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(54) **FOLDABLE ELECTRONIC DEVICE**

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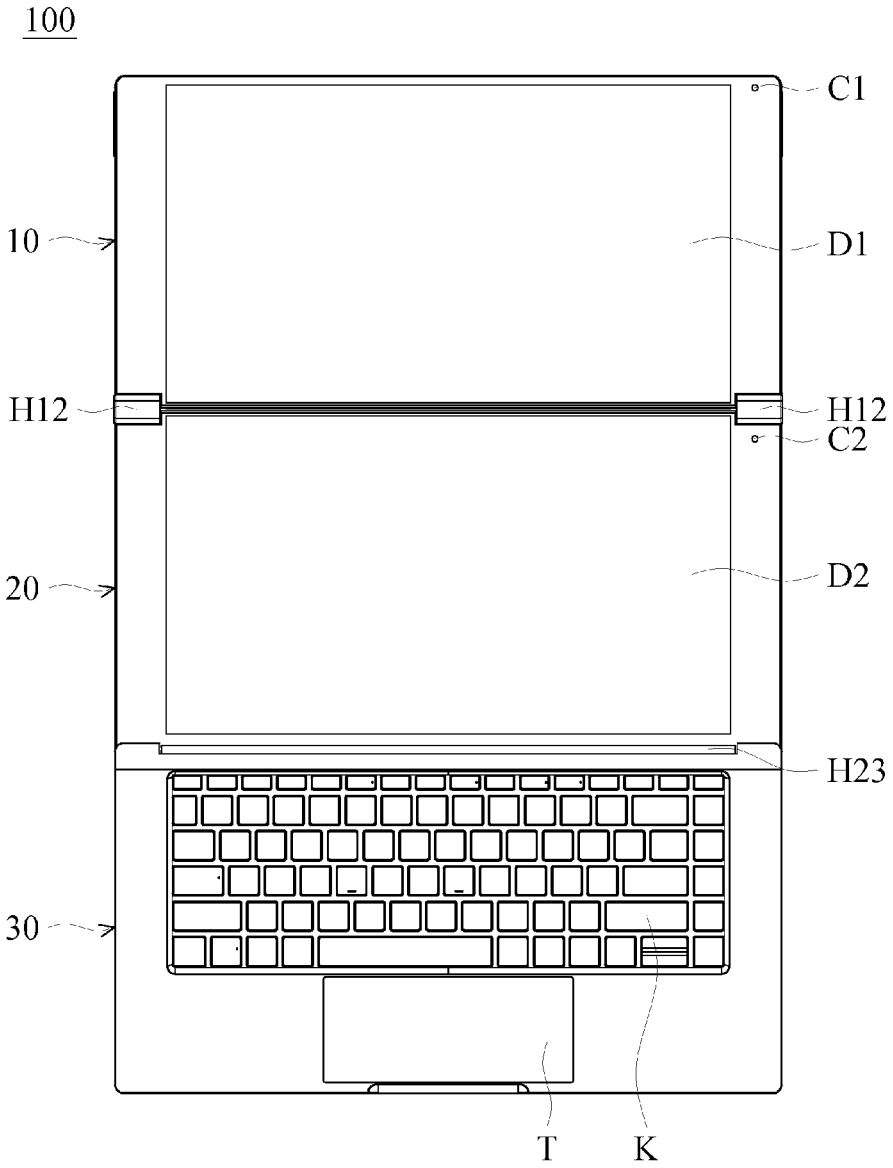
CPC ***G06F 1/1641*** (2013.01); ***G06F 1/1681*** (2013.01)

(57) **ABSTRACT**

A foldable electronic device is provided, including a first display, a second display, an input unit, a first hinge, a second hinge, and a flat support unit. The first hinge pivotally connects the first display to the second display. The second hinge pivotally connects the second display to the input unit. The first and second hinges are located on opposite sides of the second display, and the support unit is pivotally connected to the rear side of the second display.



