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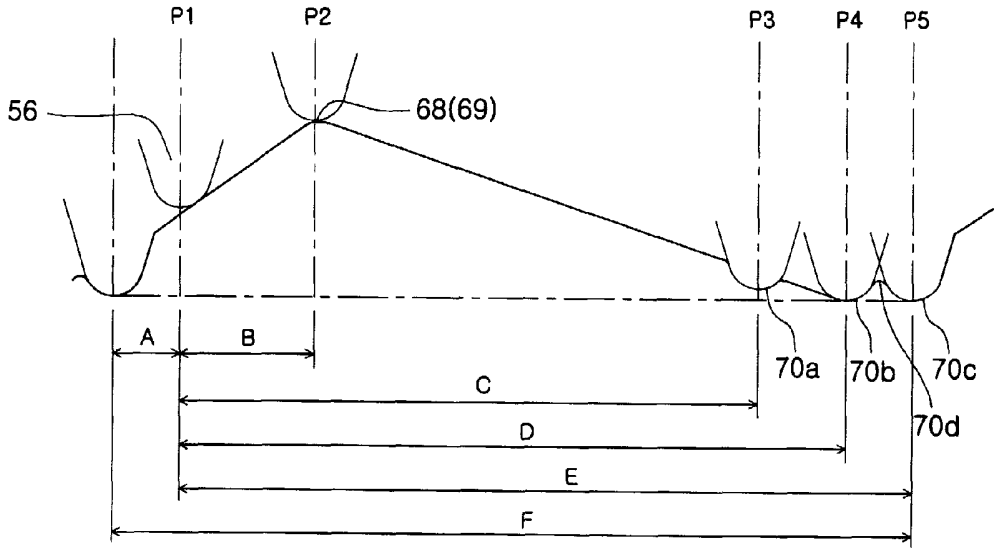
(54) Title: HINGE DEVICE



(57) Abstract: The present invention provides a hinge for coupling a stationary member with a movable member which can be relatively moved to folded and unfolded positions with respect to the stationary member. The hinge includes a housing, a cam member having a cam, a cam follower member provided with a cam follower portion interacting with the cam, and a resilient member for urging the cam member. The cam member can perform a linear motion within the housing and the cam follower member can perform a rotational motion. The cam member includes a cam surface, the cam surface includes peaks and valleys, and each valley is provided with two or more stopping grooves. The cam follower member includes protrusions protruding toward the cam surface and ends of the protrusions can be inserted into the stopping grooves.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

HINGE DEVICE

FIELD OF THE INVENTION

The present invention relates generally to a hinge device, and more particularly to a hinge for coupling two members in a device such as a portable radiotelephone comprising of two members that can be moved to folded and unfolded positions of the device with respect to each other about an axis, if so desired.

BACKGROUND OF THE INVENTION

A portable device such as a portable folder-type radiotelephone includes a keypad provided with a plurality of keys and a liquid crystal display. Usually, in the folder-type radiotelephone, the keypad is placed on one member while the liquid crystal display is placed on the other member. When the radiotelephone is not in use, the keypad or the liquid crystal display is moved to a folded position of the radiotelephone to face each other. Alternatively, when the radiotelephone is in use, the keypad or the liquid crystal display is moved to an unfolded position of the radiotelephone. It is the hinge that allows the two members to be coupled to each other and to be smoothly moved to the folded and unfolded positions.

The portable device such as the radiotelephone becomes smaller in size, but has more various implementing functions. This feature is especially notable in a radiotelephone based on standards known as IMT 2000. In addition to telephonic communication by the radiotelephone, a user can input short messages and send them by using a short message service (SMS), or view moving pictures. In some cases, the user may also use the Internet.

The conventional radiotelephone is usually unfolded or opened only at a single angle. The unfolded angle is determined through a preference survey. Recently, the radiotelephone has various functions provided to the user. The user's own preference regarding the unfolded angle varies according to each function. Therefore, it is improbable that the radiotelephone with the single unfolded angle would satisfy such user's demands.

SUMMARY OF THE INVENTION

Accordingly, the present invention is contemplated to solve the aforementioned problem. It is an object of the present invention to provide a hinge for coupling two members in a device comprising of the two members, wherein the hinge provides two or more positions at which one member is moved away from the other member and then remains stationary with respect to the other member.

The above object is accomplished by providing a hinge for rotatably coupling the two members of the device. The hinge comprises a housing. The housing contains a cam member, a cam follower member and a resilient member therein. The cam member and the cam follower member are disposed to be in contact with each other. The cam member and the cam follower member have a cam surface and a cam follower portion at positions opposing each other, respectively. The resilient member urges one of the cam member and cam follower member against the other so that the cam surface and the cam follower portion are engaged with each other.

