

A LATCH FOR CLAMP-SHELL CASINGS

Field of Invention

The present invention relates generally to latching devices and more particularly latching devices for handheld computing devices and personal digital assistants (PDA) which come in clamp-shell casings.

Background of the Invention

Most of the handheld computing devices and PDAs are housed in two-piece clamp-shell casing assemblies. A typical clamp-shell casing assembly has an upper casing containing a display and a lower casing containing a keyboard and electronics. The upper casing is hinged at its rear to the lower casing. The hinge type normally used in such casings has a shaft mounted in a housing with a frictional bushing in between the shaft and the housing. The frictional bushing opposes pivoting of the shaft relative to the housing with a substantially constant frictional force. The shaft is usually attached to the upper casing and the housing is attached to the lower casing. The upper casing can thus be tilted to an open and a closed position of the overall casing. The frictional force is sufficient to hold the upper casing, and hence the display, at any desirable angle relative to the lower casing. A typical casing assembly uses a latching device to lock the upper and lower casing in the closed position. Figure 1 is an example of one such latching device 2 shown in cross sectional view taken along the medial axis of the latching device. The latching device 2 consists of a hook member attached to the upper casing 6 and a recess 8 built into a side wall 10 of the lower casing 12. Located on the cantilevered end of the hook member 4 is a latch tooth 14. The profile of the recess 8 matches the latch tooth 14 so that in the closed position of the casing assembly, the latch tooth 14 is in latching abutment with the surfaces 16 formed by the recess 8 thereby holding the peripheral edges of the upper and lower casings in abutment. The hook member 4 also has an integral push button 18 extending outwards of the casing assembly through a

side wall aperture 20 in the upper casing so that its outside surface is planar or slightly below the outer surface of the side wall 22. To open the casing assembly, one will have to use a finger or nail to press the push button 18 to disengage the latch tooth 14 from the recess 8 to separate the upper and lower casings. Most users of handheld devices are mobile users who would rather do away with this extraneous and inconvenient step of having to depress the push button 18 to separate the upper and lower casings. The opening of the casing assembly is further made more inconvenient if two of these latching devices are to be used in a casing assembly. An example of such a casing assembly is a casing assembly used for notebook or laptop computers. This casing assembly being larger in size requires two latching device, one on each of the two lateral side walls of the casing assembly to hold the two halves of the casing assembly together to a closed position. Separating the upper and lower casings will then require precise coordination of depressing the push buttons and lifting the upper casing. This separating action will require the use of both hands of a user. This action is undesirable for a user who is mobile and may not have the free use of both hands.

There are other handheld computing devices and PDAs which do not use any latching means to hold the upper and lower casings in a closed position. These casings usually rely on more sophisticated hinge devices using clutch-spring mechanisms. Figure 2 is an exploded view of an example of such a hinge device. This hinge device 26 consists of a pintle 28 and a socket. The socket is made of socket portions 30A and 30B. The pintle 28 is mounted on the lower casing and the socket is attached to the upper casing. The pintle has a pintle head 32 from which extends a pair of cammed locking tab 34 (the other of which is not shown). The cammed locking tab 34 is configured to frictionally engage a corresponding notch 36 in the socket so as to release and to lock the pintle 28 to the socket. A helical spring 38 biases the pintle 28 toward the locked position, keeping the upper and lower casings in the closed position. To separate the upper and lower casings, a torque is

applied to the upper casing to overcome the biasing force to disengage the cammed locking tab 34 from the notch 36.

Although the clutch-spring hinge 26 works in holding the two halves of the casing in a closed position without the need for a separate latching device in the casing, it has several disadvantages. Firstly, the clutch-spring hinge 26 is relatively more complicated to design and assemble. The helical spring may lose its resilience through repeated opening and closing of the casing. The upper and lower casings need relatively more precise design to ensure that the upper and lower casings rest snugly on each other when the casing assembly is in the closed position.

The foregoing disadvantages then have created a need for a latching device which adequately holds the casing assembly in a closed position in the absence of any sophisticated clutch-spring hinge. Also opening a casing using two or more such latches should not require a well-coordinated series of actions.

Summary

A latching device embodying the present invention is used in a clamp-shell casing assembly having a lower casing and an upper casing pivotally tiltable over the lower casing. The latching device comprises a resiliently biased spring member fixed to the lower casing and a hook member mounted on the upper casing for engagement with the spring member to achieve a locked position of the latching device. The spring member exerts a compressive force on the hook member to hold the casing assembly in the closed position.

To open the casing, a user simply lifts the upper casing relative to the lower casing. This opening action causes the hook member to disengage the spring member and allows the user to separate the upper and lower casings. There is no need for the user to press any button to open the casing assembly thereby easing the opening action. Also with such a latching device, only a

simple hinge consisting of a shaft in a housing, with frictional bushing between the shaft and the housing, is required to hinge the upper casing to the lower casing.