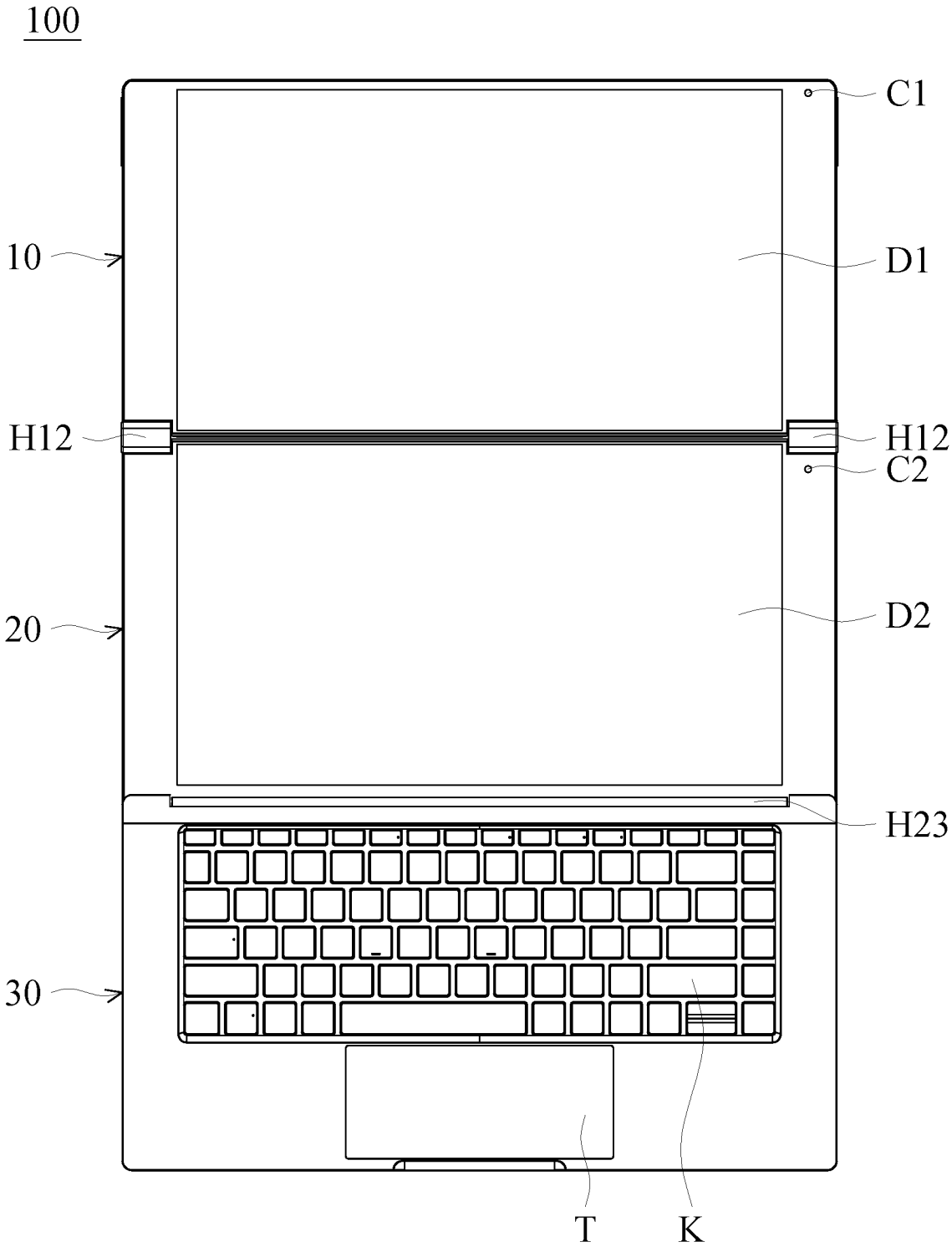


FIG. 1

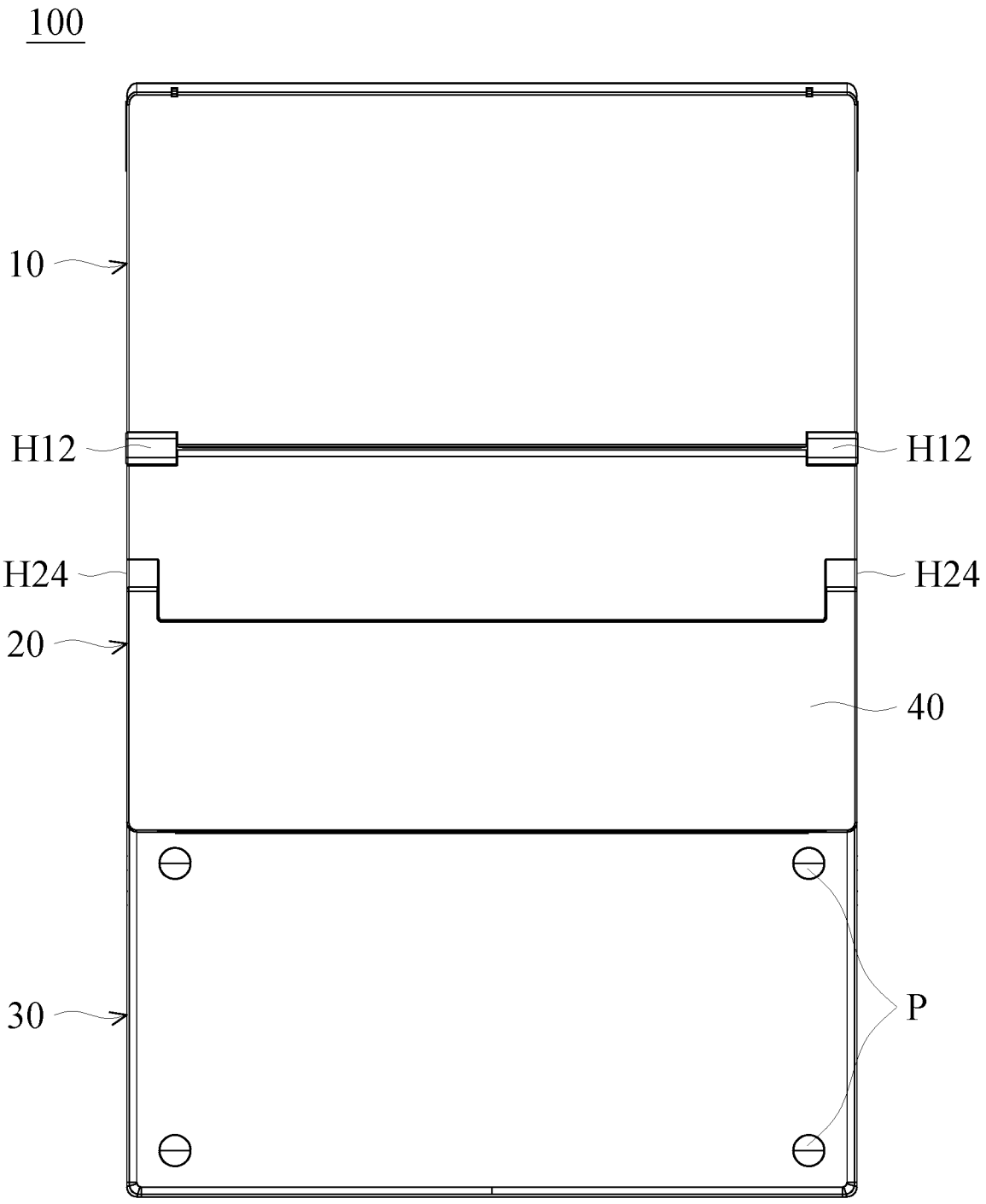


FIG. 2

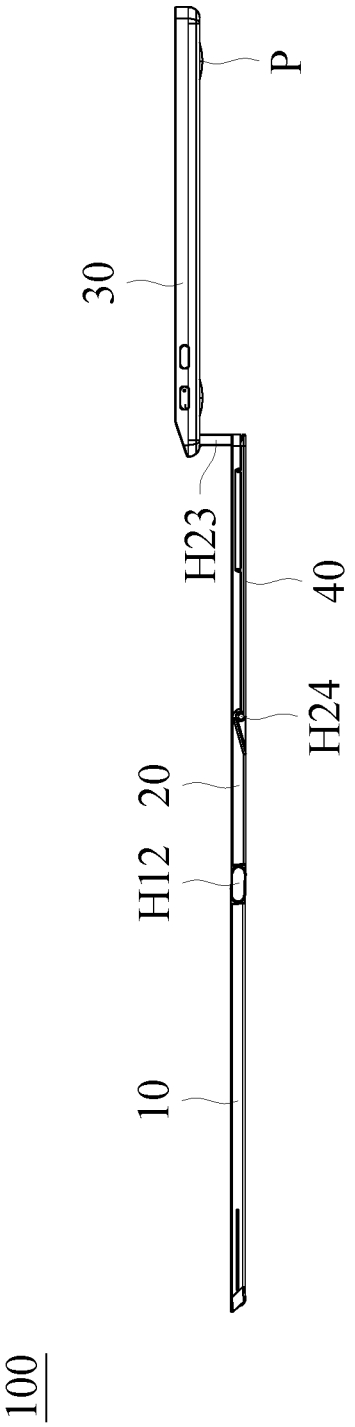


FIG. 3

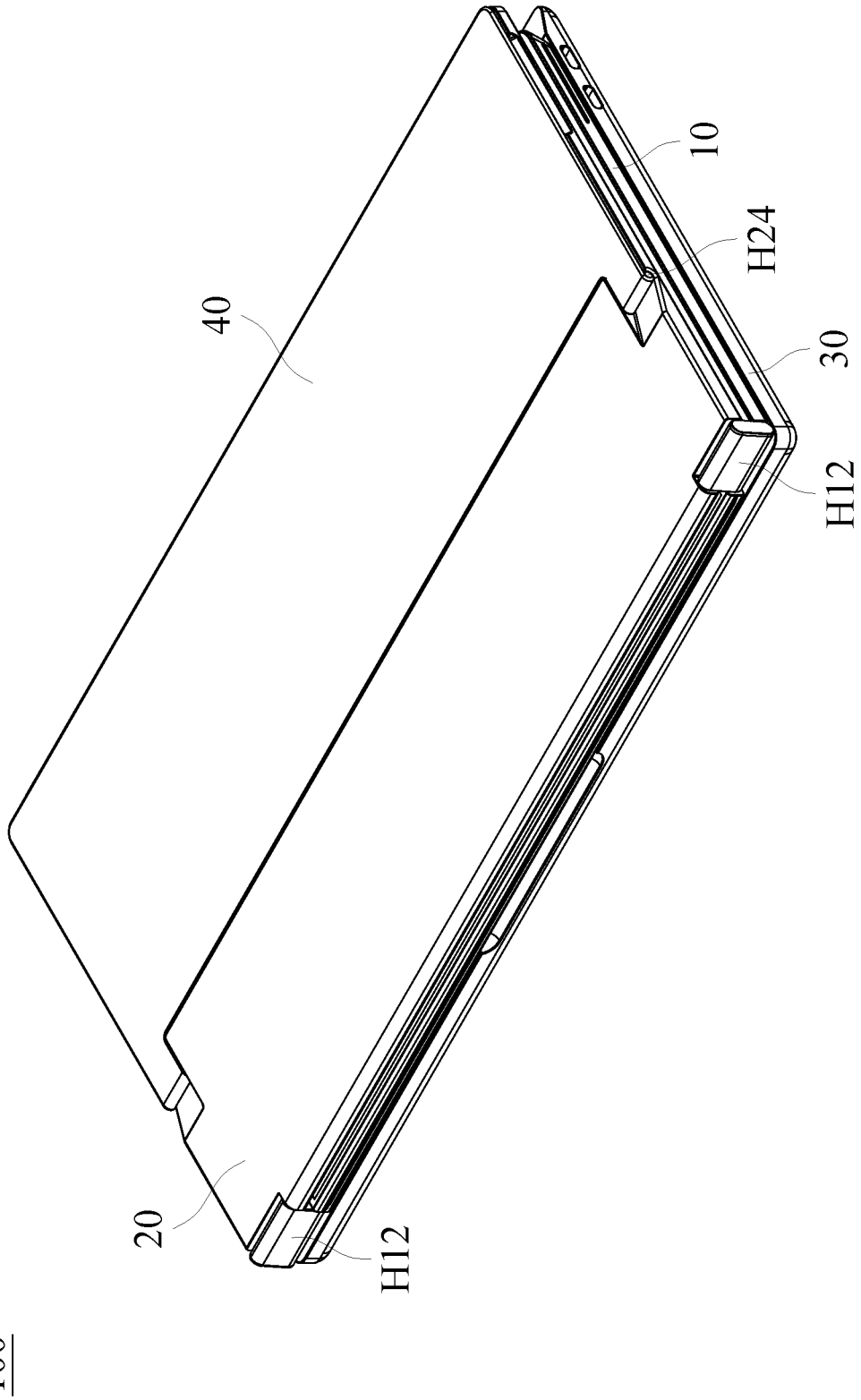


FIG. 4