According to the present invention, there is provided a hinge for coupling a stationary member with a movable member which can be relatively moved to folded and unfolded positions with respect to the stationary member, comprising a housing; a cam member having a cam and being contained within the housing; a cam follower member provided with a cam follower portion interacting with the cam of the cam member; and a resilient member for urging one of the cam member and cam follower member against the other so that the cam follower portion of the cam follower member and the cam of the cam member are in contact with each other; wherein one of the cam member and the cam follower member can perform a linear motion within the housing and the other can perform a rotational motion by the linear motion, so that the movable member can rotate with respect to the stationary member; and wherein when the stationary member and the movable member are moved to the unfolded positions, the cam member and the cam follower member interact with each other to remain stationary at two or more predetermined unfolded positions.

BRIEF DESCRIPTION OF THE DRAWINGS

The above object and features of the present invention will be apparent to a person skilled in the art when reading the following description of preferred embodiments taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view of a folder-type radiotelephone comprising a hinge according to an embodiment of the present invention, with a first case member and a second case member disassembled and with a disassembled hinge shown on an enlarged scale;

FIG. 2 is an exploded perspective view of the hinge of FIG. 1;

FIG. 3 is a diagram of cam profile of the hinge of FIG. 1;

FIGS. 4a to 4c are sectional views of the hinge showing the operations of the hinge of FIG. 1; and

FIG. 5 is a side view showing states in which the radiotelephone of FIG. 1 can be opened or unfolded.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings.

Referring to FIG. 1, a portable folder-type radiotelephone 10 comprises a first case member 11 and a second case member 12. A hinge 14 is mounted between the first case member 11 and the second case member 12 to couple them. The hinge 14 is inserted into a mounting hole of the first case member 11. Thereafter, the second case member 12 is coupled therewith. The mounting hole has a shape substantially matching with that of a housing of the hinge 14 to prevent rotation of the entire hinge 14. In addition, the mounting hole and the hinge are sized such that there is a degree of frictional force between the mounting hole and the exterior surface of the hinge 14 to be disengaged only with considerable external force.

Referring to FIG. 1, the hinge 14 includes a rotatable extension shaft 16 which protrudes toward the second case member 12. A coupling member 17 is fitted into the extension shaft 16. The coupling member 17 includes an engaging surface 18. The

second case member 12 is provided with a bushing 19 for accommodating the coupling member 17. The bushing 19 has an engaging surface interacting with the engaging surface 18. Alternatively, in another embodiment, the second case member may be provided with the extension shaft, whereas the hinge may be provided with the bushing. In a further embodiment, the extension shaft 16 may be engaged directly to the second case member without the coupling member 17.

Referring to FIG. 2, the hinge 14 according to an embodiment of the present invention includes a housing 24, and a cam follower member 26, a cam member 28, and a resilient member 30 which are sequentially accommodated in the housing 24. The hinge 14 further includes the coupling member 17.

The housing 24 comprises of an elongated can. The housing 24 includes flat walls 24a and arc-shaped walls 24b. When the housing is fitted into the case member of the radiotelephone, the flat walls 24a function to prevent the rotation of the housing. In addition, as will be described later, the flat walls 24a also function to prevent rotation of the cam member 28 accommodated in the housing. A longitudinal centerline of the housing 24 defines a rotation axis 100 of the hinge 14. One end of the housing 24 is provided with an end wall 36 with a shaft hole 34 formed therein. The other end opposite this end is opened. The housing 24 includes extensions 40 extending from the ends of the walls 24a. After inner parts are inserted into the housing 24, the extensions 40 can be bent to cover the open end.

However, the present invention is not limited to such a method of covering the open end. In order to cover the open end so that the resilient member 30 may not protrude, other methods except the method of bending the protrusions 40 may be used. For example, even if there is no additional extension, the open end may be covered by deforming the ends of the walls 24a or 24b by means of various plastic deformation methods of metal plate after the inner parts are inserted into the housing. In addition, the open end may be covered with a cap after the parts are inserted into the housing.

It is preferred that the housing 24 be formed of metallic material such as a brass plate and be manufactured by using a deep drawing method. Alternatively, the housing 24 may be formed by injection molding plastic resin material.

Referring to FIG. 2, the cam follower member 26 includes a disk-shaped support 52 and the extension shaft 16, which extends from the center of the support 52 along the rotation axis 100. The extension shaft 16 includes engaging surfaces 16a and engaging protrusions 16b formed on the engaging surfaces. In a case where there is no coupling member 17, the engaging surfaces and engaging protrusions are engaged directly with the case member.

