groove provided in an inner wall of the bottom shell, and the end face gear is hidden by a top inner edge of the bottom shell.

[0007] Preferably, the encoder is a photoelectric encoder, and the different angular rotation information during the rotation process is recorded and translated into different electrical signals by the encoder.

[0008] Preferably, the encoder is a pressure encoder, a pressure sensing module provided on the encoder senses pressure change values, and these pressure change values generate corresponding electrical signals through regular rotation, so that the encoder transmits appropriate electrical signals to the circuit board.

[0009] Preferably, a sliding mechanism is provided between the transmission shaft and the encoder, the sliding mechanism comprising:

a sliding plate in contact with and connected to stepped teeth provided at a top end of the transmission shaft;

and a sliding groove provided on the bottom shell and slidably connected to the sliding plate, wherein the stepped teeth, under the action of rotation of the transmission shaft, push the sliding plate to move reciprocatingly in the sliding groove, and the encoder in contact with and connected to sliding plate records different pressure values generated with the movement of the sliding plate.

[0010] Preferably, a bottom side wall of the sliding plate is provided with a sliding rail, and a rolling ball structure provided in the sliding rail rolls between the sliding groove and the sliding plate.

[0011] Preferably, a contact surface between the sliding plate and the stepped teeth is arc-shaped, which can reduce the friction between the sliding groove and the sliding plate, so as to fully transmit the pressure generated by the stepped teeth pushing the sliding plate to the pressure sensing module of the encoder.

[0012] Preferably, a prompt mechanism is provided on the bottom shell, the prompt mechanism comprising:

a mounting seat fixed on the bottom shell;
a limitation ring mounted to a top end of the mounting seat; and

a rolling ball which slides on an inner wall of the mounting seat and which is in contact with and connected to the end face gear, wherein a top portion of a spring provided in the mounting seat is in contact with and connected to the rolling ball, and the limitation ring limits the rolling ball to prevent the rolling ball from leaving the mounting seat. The end face gear pushes the rolling ball to move reciprocatingly inside the mounting seat.

The prompt mechanism generates sound prompts through sliding of the rolling ball on a gear surface of the end face gear, which can improve the experience of the product while prompting the user to operate.

[0013] Preferably, the end face gear is provided with a marking gear tooth. The sound generated by the rolling ball when the rolling ball rotates to the marking gear tooth made of a different material is different from the sound generated when the rolling ball rotates to the other gear teeth, which can help the user to determine the number of rotations, and improve the user's control over the rotation information sent by the rotating disk.

[0014] Compared with the prior art, embodiments of the present invention have the beneficial effects as follows.

1. In the signal entry apparatus for an electronic device based on mechanical gear linkage provided in the present invention, rotation information during the rotation process of the transmission mechanism is translated by the encoder to an electrical signal, which electrical signal is transmitted to the circuit board to complete the work of electrical signal transmission, which can expand the way of information entry and improve the amount of information during information entry.

2. In the signal entry apparatus for an electronic device based on mechanical gear linkage provided in the present invention, different electrical signals are generated from the mechanical information generated by the transmission mechanism and are transmitted to the circuit board, the circuit board performs a corresponding operation based on the corresponding information, such that more characteristic signals can be encoded to better complete the information entry of the electronic device, improving the operability of the electronic device.

Brief Description of the Drawings

[0015]

Fig. 1 is a schematic diagram of the structure of a signal entry apparatus for an electronic device based on mechanical gear linkage provided by the present invention.

Fig. 2 is a schematic diagram of the internal structure of the signal entry apparatus for an electronic device based on mechanical gear linkage provided by the present invention.

Fig. 3 is a schematic diagram of a connection structure between a rotating disk and a transmission mechanism of a signal entry apparatus for an electronic device based on mechanical gear linkage provided by the present invention.

Fig. 4 is a schematic diagram of the internal structure

of a middle bottom shell of a signal entry apparatus for an electronic device based on mechanical gear linkage provided by the present invention.

Fig. 5 is a schematic diagram of the structure of a transmission mechanism of a signal entry apparatus for an electronic device based on mechanical gear linkage provided by the present invention.

Fig. 6 is a schematic diagram of the structure of a sliding mechanism of a signal entry apparatus for an electronic device based on mechanical gear linkage provided by the present invention.

Fig. 7 is a schematic diagram of a connection structure between a transmission mechanism and a sliding mechanism of a signal entry apparatus for an electronic device based on mechanical gear linkage provided by the present invention.