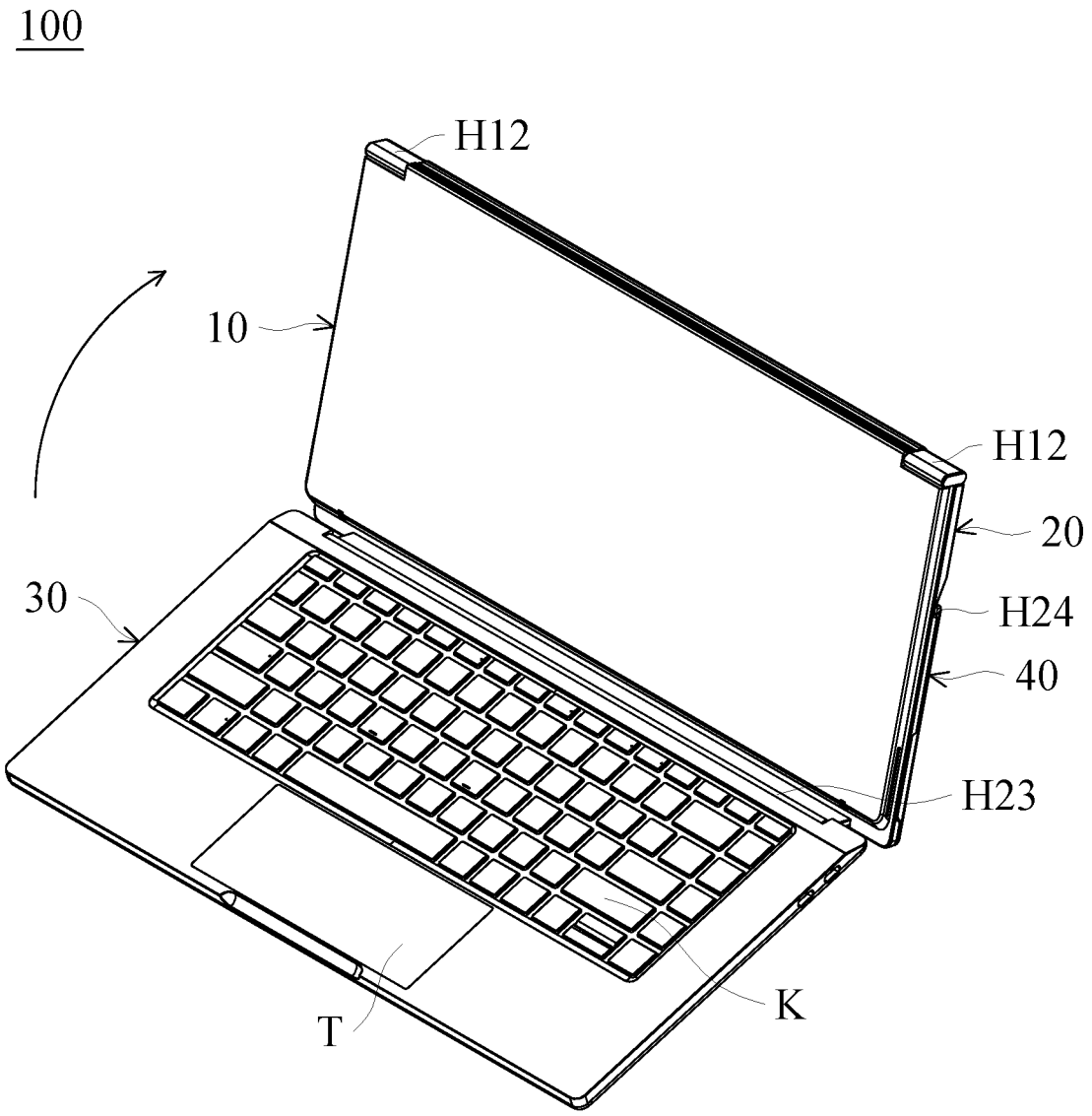


FIG. 5

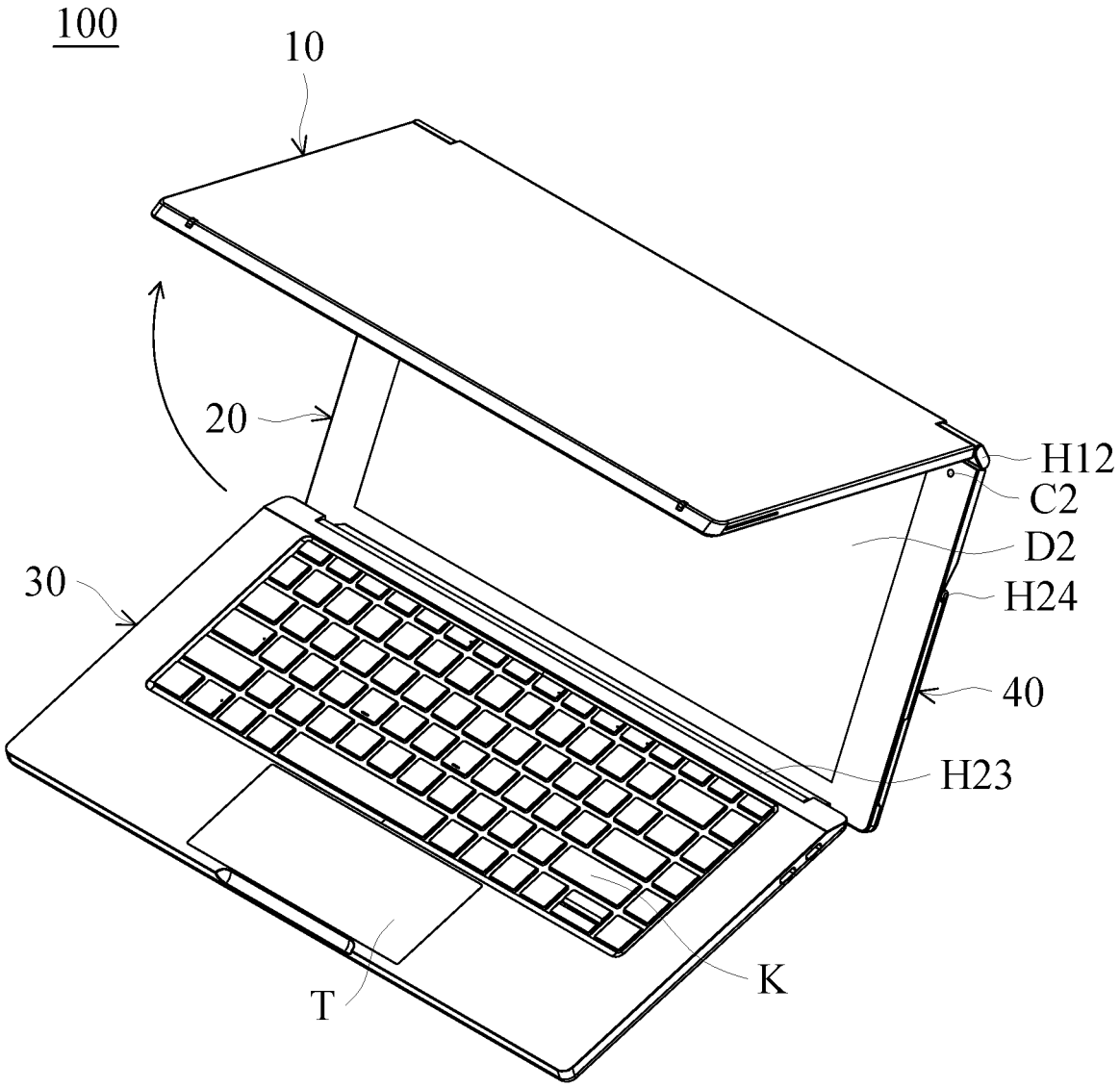


FIG. 6

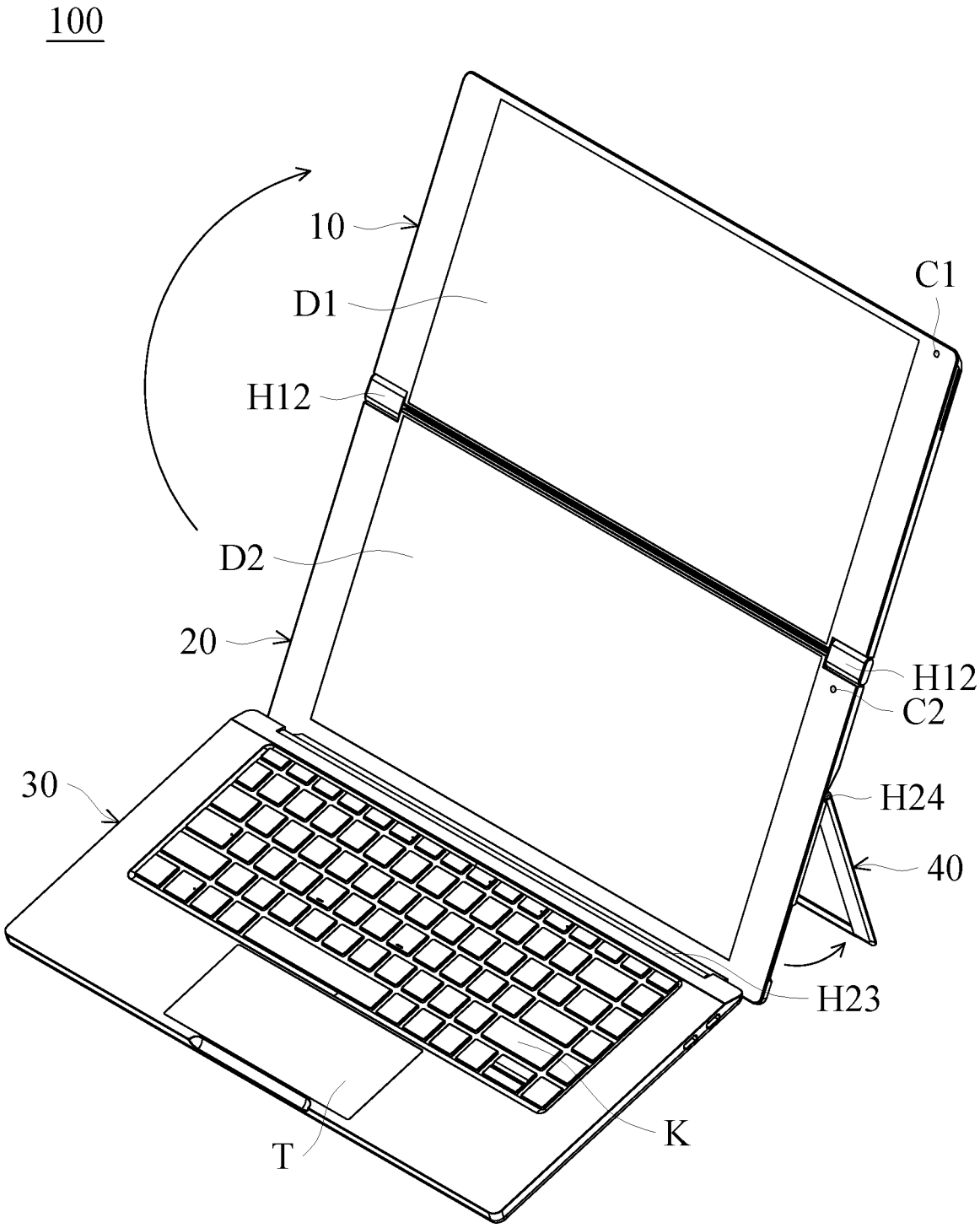


FIG. 7

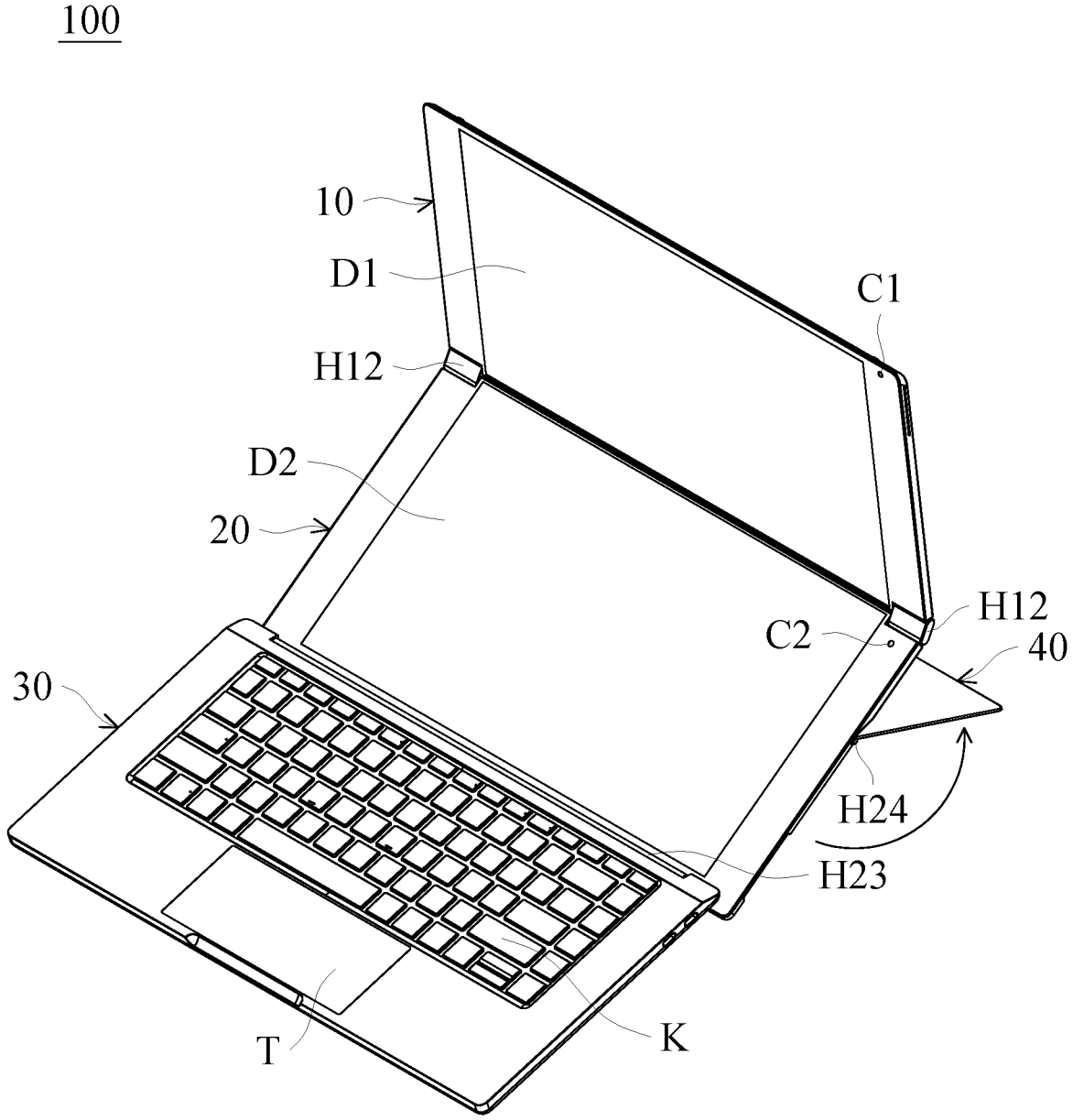


FIG. 8

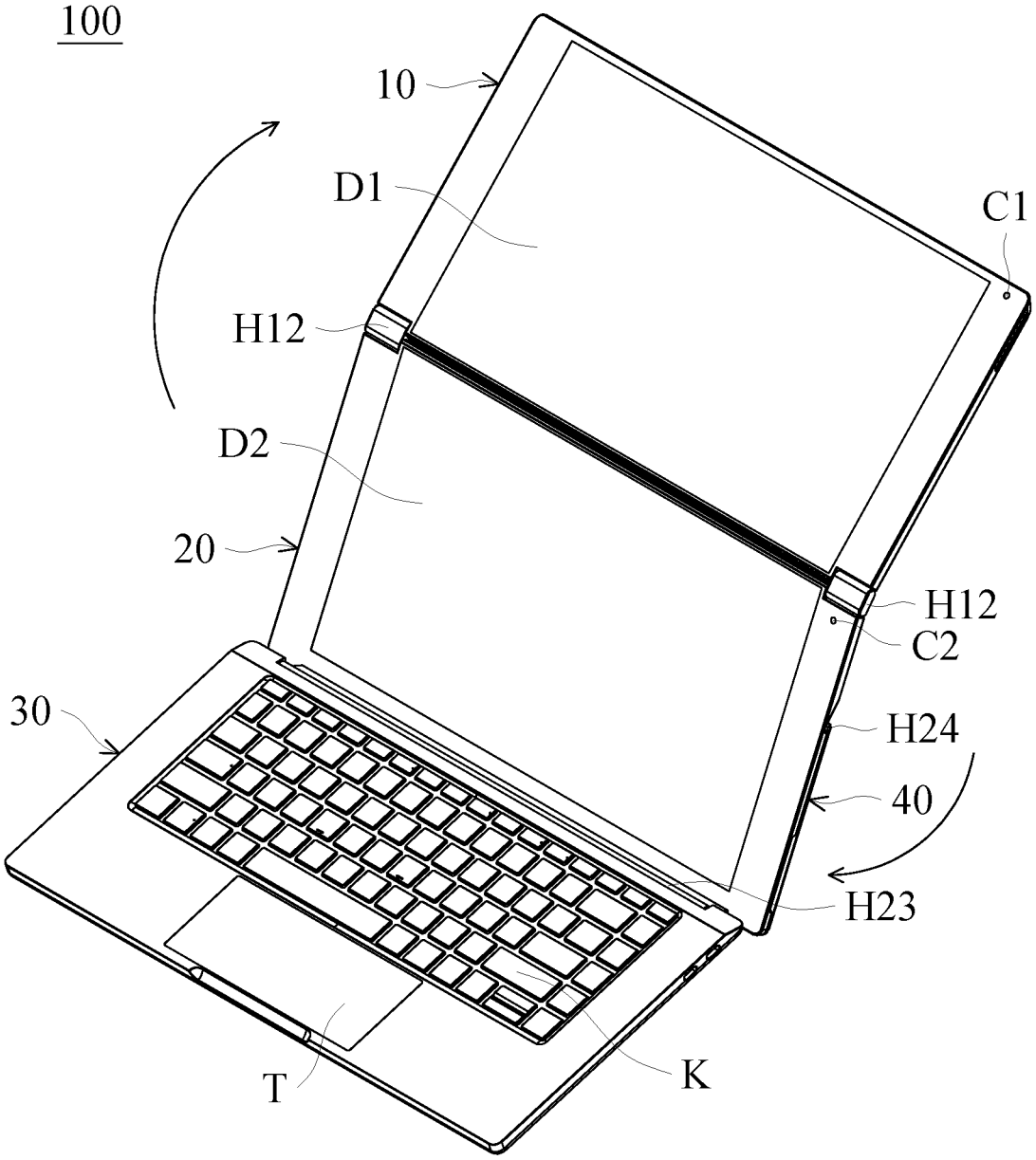