Brief Description of the Drawings

Fig. 1 is a cross sectional view of a prior art latching device shown attached to a clamp-shell casing assembly.

Fig. 2 is an exploded view of a prior art clutch-spring hinge mechanism used to hinge an upper half of a clamp-shell casing to a lower half of the casing.

Fig. 3 is a perspective view of a clamp-shell casing assembly having a lower casing and an upper casing pivotally tiltable over the lower casing and further having a latching device in accordance with the present invention. The casing assembly is shown in the closed position.

Fig. 4 is an exploded view of the latching device in Fig. 3.

Fig. 5 is a fragmentary cross-sectional view taken along line 1-1 of Fig. 3 with the casing assembly in the open position.

Fig. 6 and 7 are views similar to Fig. 5, showing the latching device in different operative positions when the upper casing is brought downwards towards the lower casing.

Detailed Description of the Preferred Embodiment

Figure 3 shows a typical injection molded plastic clamp-shell casing assembly 50 of the general type with which the invention may be used. The hinge (not shown) used in the clamp-shell casing assembly is generally of the simple type that comprises a shaft (not shown) mounted in a housing (not shown) with frictional bushing between the shaft and the housing. The casing assembly with such a hinge will be described although it will be expressly

understood by those skilled in the art that specific casing hinges may call for the analogous use of other hinges.

The casing assembly of Figure 3 and Figures 4 to 7 has a lower casing 52 and an upper casing 54 which is pivotally tiltable over the lower casing 52. Typically the lower casing 52 contains a keyboard (not shown) and a printed circuit board assembly (PCBA) (not shown) and the upper casing 54 contains a display (not shown). The display is connected to the PCBA through cables (not shown) running from the upper casing to the PCBA in the lower casing through a hinge assembly 56.

A latching device 58 comprises a spring member 60 attached on the lower casing 52 to engage a hook member 62 mounted on the upper casing 54 for holding the casing assembly 50 closed.

Figure 4 is an exploded view of the latching device 58. The spring member 60 is rigidly affixed to an integral supporting wall 64 depending from a top inner surface (not shown) of the lower casing 52. The spring member is affixed to the supporting wall 64 using screws or other fastening means through two apertures 66 and 68 on a mounting flange 70 at one end of the spring member 60. A folded edge 72 between the mounting flange 70 and the rest of the spring member 60 forms a pivoting axis A of the spring member 60. A spring shaft 74 extends away from the pivoting axis, the shaft 74 forming an obtuse angle relative to the mounting flange 70. On a cantilevered end of the spring member 60 is a groove 78 and a ridge 80. A free leading end 82 of the spring member inclines at an angle relative to a planar axis B of the spring member 60 and points towards the supporting wall 64. The leading end 82 first comes into contact with the hook member 62 in the downward movement of the upper casing 54 in a closing action.

The hook member 62 is typically made from a wear resistant material, for example Delrin (Delrin, a trademarked plastic product from Dupont, Wilmington, Delaware, USA.), using typically an injection molding manufacturing process. A latch tooth 84 is located on one end of the hook member 62. On the opposing end of the hook member are two lateral

mounting flanges 86 and 88 with apertures 90 and 92 for screw engagement. The hook member 62 is rigidly affixed to the upper casing using screws (not shown) or other fastening means through the two apertures 90 and 92 of the hook member 62.

Figure 5 shows a fragmentary cross-sectional view taken along line 1-1 of Figure 3 with the spring member 60 and hook member 62 when the casing assembly 50 is in an open position. The spring member 60 is hidden from external view and is accessible only through an aperture 94 in a top surface 96 of the lower casing 52. In the open position, the unused spring member is in an unlatch position. During closing of the casing assembly 50, the hook member 62 contacts the spring member 60 through the aperture 94 in the lower casing 52. A first surface 98 of the latch tooth 62 slides over the inclined leading edge 82 of the spring member, causing the spring member 60 to deflect backwards about the pivoting axis A towards the supporting wall 64. Figure 6 shows the spring member 60 with a maximum deflection when the tip of the latch tooth 62 meets the ridge 80 of the spring member 60. The spring member 60 pivots about the pivot axis A sufficiently to clear the latch tooth 84 so as not to impinge on the supporting wall 64. Thus a clearance gap 100 is provided rearward of the spring member 60. Energy is stored in the deflected spring member 60 when it is pushed towards the supporting wall 64.

Further downward movement of the upper casing 54 causes the latch tooth 84 to slide over the ridge 80. The energy stored in the spring member urges the spring member 60 back towards its unlatch position. A retaining surface 102 on the spring member 60 interacts with a latching surface 104 of the hook member 62 to pull the upper casing 54 towards the lower casing 52 to the closed position of the casing assembly 50. The latching device is in a locked position when the latch tooth 84 sits snugly in the groove 78 of the spring member 60 as shown in Figure 7. The compressive force exerted by the spring member 60 on the hook member 62 keeps the upper casing 54 and lower casing 52 in the closed position.