Fig. 8 is a schematic diagram of the internal structure of a sliding groove of a signal entry apparatus for an electronic device based on mechanical gear linkage provided by the present invention.

Fig. 9 is a schematic diagram of a prompt mechanism of a signal entry apparatus for an electronic device based on mechanical gear linkage provided by the present invention.

Detailed Description of the Embodiments

[0016] Unless otherwise defined, all technological and scientific terms used herein have the same meanings as those commonly understood by those skilled in the art to which the present application belongs. The terms used in the description of the present application herein are merely for the purpose of describing specific embodiments, but are not intended to limit the present application. The terms "comprising" and "having" and any variations thereof in the description and the claims of the present application as well as the brief description of the drawings described above are intended to cover non-exclusive inclusion. The terms "first", "second", etc. in the description and the claims of the present application as well as the foregoing drawings are used to distinguish between different objects, rather than describing a specific order.

[0017] The phrase "embodiment" mentioned herein means that the specific features, structures and characteristics described in conjunction with the embodiment may be included in at least one of the embodiments of the present application. The phrase at various positions in the description does not necessarily refer to the same embodiment, or an independent or alternative embodiment exclusive of another embodiment. Those skilled in the art understand explicitly or implicitly that an embodiment described herein may be combined with another embodiment.

[0018] An embodiment of the present invention provides a signal entry apparatus for an electronic device based on mechanical gear linkage. As shown in Figs. 1-9, the signal entry apparatus for an electronic device

based on mechanical gear linkage is applied to an electronic device and comprises: a rotating disk 200 mounted on a bottom shell 110 of the electronic device; a transmission mechanism 300 arranged inside the bottom shell 110 and rotatably connected to the rotating disk 200; and an encoder 400 connected to the transmission mechanism 300. The encoder 400 converts a mechanical movement characteristic generated by the transmission mechanism 300 into an electrical signal, which electrical signal is transmitted through a circuit to a circuit board 500 arranged inside the bottom shell 110, and the electronic device is adjusted by the circuit board 500.

[0019] It should be noted that the electronic device includes a smart toothbrush, a dental flosser, a shaver, a hair dryer, a handheld vacuum cleaner and other home appliances, which will not be limited here.

[0020] A waterproof inner shell 130 is provided inside the bottom shell 110 of the electronic device, the circuit board 500 arranged inside the waterproof inner shell 130 is connected via a circuit to a surface 600 provided on an outer side of the rotating disk 200. A closed space is formed between the surface 600, the waterproof inner shell 130 and the bottom shell 110. Except for a connection line between the circuit board 500 and the encoder 400, the closed space formed between the surface 600, the waterproof inner shell 130 and the bottom shell 110 is not in contact with the outside, thus reducing the entry of external air moisture and increasing the waterproof performance of the electronic device. The circuit board 500 and the surface 600 are both components of the electronic device, which are applications of the prior art.

[0021] A sliding rail provided on a curved outer wall of the rotating disk 200 slides in a sliding groove provided on an inner wall of the bottom shell 110, the sliding rail on the rotating disk 200 and the sliding groove on the inner wall of the bottom shell 110 are both prior art, an end face gear 210 is provided at a lower end face of the rotating disk 200, and the end face gear 210 is hidden by a top inner edge of the bottom shell 110.

[0022] The transmission mechanism 300 comprises: a rotating gear 310 rotatably arranged on an outer knob shell 120 of the bottom shell 110; and a transmission shaft 320 connected between the rotating gear 310 and the encoder 400. An outer edge of the rotating gear 310 is rotatably connected to the end face gear 210, the transmission shaft 320 is directly connected to a rotating shaft of the encoder 400, and the rotation generated by the rotating disk 200 is transmitted to the encoder 400 through the transmission mechanism 300.

[0023] In this embodiment, the encoder 400 is a photoelectric encoder in the prior art. The photoelectric encoder is a sensor that converts mechanical geometric displacement of an output shaft into pulse or digital quantity through photoelectric conversion, the different angular rotation information in the rotation process is recorded and translated into different electrical signals by the encoder 400, and the different electrical signals are transmitted to the circuit board 500 located inside the water-

proof inner shell 130. The circuit board 500 performs a corresponding operation according to the corresponding information, and more characteristic signals can be encoded according to the number of rotations of the rotating disk 200 to better complete the information conversion work of the electronic device, such as switching pages, returning, confirming and other operations. The encoder 400 is driven by the rotating disk 200, which makes it possible to prevent a drive structure from directly coming into contact with the circuit board 500, reduce the chance of the circuit board 500 being in contact with the outside, and improve the waterproof performance of the circuit board 500.