FIG. 9

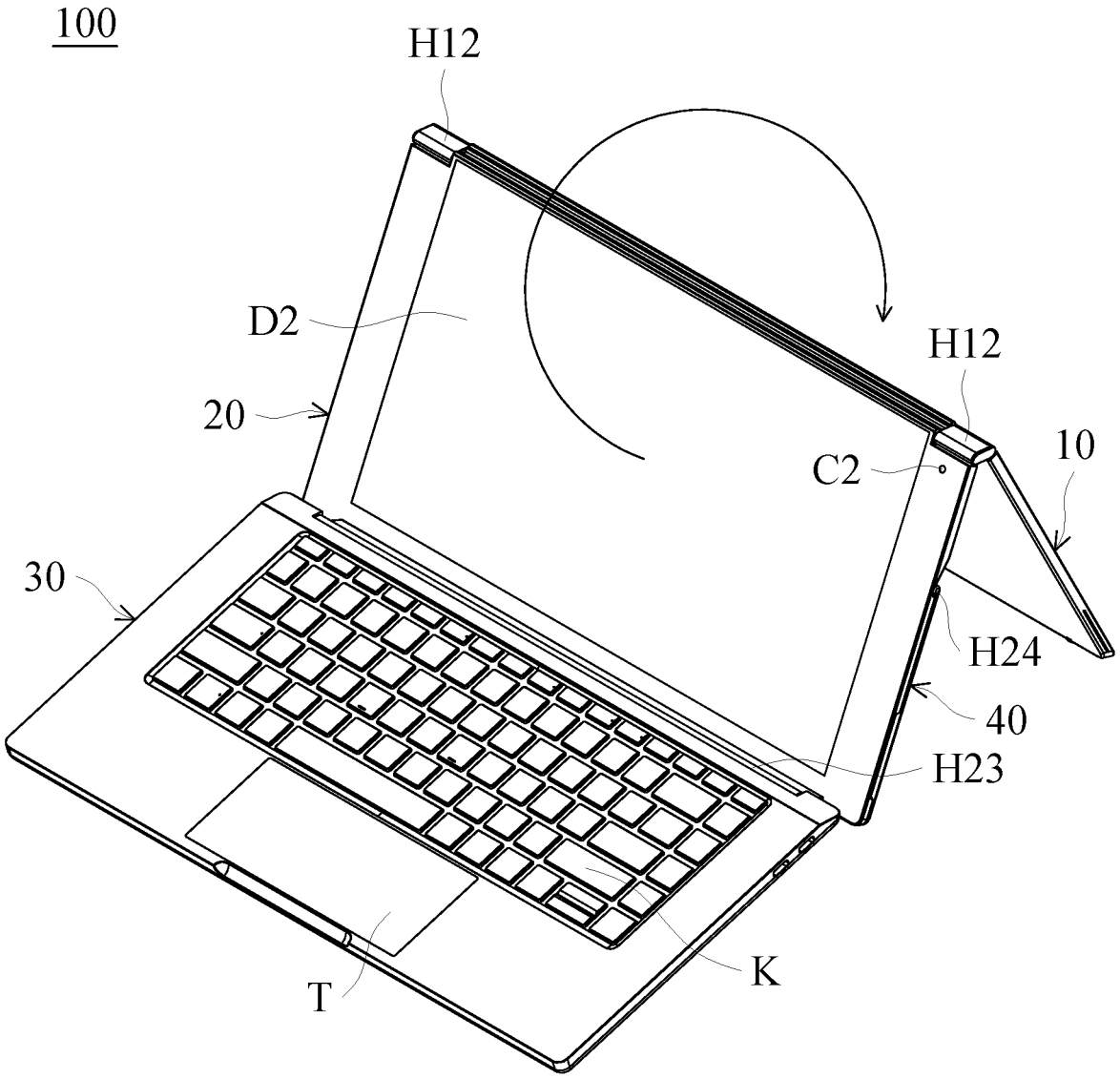


FIG. 10

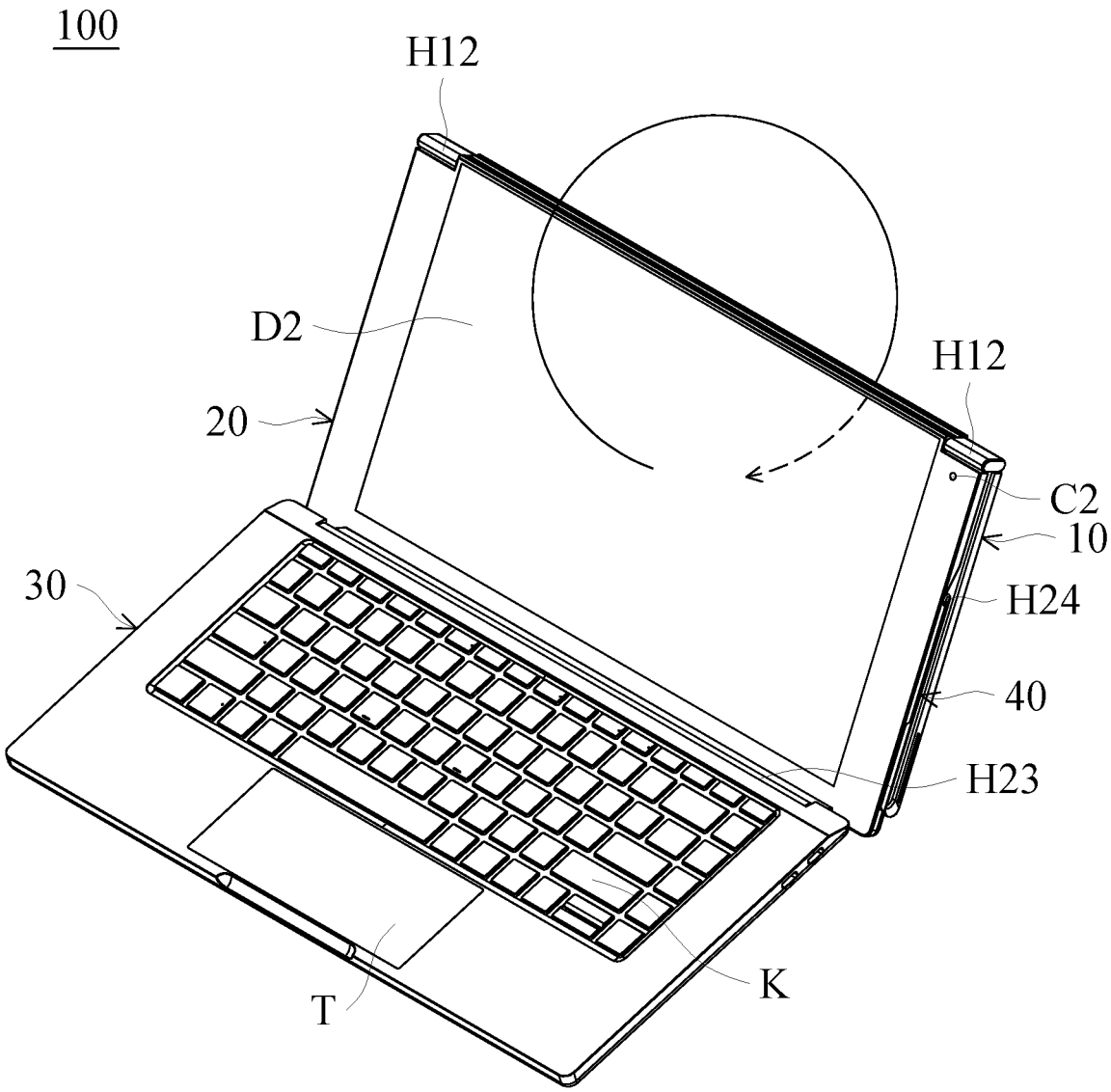


FIG. 11

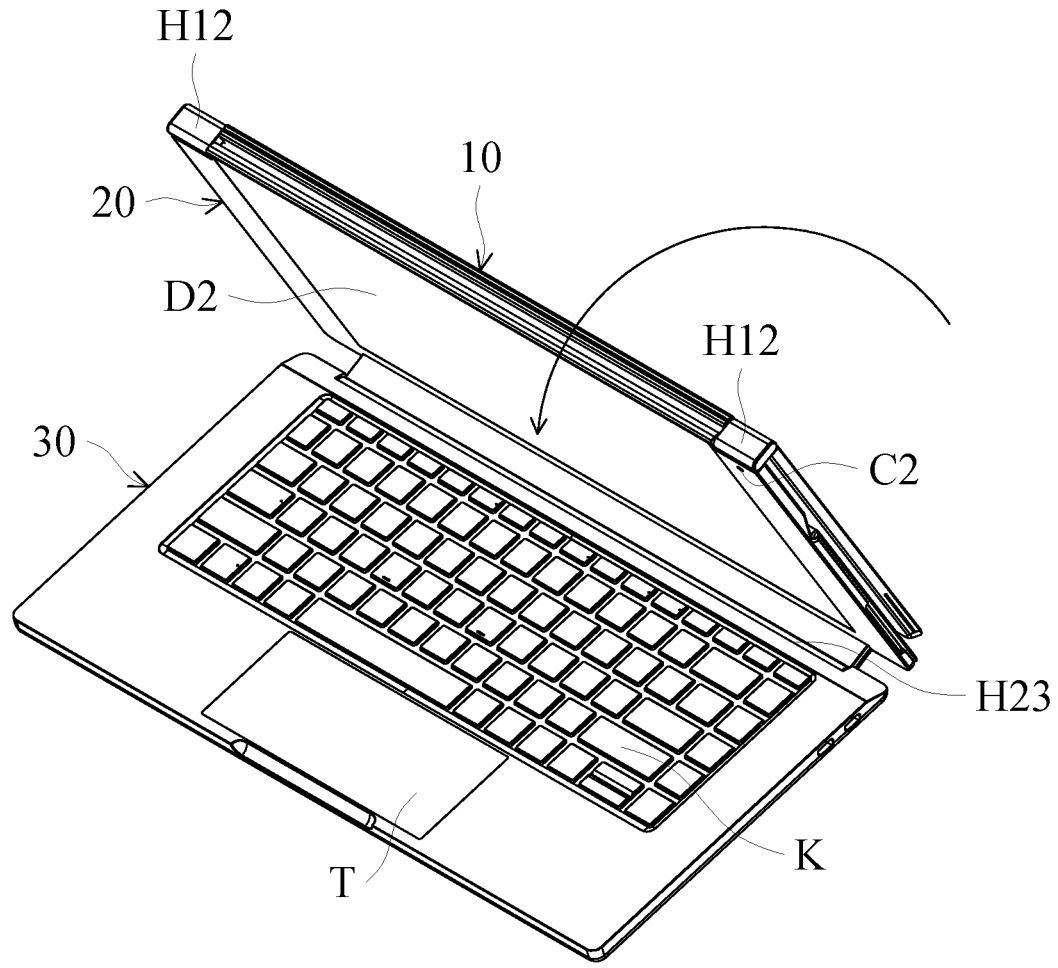


FIG. 12

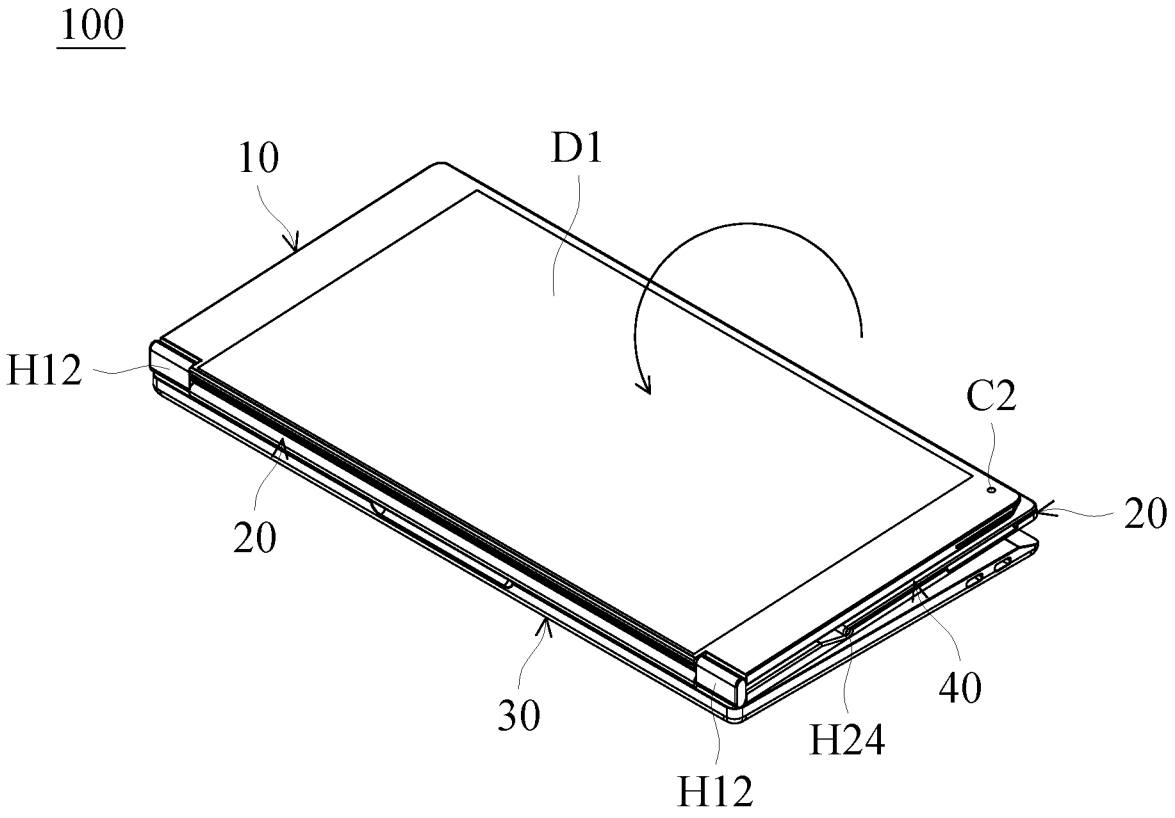


FIG. 13

FOLDABLE ELECTRONIC DEVICE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority of Taiwan Patent Application No. 112200040, filed on Jan. 4, 2023, the entirety of which is incorporated by reference herein.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention relates to a foldable electronic device, and, in particular, to a foldable electronic device that can be used either as a laptop computer or a tablet computer.