On the other end of the cam follower member opposite the extension shaft 16, a central guide rod 55 protrudes from the support 52. The central guide rod 55 is provided on its sides with two wings 56, which extend in a direction parallel to the rotation axis (hereinafter, referred to as "direction of rotation axis") by a length shorter than that of the central guide rod 55. The wings 56 are symmetrically disposed with respect to the rotation axis 100 of the hinge 14. The wings 56 function as a cam follower portion or cam follower. The cam follower portion or cam follower means a portion interacting with a cam surface to be described later. Each of the wings 56 is provided with a slant surface 56a by which the thickness of the wing is reduced toward its end, and the end of each wing is rounded. It can be understood by a person skilled in the art that the thickness, gradient and curvature of the end of the wing may be determined to interact with stopping grooves formed on the cam surface to be described later. Of course, the configuration of the cam follower is not limited to that of the above wings 56. In another embodiment, the cam follower may be comprised of pillars separated from the central guide rod.

The cam follower member 26 is inserted through the open end of the housing 24. The cam follower member 26 can rotate about the rotation axis 100 within the housing 24. As describe above, the extension shaft 16 of the cam follower member 26 extends through the hole 34 of the housing 24.

The coupling member 17 is fitted tightly into the extension shaft 16. The coupling member 17 is provided for the purpose of increasing the distance from the rotation axis to the engaging surfaces, the area of the engaging surfaces and the size of the engaging protrusions, thereby ensuring transmission of the rotation of the cam follower member to the case member 12 of the radiotelephone 10. Depending on the configuration of the case member 12, there may be no need for the coupling member.

Still referring to FIG. 2, the cam member 28 is fitted into the housing in such a manner that its linear motion within the housing 24 may be allowed, but its rotational motion within the housing 24 along the rotation axis can be prevented. To this end, the cam member 28 includes flat walls 28a to be matched with the shape of the housing. A cam portion 64 is formed on an end of the cam member 28 facing the cam follower member 26. The cam portion 64 includes a cam surface 66 formed on the side of the cam member facing the cam follower member 26. The cam portion 64 includes two peaks 68, 69 opposing diametrically with respect to the rotation axis 100, and two valleys 70, 71 separated by the peaks 68, 69 and opposing diametrically with respect to the rotation axis 100. The cam surface 66 consists of the peaks 68, 69, the valleys 70, 71 and a curved surface connecting the peaks 68, 69 and the valleys 70, 71.

As shown in FIGS. 2 and 3, the valleys 70, 71 are provided with a plurality of stopping grooves 70a, 70b, 70c. Although three grooves are shown in FIGS. 2 and 3, it is not limited thereto but there may be two, four or more grooves.

Referring to FIG. 3, the cam surface connecting the peaks and the valleys is a slant surface. A first stopping groove 70a of the cam surface 66 is formed on a lower portion of the slant surface of the cam surface. A second stopping groove 70b is formed on an end portion of the gentle slant surface of the cam surface. A third stopping groove 70c is formed behind a projection 70d beyond the end portion of the slant surface. Referring FIGS. 2 and 3, it is preferred that a radial profile of the cam surface of the cam member 28 from the rotation axis have an identical height regardless of the distance from the rotation axis.

Referring to FIG. 2 again, the cam member 28 preferably includes a cylindrical boss 76 extending along its central axis. The boss 76 is provided with a throughhole 77 extending along the rotation axis 100 to penetrate through the cam member 28. The central guide rod 55 formed on the cam follower member 26 is fitted into the throughhole 77 to guide the relative motion between the cam member and the cam follower member.

The cam member 28 is inserted through the open end of the housing 24. At this time, the cam surface is oriented to face the wings 56 of the cam follower member. The cam member is snugly inserted into the interior of the housing 24 so that its linear motion

within the housing 24 along the rotation axis is allowable, but its rotational motion within the housing 24 can be prevented.

The resilient member 30 urges the cam member 28 against the cam follower member 26. The resilient member 30 may be preferably a compression coil spring, and more preferably a conical compression coil spring.

After the cam follower member 26, the cam member 28 and the resilient member 30 are sequentially inserted into the housing 24, the open end of the housing 24 is at least partially covered by bending the extensions 40 along bending lines 50 (see FIGS. 1 and 2).

The cam member, the cam follower member and the coupling member are manufactured by injection molding of plastic resin material, and preferably engineering plastic resin material. Alternatively, the members may be manufactured with metal by way of powder metallurgy.

