

SECURING DEVICE

TECHNICAL FIELD

The present invention relates to a securing device, in particular, a securing device for securing a removable mass storage device to an electrical connector.

5 BACKGROUND

The demand for removable mass storage devices increases with the advent of new computers, cameras and other electronic equipment. As technology progresses, these electronic equipment become faster in terms of their processing speed, more powerful and complex in terms of features and smaller in size for
10 better end-user experience. Accordingly, the removable mass storage devices made for such electronic equipment have to be faster in managing the data exchange and processing, be smaller in size as well as have more security features to prevent accidental misuse and data loss.

An example of such removable mass storage devices is a CompactFlash
15 (trademark of CompactFlash Association (CFA)) card (also known as CF card) which uses flash memory to store the data. The CF cards are designed in compliance with the CFA Standard and are broadly classified into two types – Type I and Type II. Both the Type I and Type II of CF cards are 36.4mm wide and 42.5mm long. However, the Type I and Type II CF cards have a thickness of
20 3.3mm and 5.0mm respectively.

The current CF card has a Parallel Advanced Technology Attachment (ATA) interface while the next generation CF card (also known as “CFast”) will be updated to have a serial interface based on the Serial ATA (or also known as SATA) specification. This is because as the drive capacity becomes denser, the
25 transfer speed of Parallel ATA (PATA) which has a maximum throughput of about 133MB/second is not able to keep up with the speed of moving a large

quantity of data on and off the storage device. The CFast card while retaining the form factor of the CF card, has an enhanced throughput of about 150MB/second to about 300MB/second due to the SATA interface, is therefore better able to meet the expectations of a faster storage device.

5 An important consideration when designing electrical connectors for use with the CF and/or CFast card (hereby collectively referred to as CF card) is the secure engagement of the CF card to the electrical connector when in use. The CF card can get disengaged from the electrical connector, e.g., due to the electronic equipment vibration or when the electronic equipment is accidentally
10 dropped. For an electrical connector with a storage device ejector, the CF card can also be disengaged by the user ejecting the CF card accidentally by depressing the ejector. When the CF card is disengaged from the electrical connector, the data reading/writing, processing and/or transmission between the CF card and the electronic equipment may be affected resulting in data loss.

15 The present invention is directed to a securing device, in particular, a securing device for securing a removable mass storage device to an electrical connector.

SUMMARY

 It would be desirable to provide a securing device for securing a
20 removable mass storage device to an electrical connector. It would also be desirable to provide a securing device that can be used with different types of removable mass storage devices, including but not limited to, the CF Type I, CF Type II and CFast card.

 In accordance with one embodiment of the present invention, there is
25 provided a securing device comprising: a frame including a first extension, a second extension and a body connecting the first extension to the second extension; a retainer device comprising a first retainer arm, a second retainer arm

and a bridging arm connecting a first end of the first retainer arm to a first end of the second retainer arm; a plurality of coupling devices extending from the body of the frame, coupling a second end of the first retainer arm of the retainer device and a second end of the second retainer arm of the retainer device to the frame;
5 and a plurality of locking devices incorporated in the frame, locking the frame to an electrical connector to which the frame is to be attached.

In accordance with another embodiment of the present invention, there is provided an electrical connector comprising: an insulative connector housing comprising an elongated terminal base defined in the connector housing for
10 receiving a removable mass storage device, the terminal base having a plurality of electrical terminals wherein first ends of the electrical terminals may be attached to a printed circuit board and second ends of the electrical terminals are used to establish electrical connection with a plurality of terminal slots extending from a device first end of the removable mass storage device, and a plurality of
15 guiding arms extending from the ends of the connector housing away from the terminal base wherein each guiding arm includes a guiding channel configured for use with the removable mass storage device; and a securing device comprising a frame including a first extension, a second extension and a body connecting the first extension to the second extension, a retainer device
20 comprising a first retainer arm, a second retainer arm and a bridging arm connecting a first end of the first retainer arm to a first end of the second retainer arm, a plurality of coupling devices extending from the body of the frame, coupling a second end of the first retainer arm of the retainer device and a second end of the second retainer arm of the retainer device to the frame, and a plurality
25 of locking devices incorporated in the frame, locking the frame to the guiding arms of the connector housing to which the frame is to be attached.

The invention further includes any alternative combination of parts or features mentioned herein or shown in the accompanying drawings. Known

equivalents of these parts or features which are not expressly set out are nevertheless deemed to be included.