[0024] As a preferred implementation in this embodiment, as shown in Figs. 3 and 5-8, a sliding mechanism is provided between the transmission shaft 320 and the encoder 400. The sliding mechanism comprises: a sliding plate 342 in contact with and connected to stepped teeth 341 provided at a top end of the transmission shaft 320; and a sliding groove 343 provided on the bottom shell 110 and slidably connected to the sliding plate 342.

[0025] Under the action of the rotation of the transmission shaft 320 on the stepped teeth 341, an uneven surface of the stepped teeth 341 pushes the sliding plate 342 sliding in the sliding groove 343, so that different pressure values are generated on the encoder 400 in contact with and connected to the sliding plate 342.

[0026] In this embodiment, the encoder 400 is a pressure encoder in the prior art. The pressure encoder can convert a pressure change value received by a pressure sensing module of the pressure encoder into a specific electrical signal. The stepped teeth 341 are prior art, and are composed of a cylindrical structure with an uneven arc surface. The arc surface will produce a pushing effect similar to a cam structure, and the cooperation between the sliding plate 342 sliding on the sliding groove 343 and the arc surface of the stepped teeth 341 will convert the rotational movement into a reciprocating movement. An effect is produced similar to the conversion of rotational movement into reciprocating movement by a crank link.

[0027] A pressure sensing module of the encoder 400 is in contact with and connected to one end of the sliding plate 342, the other end of the sliding plate 342 is in contact with and connected to the stepped teeth 341. Under the action of the transmission shaft 320, the stepped teeth 341 rotates to convert the rotational movement of the transmission shaft 320 into a reciprocating linear movement, so as to push the sliding plate 342 to move back and forth in the sliding groove 343. The pressure sensing module of the encoder 400 in contact with and connected to the sliding plate 342 will produce different pressure values due to the sliding plate 342 sliding back and forth. Through the regular rotation, these pressure change values generate a special electrical signal to record the number of rotations, so that the encoder 400 with a pressure sensing ability recognizes the rotation condition of the transmission shaft 320 according to the law of the pressure values, so as to transmit different electrical sig-

nals to the circuit board 500 to achieve the work of signal entry for the electronic device.

[0028] As a preferred implementation in this embodiment, a side wall of a portion of the sliding plate 342 sliding in the sliding groove 343 is provided with a sliding rail, and a rolling ball structure 344 provided in the sliding rail rolls between the sliding groove 343 and the sliding plate 342.

[0029] In this embodiment, the rolling ball structure 344 is prior art, which can reduce the friction between the sliding groove 343 and the sliding plate 342, so as to fully transmit the pressure generated by the stepped teeth 341 pushing the sliding plate 342 to the pressure sensing module of the encoder 400, thus reducing the error generated in the process of signal transmission.

[0030] In a further preferred embodiment of the present invention, a contact surface between the sliding plate 342 and the stepped teeth 341 is arc-shaped. The efficiency of the stepped teeth 341 pushing the sliding plate 342 is improved, the friction is reduced, and the error generated by the mechanical structure is further reduced.

[0031] In a further preferred embodiment of the present invention, as shown in Figs. 3 and 9, the bottom shell 110 is provided with a prompt mechanism 700. The prompt mechanism 700 comprises: a mounting seat 730 fixed on the bottom shell 110; a limitation ring 740 mounted to a top end of the mounting seat 730; and a rolling ball 710 which slides on an inner wall of the mounting seat 730 and which is in contact with and connected to the end face gear 210. A top portion of a spring 720 provided in the mounting seat 730 is in contact with and connected to the rolling ball 710. When the rolling ball 710 slides on a gear surface of the end face gear 210, the rolling ball 710 moves reciprocally inside the mounting seat 730 under the support of the spring 720.

[0032] In this embodiment, the mounting seat 730 is a cylindrical structure with a circular opening on the top end surface. The spring 720 and the rolling ball 710 are both assembled inside the mounting seat 730, and the limitation ring 740 mounted to the top end of the mounting seat 730 via a threaded structure is a circular through ring structure. The diameter of a circular opening on an upper end face of the limitation ring 740 is smaller than that of a circular opening on a lower end face, and is smaller than that of the rolling ball 710. When the spring 720 and the rolling ball 710 are both assembled inside the mounting seat 730, the limitation ring 740 prevents the rolling ball 710 from leaving the mounting seat 730. The prompt mechanism 700 generates sound prompts through sliding of the rolling ball 710 on a gear surface of the end face gear 210, which can improve the experience of the product while prompting the user to operate.