Hereinafter, the operation of the hinge 14 according to the present invention will be explained with reference to FIGS. 3, 4a to 4c and 5. FIG. 4a shows the hinge in a state where the first case member 11 and the second case member 12 are in the folded position. At this time, the case members 11 and 12 are in contact with each other at P1 position as shown, and the wings 56 are disposed at P1 position of FIG. 3. Since the resilient member 30 urges the cam member 28 against the cam follower member 26, the wings 56 are subject to force urging the wings 56 downward of the slant surface. The force serves to rotate the cam follower member 26, and consequently, serves to urge the second case member 12 toward the first case member 11. Therefore, the first case member 11 and the second case member 12 are maintained stably in the folded state.

Under this condition, when the case members are moved away from each other about the hinge in order to open the radiotelephone 10 so that the radiotelephone 10 can be in use, the wings 56 reach the peaks 68 of the cam surface 66. This state is shown in FIG. 4b, which corresponds to the state where the wings are disposed at P2 position in FIGS. 3 and 5. When the case members are moved further away from each other, the wings 56 go over the peaks 68 of the cam surface 66. From the folded state where the two case members 11, 12 are in contact with each other to the state where the wings 56 go over the peaks 68 of the cam surface, the cam follower member 26 should be rotated by an angle of

B or more.

When the wings 56 go over the peaks 68, 69 of the cam surface 66, the wings 56 slide down along the slant surface of the cam surface 66 without external force since the resilient member 30 is urging the cam member 28 against the cam follower member 26. At this time, the first case member 11 and the second case member 12 are spontaneously moved away from each other. During the movement of the case members 11, 12 away from each other, the wings 56 come to P4 position of FIG. 3 by inertia force and are seated into the second stopping groove 70b. At this time, the unfolded angle is designated by D (see FIGS. 3 and 5).

A user can regulate the unfolded angle, if desired. For example, when the user moves the case members 11, 12 toward each other to make the unfolded angel smaller, the wings 56 come to P3 position and are seated into the first stopping groove 70a. At this time, the unfolded angle is designated by C (see FIGS. 3 and 5).

When the user moves the case members 11, 12 away from each other to make the unfolded angle larger, the wings 56 come to P5 position and are seated into the third stopping groove 70c. This state is shown in FIG. 4c. In this state, the case members are moved farthest away from each other so that the radiotelephone is fully opened. At this time, the unfolded angle is designated by E (see FIGS. 3 and 5).

Thus, when the unfolded angles are changed, the wings go over the projections between the stopping grooves. Therefore, the user operating the radiotelephone can have a feeling of a change of position such as a 'click' sound.

In preferred embodiments of the present invention, the unfolded angles at P3, P4 and P5 positions are set to about 130°, 150° and 163°. The user can conveniently use a variety of functions of the radiotelephone at each position. For example, assuming that the radiotelephone meets IMT 2000 standards, the user can conveniently view moving pictures (for example, watching of TV or sports broadcasting) in a state where the radiotelephone is set at P3 position and is put on a flat place. Usually, the user can talk over the radiotelephone at P4 position. In addition, the user can conveniently input short messages at P5 position. Thus, the functions that can be used at each position may be different, but they are not limited to the above functions. Furthermore, it has been

described that when the case members are moved away from each other, the case members are spontaneously stopped at P4 position. However, P3 or P5 position may become the position for spontaneously stopping the case members by changing the configuration of grooves.

When the user utilizes the hinge of the present invention, the unfolded angle of the radiotelephone may be regulated. A variety of functions of the radiotelephone can be conveniently used at each position. Since the stopping grooves are provided on the cam surface, the user can have a feeling of a change of position such as a 'click' sound, so that the unfolded angle may be conveniently regulated. In addition, since the case members of the radiotelephone are moved away from each other at the predetermined angles, there is no need for the user to accurately adjust the angle. The coupling member ensures the engagement of the hinge member with the case members.

Although the present invention has been described in connection with the preferred embodiments, it is not limited thereto. It will be understood by a person skilled in the art that modifications and changes can be made to the present invention without departing from the scope and spirit of the present invention, and that the present invention is intended to include these modifications and changes.

What is claimed is:

1. A hinge for coupling a stationary member with a movable member which can be relatively moved to folded and unfolded positions with respect to the stationary member, comprising:

a housing;

a cam member having a cam and being contained within the housing;

a cam follower member provided with a cam follower portion interacting with the cam of the cam member; and

a resilient member for urging one of the cam member and cam follower member against the other so that the cam follower portion of the cam follower member and the cam of the cam member are in contact with each other;

wherein one of the cam member and the cam follower member can perform a linear motion within the housing and the other can perform a rotational motion by the linear motion, so that the movable member can rotate with respect to the stationary member; and

wherein when the stationary member and the movable member are moved to the unfolded positions, the cam member and the cam follower member interact with each other so as to remain stationary at two or more predetermined unfolded positions.