BRIEF DESCRIPTION OF THE DRAWINGS

5 An exemplary form of the present invention will now be described with reference to the accompanying drawings in which:

Figure 1 is an exploded, perspective view of an electrical connector in accordance with one embodiment of the invention together with a removable mass storage device ready to be inserted;

10 **Figure 2** is a perspective view of the electrical connector in Figure 1 with the removable mass storage device ready to be engaged;

Figure 3 is a perspective view of a securing device in accordance with an embodiment of the invention;

Figure 4 is a perspective view of the securing device with another embodiment of coupling devices in accordance with the invention;

15 **Figure 5** is a perspective view of an electrical connector with the securing device in Figure 4 securing a removable mass storage device when in use;

Figure 6A is a section view taken from the direction L as shown in Figure 2 of a securing device aligned to a connector housing of an electrical connector before coupling;

20 **Figure 6B** is a section view of the securing device and the connector housing in Figure 6A taken from the direction R as shown in Figure 2;

Figure 6C is a section view taken from the direction L as shown in Figure 2 of another securing device aligned to a connector housing of another electrical connector before coupling;

Figure 6D is a section view of the securing device in Figure 6C coupled to the connector housing of the electrical connector; and

Figure 6E is a cross-sectional view of the securing device in Figure 6C coupled to the connector housing of the electrical connector taken from the
5 direction of O as shown in Figure 2.

While the above-identified drawing figures set forth several embodiments of the invention, other embodiments are also contemplated, as noted in the discussion. In all cases, this disclosure presents the invention by way of representation and not limitation. It should be understood that numerous other
10 modifications and embodiments can be devised by those skilled in the art, which fall within the scope and spirit of the principles of the invention. The figures may not be drawn to scale. Like reference numbers have been used throughout the figures to denote like parts.

DETAILED DESCRIPTION

15 The demand for removable mass storage devices increases with the advent of new computers, cameras and other electronic equipment. Examples of such removable mass storage devices are CompactFlash[™] (CF) card Type I, CF card Type II as well as a CFast card.

When in use, the removable mass storage device is engaged with an
20 electrical connector usually placed at one end of a media slot in electronic equipment where the electrical connector is coupled to the electronic equipment. The removable mass storage device can get disengaged from the electrical connector, e.g., due to the electronic equipment vibration or when the electronic equipment is accidentally dropped. For an electrical connector with a storage
25 device ejector, the removable mass storage card can also be disengaged by the user ejecting the removable mass storage device by accidentally depressing the ejector. When the removable mass storage card is disengaged from the electrical

connector, the data reading/writing, processing and/or transmission between the removable mass storage card and the electronic equipment may be affected resulting in data loss.

It would be desirable to provide a securing device for securing a
5 removable mass storage device to an electrical connector. It would also be desirable to provide a securing device that can be used with different types of removable mass storage devices, including but not limited to, the CF Type I, CF Type II and CFast card.

Figure 1 shows an exploded, perspective view of an exemplary electrical
10 connector in accordance with the present invention with a removable mass storage device such as a CF card ready to be inserted. Figure 2 is a perspective view of the electrical connector in Figure 1 with the removable mass storage device ready to be engaged. It is worthwhile to note that while a CF card header connector is used to explain the invention in conjunction with a CF card, the
15 invention is by no means restricted to a CF card header connector or an electrical connector used solely in conjunction with a CF card.

The electrical connector **1** comprises an insulative connector housing **10** comprising an elongated terminal base **35** defined in the connector housing **10** for receiving a removable mass storage device **2**, the terminal base **35** having a
20 plurality of electrical terminals **30** wherein first ends **31** of the electrical terminals **30** may be attached to a printed circuit board (not shown) and second ends **32** of the electrical terminals **30** are used to establish electrical connection with a plurality of terminal slots **22** extending from a device first end **23** of the removable mass storage device **2**; and a securing device **100** coupled to the
25 connector housing **10**.

Extending from the ends of the connector housing **10** away from the terminal base **35** are a plurality of guiding arms **12** wherein each guiding arm **12**

includes a guiding channel **14** configured for use with the removable mass storage device **2**. In one embodiment, a plurality of solder tabs **16** are coupled to the guiding arms **12** so as to secure the electrical connector **1** to the printed circuit board to prevent lift-off of the electrical connector **1** from the printed circuit board as the removable mass storage device **2** mates with or un-mates from the electrical connector **1**.

Referring to Figure 3, the securing device **100** comprises a frame **110** including a first extension **111**, a second extension **112** and a body **113** connecting the first extension **111** to the second extension **112**, a retainer device **150** comprising a first retainer arm **151**, a second retainer arm **152** and a bridging arm **153** connecting a first end of the first retainer arm **151** to a first end of the second retainer arm **152**, a plurality of coupling devices **200** extending from the body **113** of the frame **110**, coupling a second end **1512** of the first retainer arm **151** of the retainer device **150** and a second end **1522** of the second retainer arm **152** of the retainer device **150** to the frame **110**, and a plurality of locking devices incorporated in the frame **110**, locking the frame **110** to the guiding arms **12** (not shown) of the connector housing **10** to which the frame **110** is to be attached when the securing device **100** is in use.

In one embodiment, the coupling devices **200** are portions **205** of the body **113** stamped and lifted off the body **113** at one edge **206** of each portions **205**. The coupling devices **200** further include a plurality of openings **208** on the portions **205** of the body **113** configured for insertion by the second ends **1512**, **1522** of the first and the second retainer arms **151**, **152** as the retainer device **150** is coupled to the frame **110**.