Description of the Related Art

[0003] Conventional laptop computers typically have one screen, and it would be inconvenient for two different users when watching the screen at the same time. Moreover, since the screen of conventional laptop computers usually cannot rotate in a wide range, the viewing angle for users is limited, and the laptop computers also cannot be used as tablet computers.

[0004] Therefore, to design a foldable electronic device that can be used either as laptop computer or tablet computer becomes a challenge.

BRIEF SUMMARY OF THE INVENTION

[0005] An embodiment of the present invention provides a foldable electronic device that includes a first display unit, a second display unit, an input unit, a first hinge, a second hinge, and a support unit. The first hinge is pivotally connecting the first display unit to the second display unit. The second hinge is pivotally connecting the second display unit to the input unit, wherein the first and second hinges are located on opposite sides of the second display unit. The support unit has a flat structure that is pivotally connected to the rear side of the second display unit.

[0006] In some embodiments, the first display unit has a first screen, and the second display unit has a second screen facing the first screen when the foldable electronic device is in a closed mode.

[0007] In some embodiments, when the foldable electronic device is in the closed mode, the first display unit is located between the second display unit and the input unit.

[0008] In some embodiments, when the foldable electronic device is in the closed mode, the user input interface of the input unit faces the first display unit.

[0009] In some embodiments, when the foldable electronic device is in a dual screen mode, the first and second screens face the same direction, and the support unit is angled relative to the second display unit for supporting the first and second display units.

[0010] In some embodiments, when the foldable electronic device is in a tent mode, the first and second display units form an inverted-V structure.

[0011] In some embodiments, when the foldable electronic device is in a laptop mode, the first and second screens face opposite directions, and a tilt angle is formed between the second screen and the input unit.

[0012] In some embodiments, when the foldable electronic device is in a tablet mode, the first and second screens face opposite directions, and a user input interface of the input unit faces the second display unit.

[0013] In some embodiments, when the foldable electronic device is in the tablet mode, the second display unit is located between the first display unit and the input unit.

[0014] In some embodiments, the input unit comprises a keyboard or a touchpad.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The present invention can be more fully understood by reading the subsequent detailed description and examples with references made to the accompanying drawings, wherein:

[0016] FIG. **1** is a front view of a foldable electronic device **100** when expanded, in accordance with an embodiment of the invention.

[0017] FIG. **2** is a rear view of the foldable electronic device **100** in FIG. **1**.

[0018] FIG. **3** is side view of the foldable electronic device **100** in FIGS. **1** and **2**, wherein the second hinge H**23** rotates 90 degrees relative to the first display unit **10**, the second display unit **20**, the input unit **30**, and the support unit **40**.

[0019] FIG. **4** is a perspective diagram of the foldable electronic device **100** when in a closed mode.

[0020] FIG. **5** is a perspective diagram showing the first and second display units **10** and **20** when unfolded relative to the input unit **30** from the state of FIG. **4**.

[0021] FIG. **6** is a perspective diagram showing the first display unit **10** when unfolded relative to second display unit **20** from the state of FIG. **5**.

[0022] FIG. **7** is a perspective diagram showing the support unit **40** unfolded relative to second display unit **20** for supporting the first and second display units **10** and **20**.

[0023] FIG. **8** is a perspective diagram showing the first and second display units **10** and **20** and the support unit **40** rotating relative to the input unit **30**.

[0024] FIG. **9** is a perspective diagram showing the support unit **40** when folded to the rear side of the second display unit **20**.

[0025] FIG. **10** is a perspective diagram showing the first display unit **10** when flipped over to the rear side of the second display unit **20** from the state of FIG. **9**.

[0026] FIG. **11** is a perspective diagram showing the first display unit **10** when flipped over and folded to the rear side of the second display unit **20** from the state of FIG. **10**.

[0027] FIG. **12** is a perspective diagram showing the first and second display units **10** and **20** when rotating toward the input unit **30** via the second hinge H**23**.

[0028] FIG. **13** is a perspective diagram showing the first and second display units **10** and **20** folded to the input unit **30** from the state of FIG. **12**.

DETAILED DESCRIPTION OF THE INVENTION

[0029] The making and using of the embodiments of the foldable electronic device are discussed in detail below. It should be appreciated, however, that the embodiments provide many applicable inventive concepts that can be embodied in a wide variety of specific contexts. The specific embodiments discussed are merely illustrative of specific ways to make and use the embodiments, and do not limit the scope of the disclosure.

[0030] Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It should be appreciated that each term, which is defined in a commonly used dictionary, should be interpreted as having a meaning conforming to the relative skills and the background or the context of the present disclosure, and should not be interpreted in an idealized or overly formal manner unless defined otherwise.

[0031] In the following detailed description of the preferred embodiments, reference is made to the accompanying drawings, and in which specific embodiments of which the invention may be practiced are shown by way of illustration. In this regard, directional terminology, such as "top," "bottom," "left," "right," "front," "back," etc., is used with reference to the orientation of the figures being described. The components of the present invention can be positioned in a number of different orientations. As such, the directional terminology is used for the purposes of illustration and is in no way limiting.

[0032] FIG. **1** is a front view of a foldable electronic device **100** when expanded, in accordance with an embodiment of the invention. FIG. **2** is a rear view of the foldable electronic device **100** in FIG. **1**. FIG. **3** is side view of the foldable electronic device **100** in FIGS. **1** and **2**, wherein the second hinge H**23** rotates 90 degrees relative to the first display unit **10**, the second display unit **20**, the input unit **30**, and the support unit **40**.

[0033] Referring to FIGS. **1-3**, the foldable electronic device **100** may be a laptop computer that primarily comprises a first display unit **10**, a second display unit **20**, a input unit **30**, and a flat support unit **40**. The first display unit **10** and the second display unit **20** are pivotally connected to each other via a first hinge H**12**. The second display unit **20** and the input unit **30** are pivotally connected to each other via a second hinge H**23**. The support unit **40** is pivotally connected to the rear side of the second display unit **20** via the hinge H**24**.

[0034] It should be noted that the first and second hinges H**12** and H**23** are locate on opposite sides of the second display unit **20**. The first display unit **10** is capable of 360-degree rotation around the second display unit **20** via the first hinge H**12**, and the second display unit **20** is capable of 360-degree rotation around the input unit **30** via the second hinge H**23**.

[0035] In this embodiment, the second hinge H**23** comprises a drop hinge, but not limited to the embodiments disclosed in the invention.

[0036] The first display unit **10** has a first screen D**1**, and the second display unit **20** has a second screen D**2**. The second screen D**2** and the support unit **40** are located on opposite sides of the second display unit **20**. In some embodiments, the second screen D**2** may be LCD, OLED or touch screen, but not limited to the embodiments disclosed in the invention.

[0037] As shown in FIG. **1**, the first display unit **10** further has a first camera C**1**, and the second display unit **20** further has a second camera C**2**. The first camera C**1** and the first screen D**1** are disposed on the same side of the first display unit **10**, and the second camera C**2** and the second screen D**2** are disposed on the same side of the second display unit **20**. Photographing, video recording, video conference, and live streaming can be achieved by using the first and second cameras C**1** and C**2**.

[0038] Moreover, a keyboard K (e.g. qwerty keyboard) and a touchpad T are disposed on the front side of the input unit **30** as a user input interface when using the electronic device **100**. The first and second display units **10** and **20** can be unfolded relative to the input unit **30**, and the user can input instructions and/or move the cursor on the first and second screens D**1** and D**2** via the keyboard K and/or the touchpad T.

[0039] It can be seen in FIGS. **2** and **3** that several foot pads P are disposed on the bottom side of the input unit **30**. The foot pads P can contact the table for supporting the foldable electronic device **100**. When the foldable electronic device **100** is placed on the table, a gap is formed between the input unit **30** and the table for heat dissipation, thereby preventing overheating of the foldable electronic device **100**.

[0040] FIG. **4** is a perspective diagram of the foldable electronic device **100** when in a closed mode.