To separate the upper casing 54 and lower casing 52 so that the keyboard and the display are available to a user, the user applies an upward lifting force to the upper casing 54 and, hence the hook member, to overcome the compressive force of the spring member 60. The latching surface 104 of the hook member 62 will slide over the retaining surface 102 of the spring member 60 during the upward movement of the hook member 62. Once the latch tooth 62 on the hook member 62 clears the ridge 80 of the spring member 60, the latching device 58 is unlocked and the spring member 60 returns to the unlatch position. The upper casing 54 and lower casing 52 can then be separated.

The upper casing 54 and lower casing 52 are of unitary construction made from a material having electrically insulating characteristics, preferably a moldable plastic such as ABS plastic. The spring member 60 is preferably made of sheet metal, which has a uniform cross section, using a progressive die method.

The above description of a preferred embodiment of this invention is intended to be illustrative and not limiting. Other embodiments of this invention will be obvious to those skilled in the art in view of the above disclosure. For example, the spring member 60 need not be mounted to the supporting wall 64 but to the base of the lower casing 52. Also the hook member 62 need not be a separate part; it may be integrally molded with the upper casing 54. Also the location of the spring member 60 and hook member 62 may be interchanged. The latch tooth 84 is also not necessarily located on a separate hook member 62. The latch tooth 84 may be a little protuberance from a peripheral side wall of the opposing casing to that which the spring member 60 is attached. With such a latch tooth, the spring member 60 is required to protrude from the casing to engage the protuberance.

Claims

I claim:

1. A latching device for holding two halves of a casing together, the latching device comprising:
a resiliently biased spring member 12 attached to a first half of the casing wherein the spring member has a substantially uniform cross-sectional thickness; and
means in a second half of the casing for providing a latching surface such that when the two halves of the casing are brought together to a closed position, the latching surface is in latching abutment with a portion of the spring member.
2. A latching device according to Claim 1 wherein the spring member exerts a retaining force on the latching surface when the casing is in the closed position.
3. A latching device according to Claim 1 wherein one end of the spring member is attached to the first half of the casing leaving a cantilevered end extending towards the second half of the casing.
4. A latching device according to Claim 3 wherein the cantilevered end of the spring member inclines at an angle away from a planar axis defined by the spring member to guide the spring member to slide over a portion of the latching surface during the closing of the casing.
5. A latching device according to Claim 4 wherein a protuberance is formed on one of the spring member and the latching surface and a recess on the other of the spring member and the latching surface such that the



protuberance engages the recess to form a detent holding the two halves of the casing together in a closed position.

6. A latching device according to Claim 5 wherein the latching surface is provided by a hook member 14 projecting from the second half of the casing for latching engagement with the spring member.

7. A latching device according to Claim 6 wherein the hook member has a latch tooth which engages a groove on the spring member.

8. A latching device according to Claim 1 wherein the spring member is of sheet metal.

9. A latching device according to Claim 1 wherein the latching surface inclines at an angle such that the latching surface interacts with the spring member to oppose an opening action of the casing.

10. A latching device for holding two halves of a casing together, the latching device comprising:

a resiliently biased spring member attached to a first half of the casing wherein the spring member has a substantially uniform cross-sectional thickness and is shaped to include a groove and a ridge; and

a hook member projecting from a second half of the casing having a latch tooth which slides over the ridge of the spring member to sit in the groove of the spring member such that the spring member and hook member cooperate to keep the two halves of the casing together in a closed position.



11. A latching device for holding together a casing assembly having a lower casing and an upper casing hinged at its rear to the lower casing, the latching device comprising:

a resiliently biased spring member attached at one end to the lower casing leaving a cantilevered end shaped to include a groove and a ridge; and

a hook member projecting downwards from the upper casing having a latch tooth which slides over the ridge of the spring member to sit in the groove of the spring member such that the spring member and hook member cooperate to keep the two halves of the casing in a closed position.

12. A clamp-shell casing assembly having two half casings comprising:

a first half casing containing a keyboard and a printed circuit board assembly ;

a second half casing containing a display;

a hinge assembly connecting the two half casings wherein the hinge assembly further comprises:

a shaft attached to one of the two half casings; and

a housing attached to the other half casing, the housing holding the shaft such that the two half casings are tiltable relative to each other; and

a latching device comprising:

a resiliently biased spring member attached to one of the two half casings wherein the spring member has a substantially uniform cross-sectional thickness; and

means in the other half casing for providing a latching surface such that when the two half casings are brought together to a closed position, the latching surface is in latching abutment with a portion of the spring member.