2. The hinge as claimed in claim 1, wherein the cam member includes a cam surface, the cam surface includes a peak and a valley, the valley is provided with two or more stopping grooves, and the cam follower member includes a protrusion protruding toward the cam surface, an end of the protrusion can be inserted into the stopping grooves.

3. The hinge as claimed in claim 2, wherein the housing is engaged with one of the stationary member and the movable member, and one of the cam follower member and the cam member is coupled to the other of the stationary member and the movable member.

4. The hinge as claimed in claim 2 or 3, wherein a central guide rod extending along

a rotation axis is coupled to one of the cam member and the cam follower member, and a guide hole into which the central guide rod is inserted is formed on the other of the cam member and the cam follower member.

5. The hinge as claimed in claim 3, wherein the cam follower member includes an extension protruding toward the exterior of the housing, and the hinge further comprises a coupling member to be secured to the extension.

6. The hinge as claimed in claim 2, 3 or 5, wherein at least one of the stopping grooves of the cam member is disposed on the slant cam surface extending between the peaks and the valleys.

7. The hinge as claimed in claim 6, wherein at least one stopping groove is provided beyond an end portion of the slant cam surface.

Fig.1

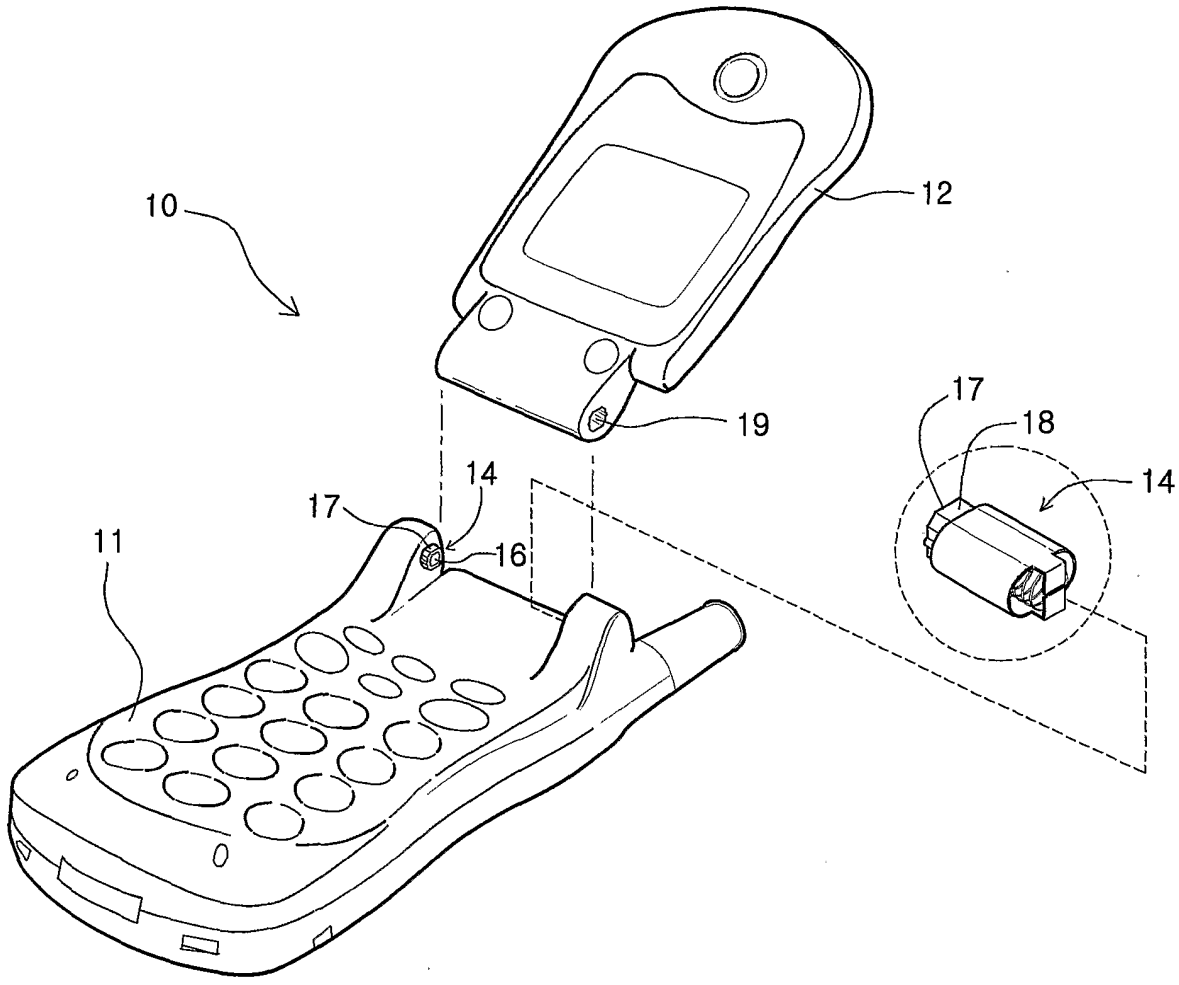
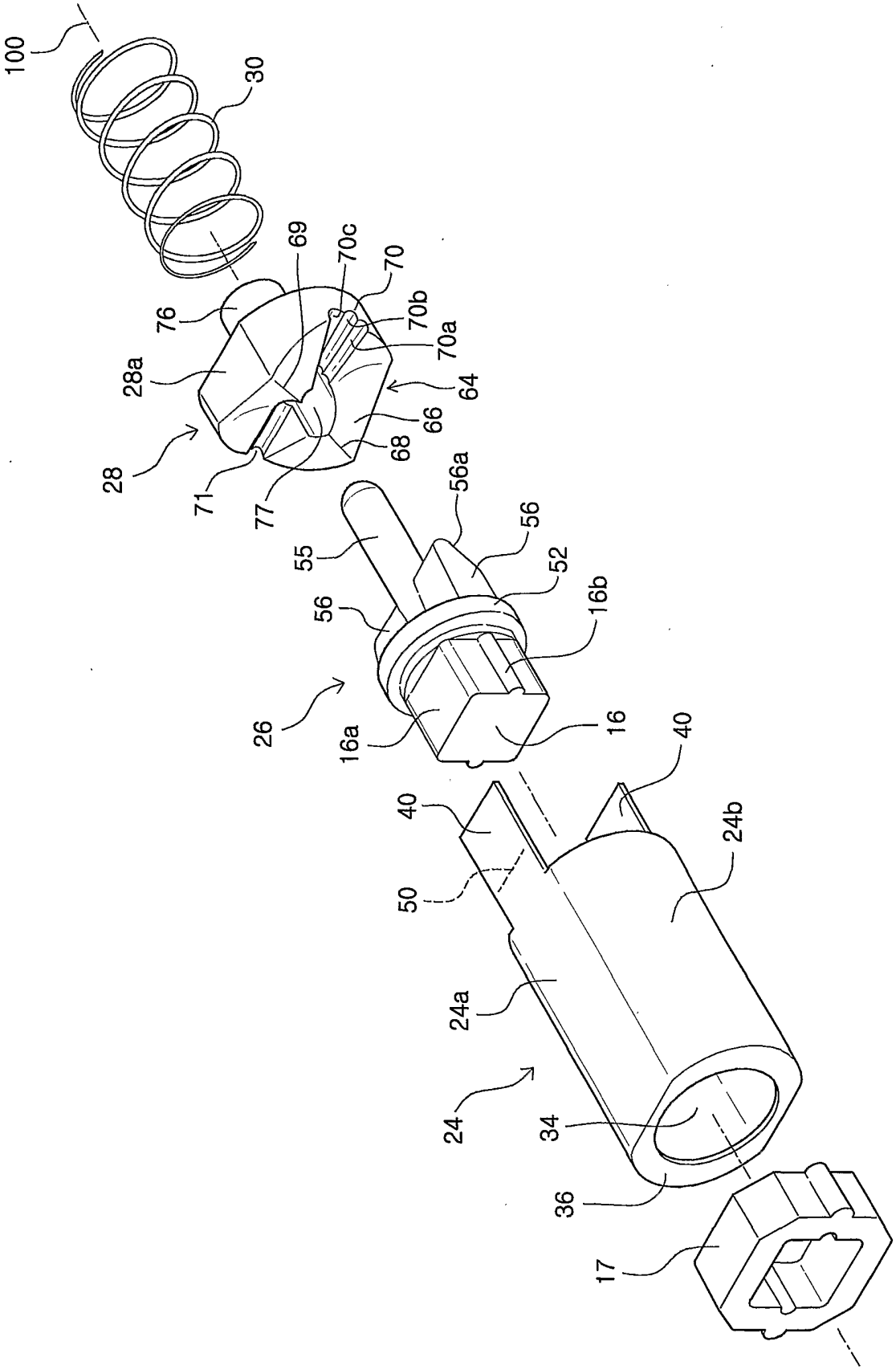