[0033] In a further preferred embodiment of the present invention, the end face gear 210 is provided with a marking gear tooth. The sound generated by the rolling ball 710 and the marking gear tooth when the rolling ball 710 rotates to the marking gear tooth will be different from the sound generated by the rolling ball and the other gear

teeth.

[0034] In this embodiment, the marking gear tooth is prior art, and is mainly made of a different material from the other gear teeth. The sound generated when the rolling ball 710 rotates to the marking gear tooth being different from that when rotating to the other gear teeth can help the user to determine the number of rotations, and improve the user's control over the rotation information sent by the rotating disk 200, improving the control accuracy of the signal transmission process.

[0035] It should be noted that, for the sake of simplicity, the foregoing embodiments are all described as a series of combinations of actions, but those skilled in the art will appreciate that the present invention is not limited by the described sequence of actions, because some steps may be performed in alternative sequences or simultaneously according to the present invention. Secondly, those skilled in the art will also appreciate that the embodiments described in the specification are all preferred embodiments, and the actions and modules involved are not necessarily essential to the present invention.

[0036] The above embodiments are only used to illustrate the technical solutions of the present invention, but not to limit the scope of protection of the present invention. Apparently, the described embodiments are merely some rather than all of the embodiments of the present invention. On the basis of the embodiments, all the other embodiments obtained by those of ordinary skill in the art without creative efforts shall fall within the scope of protection of the present invention. Although the present invention has been described in detail with reference to the above embodiments, in the case of no conflict, those of ordinary skill in the art can still combine, add or delete, or make other adjustments to the features in the various embodiments of the present invention according to the situations without any creative efforts, to obtain other technical solutions that are different and do not essentially depart from the concept of the present invention. These technical solutions also fall within the scope of protection of the present invention.

Claims

1. A signal entry apparatus for an electronic device based on mechanical gear linkage, which is applied to an electronic device, **characterized by** comprising:

a rotating disk (200);

a transmission mechanism (300) arranged inside a bottom shell (110) of the electronic device and rotatably connected to the rotating disk (200); and

an encoder (400) connected to the transmission mechanism (300),

wherein the encoder (400) converts a mechanical movement characteristic signal generated

- by the transmission mechanism (300) into an electrical signal, which electrical signal is transmitted through a circuit to a circuit board (500) arranged inside the bottom shell (500).
2. The signal entry apparatus for an electronic device based on mechanical gear linkage according to claim 1, **characterized in that** the transmission mechanism (300) comprises:
 - a rotating gear (310) rotatably arranged on an outer knob shell of the bottom shell (110); and
 - a transmission shaft (320) connected between the rotating gear (310) and the encoder (400), wherein an outer edge of the rotating gear (310) is rotatably connected to an end face gear (210) arranged on the rotating disk (200).
 3. The signal entry apparatus for an electronic device based on mechanical gear linkage according to claim 2, **characterized in that** a sliding rail provided on a curved outer wall of the rotating disk (200) is slidably arranged inside a sliding groove provided in an inner wall of the bottom shell (110).
 4. The signal entry apparatus for an electronic device based on mechanical gear linkage according to claim 3, **characterized in that** the encoder (400) is a photoelectric encoder.
 5. The signal entry apparatus for an electronic device based on mechanical gear linkage according to claim 3, **characterized in that** the encoder (400) is a pressure encoder.
 6. The signal entry apparatus for an electronic device based on mechanical gear linkage according to claim 5, **characterized in that** a sliding mechanism (320) is provided between the transmission shaft and the encoder (400), the sliding mechanism comprising:
 - a sliding plate (342) in contact with and connected to stepped teeth (341) provided at a top end of the transmission shaft (320);
 - and a sliding groove provided on the bottom shell (110) and slidably connected to the sliding plate (342),
 - wherein the stepped teeth (341), under the action of rotation of the transmission shaft (320), push the sliding plate (342) to move reciprocatingly in the sliding groove, and the sliding plate (342) is in contact with and connected to the encoder (400).
 7. The signal entry apparatus for an electronic device based on mechanical gear linkage according to claim 6, **characterized in that** a bottom side wall of the sliding plate (342) is provided with a sliding rail, and
- a rolling ball structure provided in the sliding rail rolls between the sliding groove and the sliding plate (342).
8. The signal entry apparatus for an electronic device based on mechanical gear linkage according to claim 7, **characterized in that** a contact surface between the sliding plate (342) and the stepped teeth (341) is arc-shaped.
 9. The signal entry apparatus for an electronic device based on mechanical gear linkage according to claim 4 or 8, **characterized in that** a prompt mechanism (700) is provided on the bottom shell (110), the prompt mechanism (700) comprising:
 - a mounting seat (341) fixed on the bottom shell (110);
 - a limitation ring mounted (740) to a top end of the mounting seat (341); and
 - a rolling ball (710) which slides on an inner wall of the mounting seat (341) and which is in contact with and connected to the end face gear (210),
 - wherein a top portion of a spring provided in the mounting seat (341) is in contact with and connected to the rolling ball (710); and the end face gear (210) pushes the rolling ball (710) to move reciprocatingly inside the mounting seat (341).
 10. The signal entry apparatus for an electronic device based on mechanical gear linkage according to claim 9, **characterized in that** the end face gear (210) is provided with a marking gear tooth.