[0041] Referring to FIG. **4**, when the foldable electronic device **100** is in a closed mode, the first and second screens D**1** and D**2** of the first and second display units **10** and **20** face each other and are not exposed to the outside of the foldable electronic device **100**. In this state the keyboard K and the touchpad T of the input unit **30** face the first display unit **10**, wherein the first display unit **10** is located between the second display unit **20** and the input unit **30**.

[0042] Moreover, as shown in FIG. **4**, when the foldable electronic device **100** is in the closed mode, the support unit **40** is attached to the rear side of the second display unit **20**, wherein the first and second display units **10** and **20**, the input unit **30**, and the support unit **40** are substantially parallel to each other.

[0043] FIG. **5** is a perspective diagram showing the first and second display units **10** and **20** when unfolded relative to the input unit **30** from the state of FIG. **4**. FIG. **6** is a perspective diagram showing the first display unit **10** when unfolded relative to second display unit **20** from the state of FIG. **5**. FIG. **7** is a perspective diagram showing the support unit **40** unfolded relative to second display unit **20** for supporting the first and second display units **10** and **20**. FIG. **8** is a perspective diagram showing the first and second display units **10** and **20** and the support unit **40** rotating relative to the input unit **30**.

[0044] Referring to FIG. **5**, when using the foldable electronic device **100**, the first and second display units **10** and **20** can be unfolded relative to the input unit **30** so that the first display unit **10** is exposed to the outside of the foldable electronic device **100**. Subsequently, as shown in FIG. **6**, the first display unit **10** can be rotated relative to the second display unit **20** from the state of FIG. **5** to expose the first and second screens D**1** and D**2**.

[0045] After adjusting the first and second display units **10** and **20** to an appropriate angle, the support unit **40** can be unfolded outwardly relative to second display unit **20** for supporting the first and second display units **10** and **20**, thus facilitating structural stability of the foldable electronic device **100** during usage.

[0046] It should be noted that when the first and second display units **10** and **20** are unfolded relative to the input unit **30**, as the state shown in FIG. **7**, the first and second screens D**1** and D**2** face the same direction, and the foldable electronic device **100** is switched to a dual screen mode for a better viewing experience.

[0047] When the foldable electronic device **100** is in the dual screen mode, the user can further rotate the support unit **40** and the first and second display units **10** and **20** relative to the input unit **30**, as the arrow shows in FIG. **8**, whereby the foldable electronic device **100** is switched to a tilt mode to meet each user's need. Therefore, comfortable and convenient use of the foldable electronic device **100** is achieved.

[0048] FIG. **9** is a perspective diagram showing the support unit **40** when folded to the rear side of the second display unit **20**. FIG. **10** is a perspective diagram showing the first display unit **10** when flipped over to the rear side of the second display unit **20** from the state of FIG. **9**.

[0049] Referring to FIG. **9**, to switch the foldable electronic device **100** to a tent mode, the support unit **40** can be folded to the rear side of the second display unit **20**. Subsequently, the first display unit **10** can be flipped over to the rear side of the second display unit **20** from the state of FIG. **9** to the state shown in FIG. **10**. In this state, the first and second display units **10** and **20** form an inverted-V structure that can stand on the table like a tent.

[0050] When the foldable electronic device **100** is in the tent mode, the first and second screens D**1** and D**2** face opposite sides of the foldable electronic device **100**. In this state, two users can see the first and second screens D**1** and D**2** from opposite sides, and they can make a face to face discussion about the presentation slides or documents on the first and second screens D**1** and D**2**.

[0051] FIG. **11** is a perspective diagram showing the first display unit **10** when flipped over and folded to the rear side of the second display unit **20** from the state of FIG. **10**.

[0052] Referring to FIG. **11**, to use the foldable electronic device **100** as a laptop computer, the first display unit **10** can be further flipped over and folded to the rear side of the second display unit **20** from the state of FIG. **10**. In this state, the foldable electronic device **100** is switched to a laptop mode, wherein the first and second display units **10** and **20** are folded back to back, and the first and second screens D**1** and D**2** face opposite directions.

[0053] When in the laptop mode, a tilt angle is formed between the second screen D**2** and the input unit **30**. Hence, the user can easily input instructions and/or move the cursor on the second screen D**2**, and the first screen D**1** can be shut off for power saving and meeting the user's habit when using the laptop computer.

[0054] FIG. **12** is a perspective diagram showing the first and second display units **10** and **20** when rotating toward the input unit **30** via the second hinge H**23**. FIG. **13** is a perspective diagram showing the first and second display units **10** and **20** folded to the input unit **30** from the state of FIG. **12**.

[0055] Referring to FIG. **12**, when switching the foldable electronic device **100** to a tablet mode, the first and second display units **10** and **20** can be rotated toward the input unit **30** via the second hinge H**23**. Subsequently, the first and second display units **10** and **20** can be folded to the input unit **30** as the state shown in FIG. **13**.

[0056] It should be noted that when the foldable electronic device **100** is in the tablet mode, the first and second screens D**1** and D**2** face opposite directions. Specifically, the keyboard K and the touchpad T on the input unit **30** face the second display unit **20**, and the first camera C**1** and the first screen D**1** are exposed to the outside of the foldable electronic device **100**, wherein the second display unit **20** is located between the first display unit **10** and the input unit **30**. Hence, the user can operate the foldable electronic device **100** as a tablet computer through the first screen D**1** (e.g. touch screen).

[0057] Although some embodiments of the present disclosure and their advantages have been described in detail, it should be understood that various changes, substitutions and alterations can be made herein without departing from the spirit and scope of the disclosure as defined by the appended claims. For example, it will be readily understood by those skilled in the art that many of the features, functions, processes, and materials described herein may be varied while remaining within the scope of the present disclosure. Moreover, the scope of the present application is not intended to be limited to the particular embodiments of the process, machine, manufacture, compositions of matter, means, methods and steps described in the specification. As one of ordinary skill in the art will readily appreciate from the disclosure of the present disclosure, processes, machines, manufacture, compositions of matter, means, methods, or steps, presently existing or later to be developed, that perform substantially the same function or achieve substantially the same result as the corresponding embodiments described herein may be utilized according to the present disclosure. Accordingly, the appended claims are intended to include within their scope such processes, machines, manufacture, compositions of matter, means, methods, or steps. Moreover, the scope of the appended claims should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements.

[0058] While the invention has been described by way of example and in terms of preferred embodiment, it should be understood that the invention is not limited thereto. On the contrary, it is intended to cover various modifications and similar arrangements (as would be apparent to those skilled in the art). Therefore, the scope of the appended claims should be accorded the broadest interpretation to encompass all such modifications and similar arrangements.

What is claimed is:

1. A foldable electronic device, comprising:
- a first display unit;
- a second display unit;
- an input unit;
- a first hinge, pivotally connecting the first display unit to the second display unit;
- a second hinge, pivotally connecting the second display unit to the input unit, wherein the first and second hinges are located on opposite sides of the second display unit; and
- a support unit, having a flat structure and pivotally connected to a rear side of the second display unit.

2. The foldable electronic device as claimed in claim **1**, wherein the first display unit has a first screen, and the second display unit has a second screen facing the first screen when the foldable electronic device is in a closed mode.

3. The foldable electronic device as claimed in claim **2**, wherein when the foldable electronic device is in the closed mode, the first display unit is located between the second display unit and the input unit.

4. The foldable electronic device as claimed in claim **2**, wherein when the foldable electronic device is in the closed mode, a user input interface of the input unit faces the first display unit.

5. The foldable electronic device as claimed in claim **2**, wherein when the foldable electronic device is in a dual screen mode, the first and second screens face the same direction, and the support unit is angled relative to the second display unit for supporting the first and second display units.

6. The foldable electronic device as claimed in claim **2**, wherein when the foldable electronic device is in a tent mode, the first and second display units form an inverted-V structure.

7. The foldable electronic device as claimed in claim **2**, wherein when the foldable electronic device is in a laptop mode, the first and second screens face opposite directions, and a tilt angle is formed between the second screen and the input unit.

8. The foldable electronic device as claimed in claim **2**, wherein when the foldable electronic device is in a tablet mode, the first and second screens face opposite directions, and a user input interface of the input unit faces the second display unit.

9. The foldable electronic device as claimed in claim **8**, wherein when the foldable electronic device is in the tablet mode, the second display unit is located between the first display unit and the input unit.

10. The foldable electronic device as claimed in claim **1**, wherein the input unit comprises a keyboard or a touchpad.

* * * * *