Fig.2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17

Fig.3

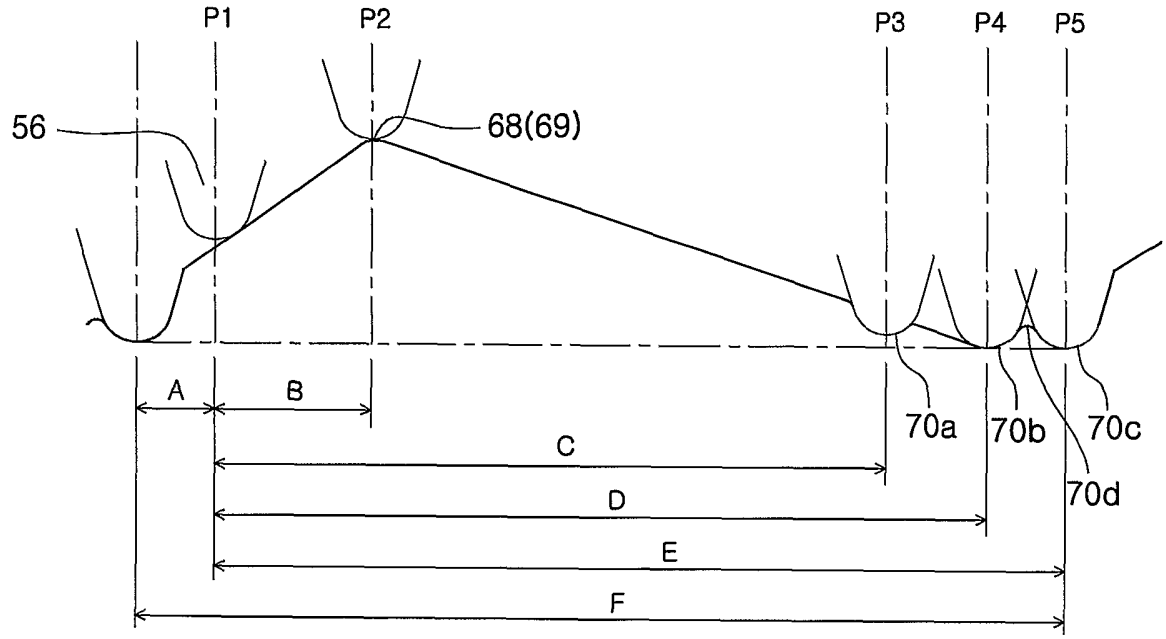


Fig.4a

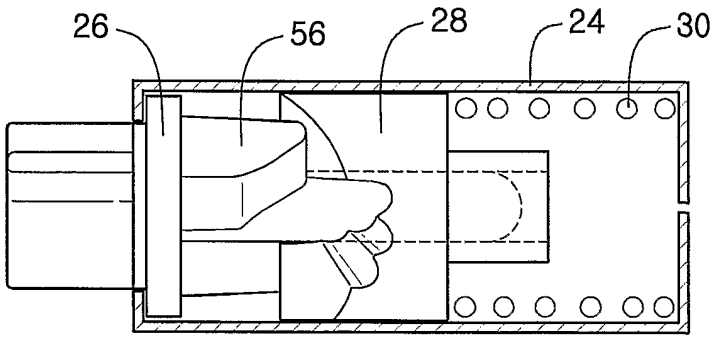


Fig.4b

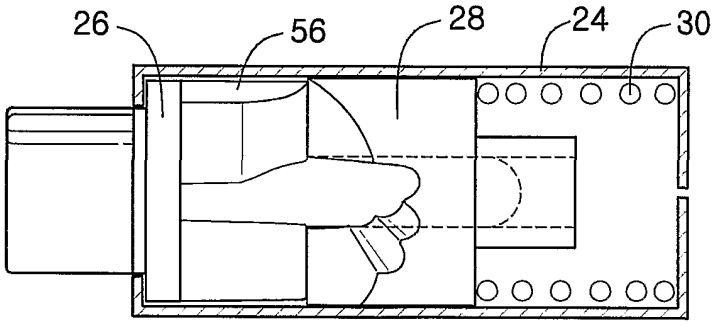


Fig.4c

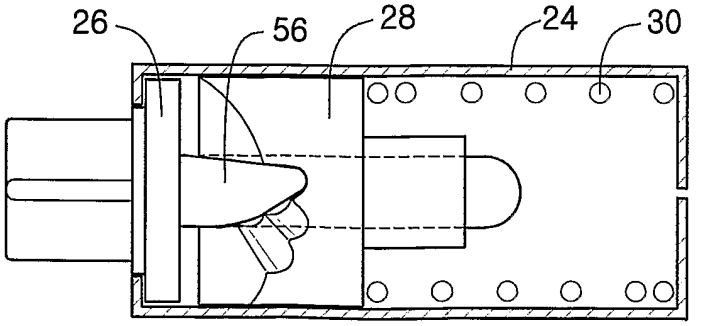
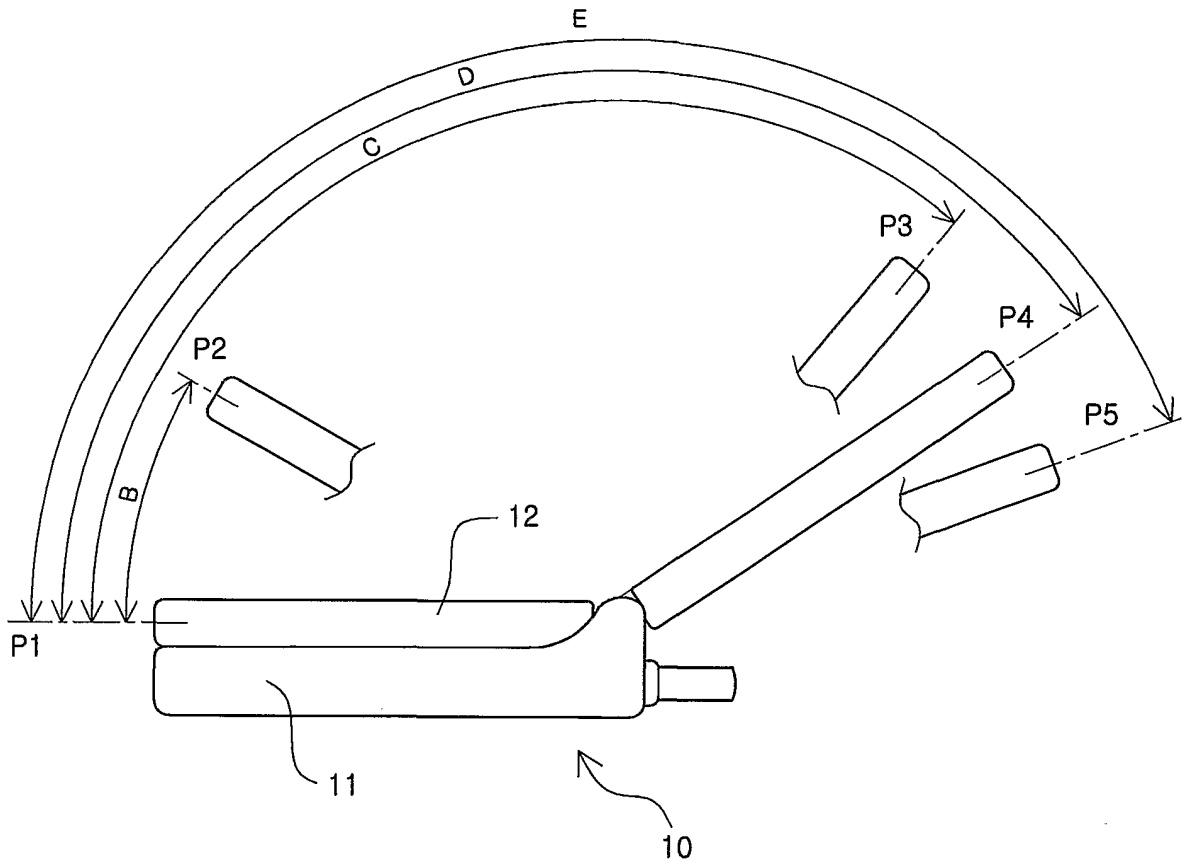


Fig.5



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR01/02220

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 H04B 1/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7 H04B 1/03, 1/38,

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korea Patents and applications for inventions since 1975
Korea Utility models and applications for Utility models since 1975

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)

FPD, PAJ, PATROM

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US5937062A (Acer Peripheral Inc.) 10. 08, 1999 See Abstract and Fig.1	1, 2, 3
A	KR20-0183262(Samsung Electronics Co.) 13. 3, 2000 See Abstract and Fig.1	1, 2, 3
A	KR20-0168344 (Samsung Electronics Co.) 29. 11, 1999 See Abstract and Fig.1	1, 2, 3
A	KR20-0222454 (Hanbit Co.) 20. 2, 2001 See Abstract and Fig.4	1, 2, 3
A	KR20-0225611 (LG Electronics Co.) 19. 3, 2001 See Abstract and Fig.5	1, 2, 3

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
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"P" document published prior to the international filing date but later than the priority date claimed
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"Y" document of particular relevence; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 MARCH 2002 (25.03.2002)	26 MARCH 2002 (26.03.2002)
Name and mailing address of the ISA/KR Korean Intellectual Property Office Facsimile No. +82-042-472-3589	Authorized officer JUN, Young Sang Telephone No. +82-042-481-5707

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR01/02220

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US5937062A	10. 08, 1999	NONE	
KR20-0183262	13. 03, 2000	NONE	
KR20-0168344	29. 11, 1999	NONE	
KR20-0222454	20. 02, 2001	NONE	
KR20-0225611	19. 03, 2001	NONE	