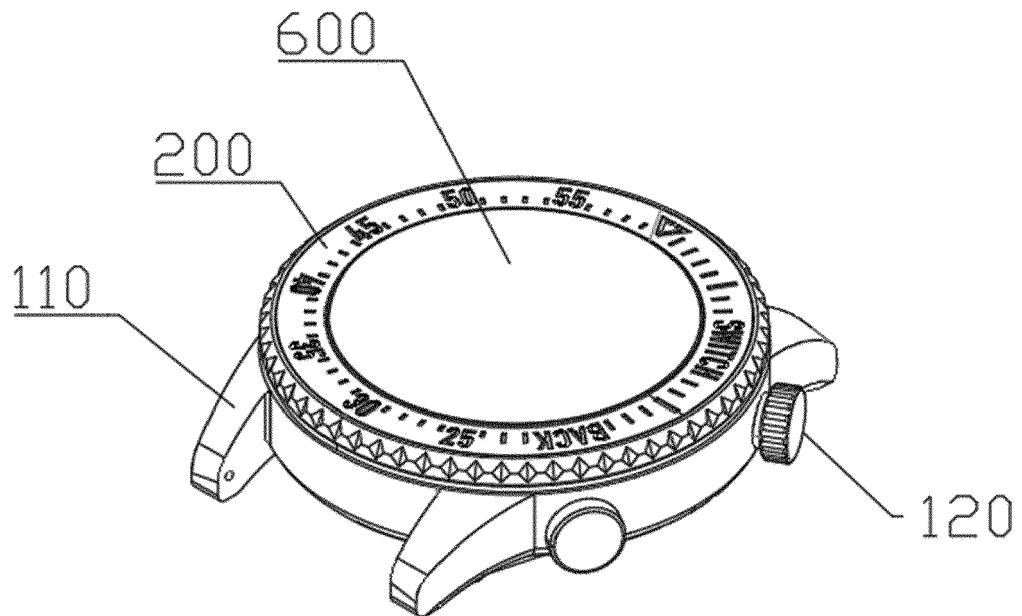


FIG. 1

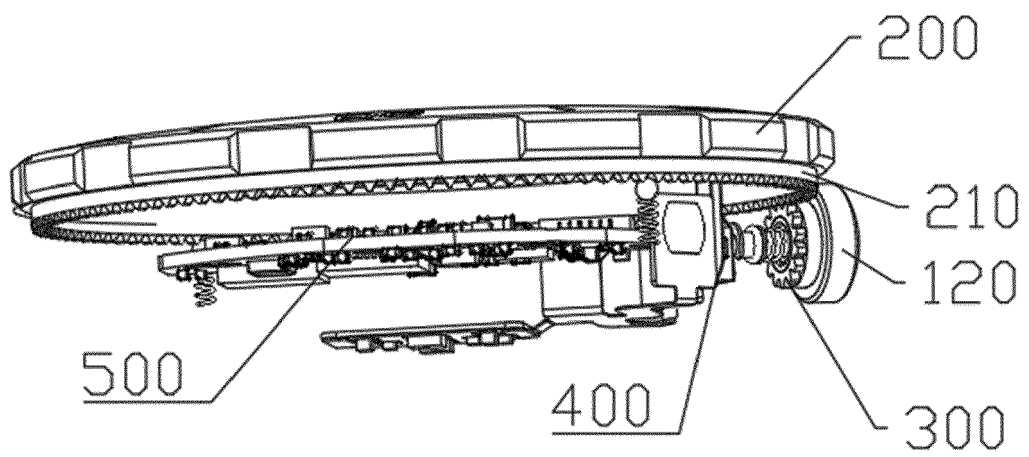


FIG. 2

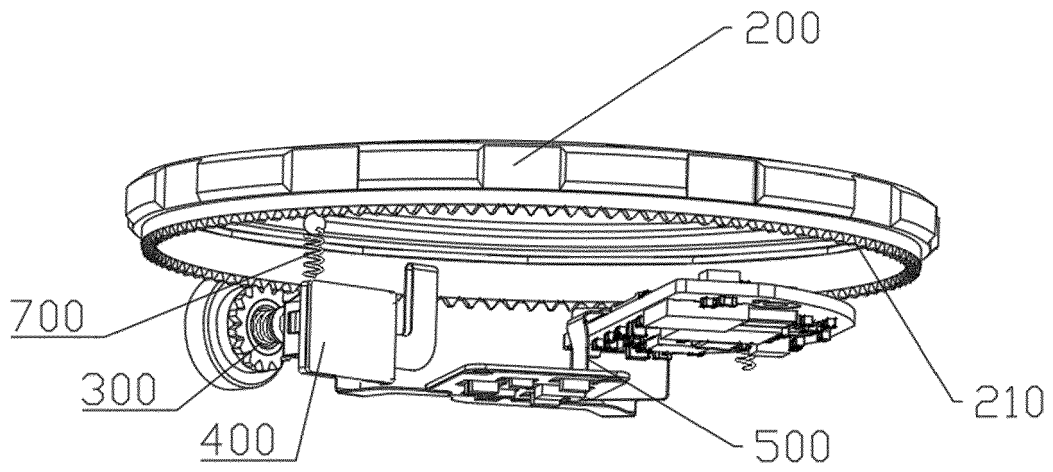


FIG. 3

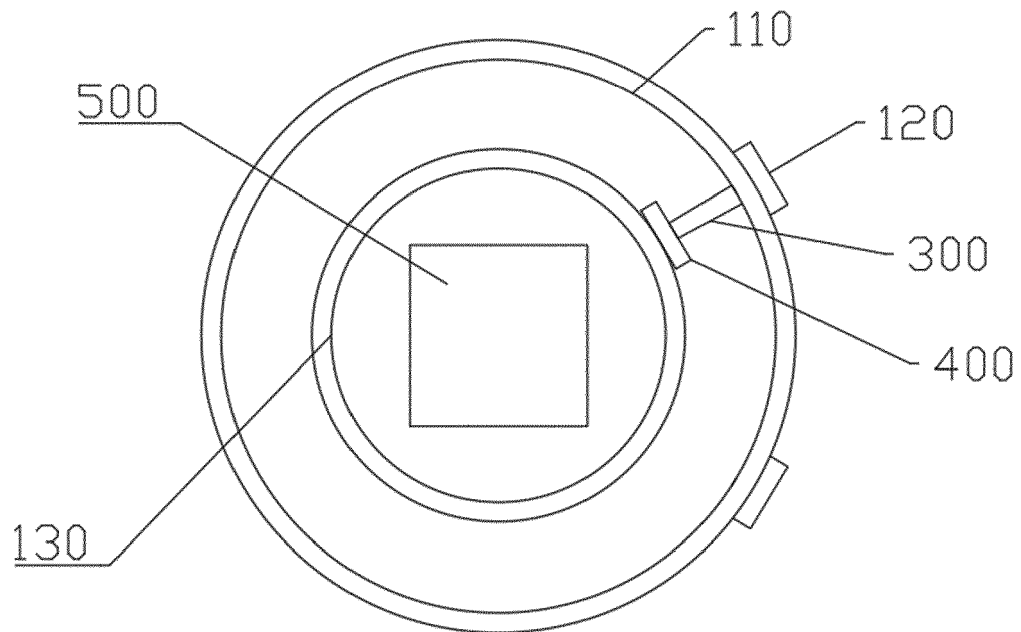


FIG. 4

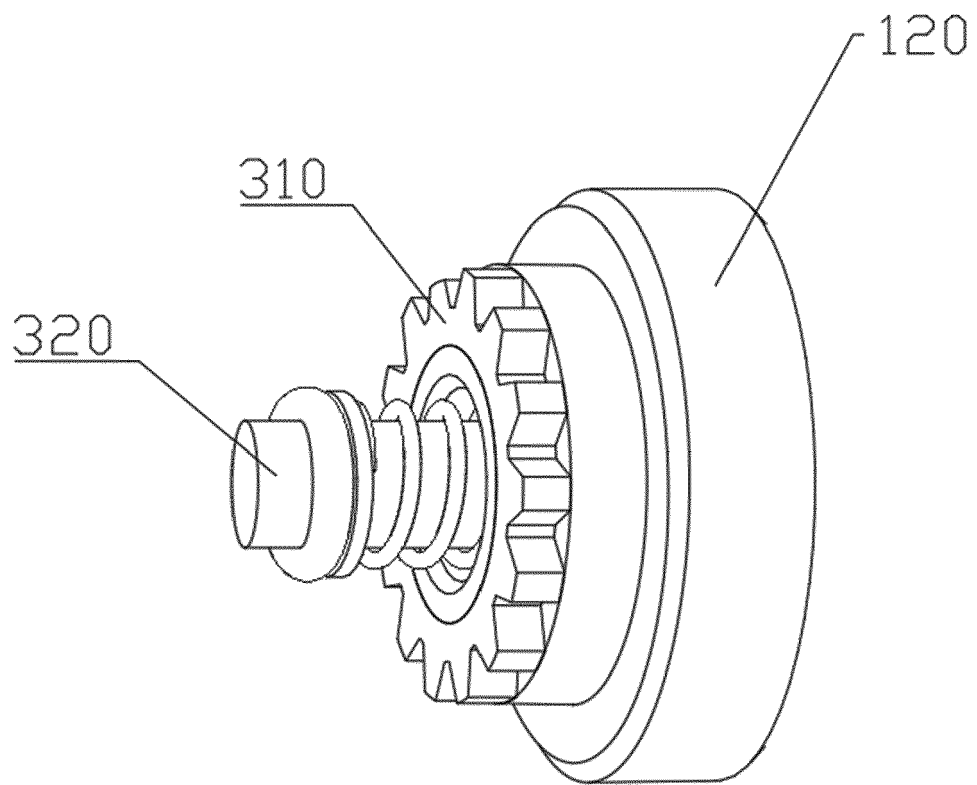


FIG. 5

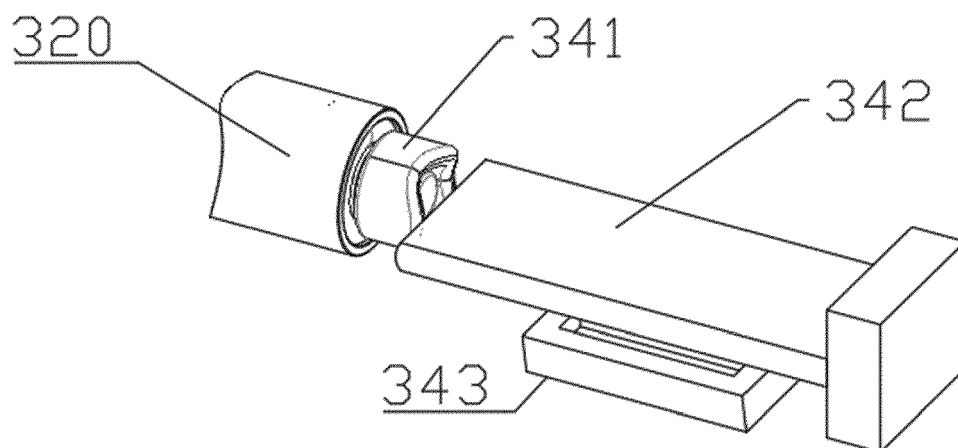


FIG. 6

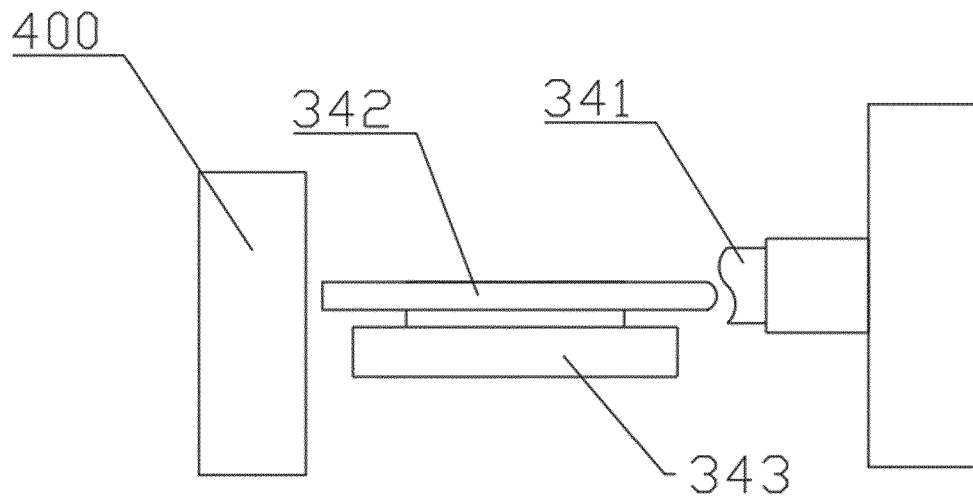


FIG. 7

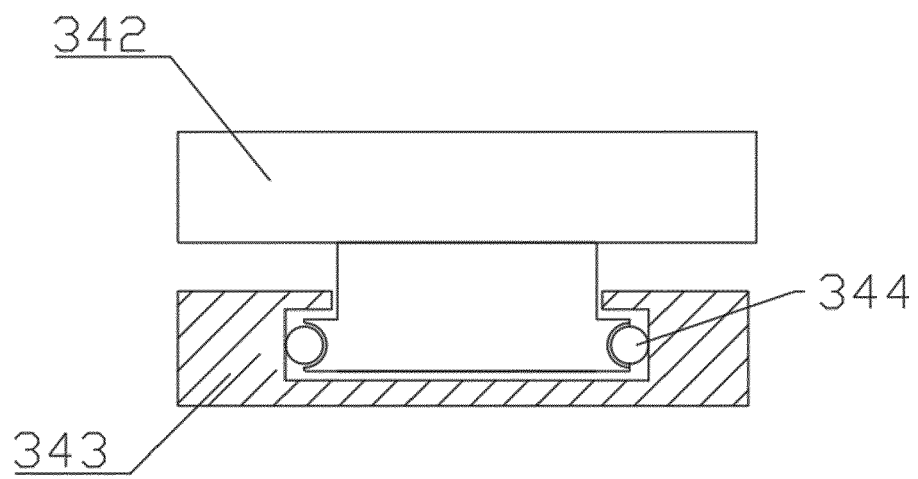


FIG. 8

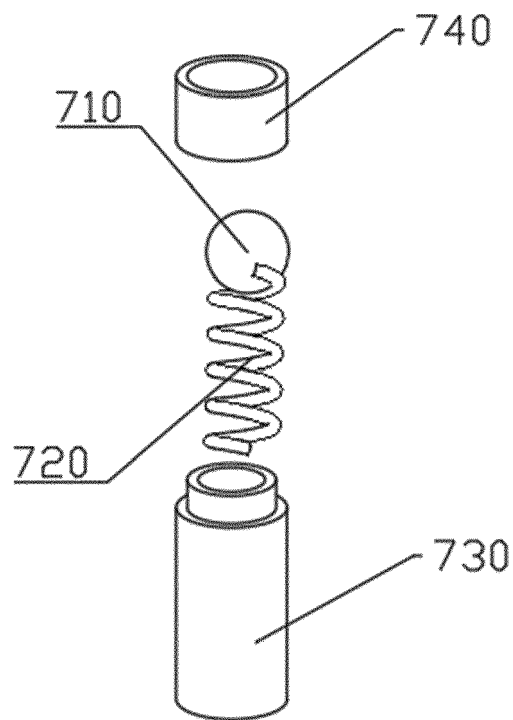


FIG. 9



EUROPEAN SEARCH REPORT

Application Number

EP 22 21 7003

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EPO FORM 1503 03.82 (P04C01)

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A	* abstract; figures 1-3, 16, 19, 20, 21 * * paragraphs [0001] - [0006], [0009] * * paragraphs [0010] - [0018] * * paragraphs [0028] - [0030], [0033], [0039], [0040] * * paragraphs [0043] - [0046] *	6-8	H01H19/62 G04G21/08 H01H19/63 H01H25/06
A	KERBER FREDERIC FREDERIC KERBER@DFKI DE ET AL: "Investigating current techniques for opposite-hand smartwatch interaction", PROCEEDINGS OF THE 2017 ACM ON CONFERENCE ON INFORMATION AND KNOWLEDGE MANAGEMENT, ACMPUB27, NEW YORK, NY, USA, 4 September 2017 (2017-09-04), pages 1-12, XP058541663, DOI: 10.1145/3098279.3098542 ISBN: 978-1-4503-5586-5 * abstract; figures 1-3 * * page 3, right-hand column - page 4, right-hand column *	1-10	TECHNICAL FIELDS SEARCHED (IPC) H01H G04G
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 21 August 2023	Examiner Bauer, Rodolphe
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	



EUROPEAN SEARCH REPORT

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CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 22 21 7003

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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