Preferably, the first retainer arm **151** and the second retainer arm **152** of the retainer device **150** are bent at an angle at their respective second ends **1512**, **1522**. In Figure 3, the second retainer arms **151**, **152** are bent at an angle of about 90 degrees at their respective second ends **1512**, **1522** before they are inserted

through the openings **208** on the portions **205** of the body **113**. By doing so, the retainer device **150** may be firmly coupled to the frame **110** during use.

While some parts such as the retainer device **150** and the coupling devices **200** may be shown in the figures with apparent linkages, sharp bends or folds, it
5 will be apparent to the person skilled in the art and it is within the spirit of the invention to use, e.g., smooth curves and continuous metal wires. Different shapes and bends may be selected and designed according to the requirements of the retainer device **150** and the coupling devices **200**.

Figure 4 shows the securing device **100** with another embodiment of a
10 coupling device in accordance with the invention wherein the coupling devices **250** are portions **255** of the body **113** stamped and lifted off the body **113** at one edge **256** of each portions **255** and further bent at a plurality of sections along the portions **255**. In the example as shown in Figure 4, the portions **255** are bent at a first section **261** and a second section **262**. In so doing, there is no need to create
15 openings such as holes on the portions **255** and the retainer device **150** may be coupled to the frame **110** by having the second ends **1512**, **1522** of the first and the second retainer arms **151**, **152** slotted via openings **263** into enclosures **265** formed by the bends at the first sections **261** and retained in place by the bends at the second sections **262**.

20 Preferably, the coupling devices **250** further comprises a plurality of stoppers **270** formed from portions of the body **113** adjacent to the first section **261** of the coupling device **250**, stamped and lifted off the body **113** at one edge **272** of each portions. The stoppers **270** serve to minimise the likelihood of the retainer device **150** de-coupling from the frame **110**, e.g., as a result of an
25 accidental nudge in the direction **I** towards the openings **263**.

Figure 5 illustrates how the securing device **100** of the electrical connector **1** may be used to secure the removable mass storage device **2** when in use. With

reference to Figure 2, as the removable mass storage device **2** is inserted in the direction **I** into the electrical connector **1**, the guiding channel **14** on each guiding arm **12** helps to align the removable mass storage device **2** to the terminal base **35** of the electrical connector **1** so that the second ends **32** of the electrical terminals **30** may be properly inserted into the terminal slots **22** extending from the device first end **23** of the removable mass storage device **2** when the removable mass storage device **2** mates with the electrical connector **1**. The guiding channel **14** on each guiding arm **12** also helps the proper disengagement of the removable mass storage device **2** from the electrical connector **1** to prevent the accidental damage and/or bending of the second ends **32** of the electrical terminals **30** during the un-mating process.

As the removable mass storage device **2** moves towards the terminal base **35** of the electrical connector **1**, the retainer device **150** may either rest on a first surface **25** of the removable mass storage device **2** or be isolated from the removable mass storage device **2** such as in a raised position. If the retainer device **150** is resting on the first surface **25** of the removable mass storage device **2**, when the device first end **23** of the removable mass storage device **2** fully mates with the terminal base **35** of the electrical connector **1**, the retainer device will slide over a device second end **24** of the removable mass storage device **2** and thus, securing the removable mass storage device **2** to the electrical connector **1**.

If the retainer device **150** is isolated from the first surface **25** of the removable mass storage device **2**, when the device first end **23** of the removable mass storage device **2** fully mates with the terminal base **35** of the electrical connector **1**, the retainer device **150** may be manually lowered (if it was previously in a raised position) in a direction **D** towards the removable mass storage device **2** until the retainer device **150** fully engages with the device second end **24** of the removable mass storage device **2** and so, securing the removable mass storage device **2** to the electrical connector **1**.

To remove the removable mass storage device **2** from the electrical connector **1**, the retainer device **150** is first raised in a direction **U** away from the removable mass storage device **2** so that the retainer device **150** disengages from the device second end **24** of the removable mass storage device. The removable mass storage device **2** may then be removed by applying a pulling force in a direction **O** to un-mate the removable mass storage device at the device first end **23** from the terminal base **35** of the electrical connector **1**.

As the retainer device **150** is coupled to the frame **110** at the body **113**, the installation of the retainer device **150** does not add to the physical width of the electrical connector **1**. By having the securing device **100** as a separate element that can be attached to a connector housing, the securing device **100** can be used on existing electrical connectors as well as incorporated on different types of electrical connectors.

Referring to Figures 3 and 4, during operation, when the retainer device **150** is raised in the direction **U** prior to the un-mating of the removable mass storage device **2** (not shown) and when the retainer device **150** is lowered in the direction **D** during the mating of the removable mass storage device **2** to the electrical connector **1** (not shown), the coupling of the second ends **1512**, **1522** of the first and the second retainer arms **151**, **152** to the coupling devices **200** at the openings **208** or to the coupling devices **250** at the enclosures **265** urge the first and the second retainer arms **151**, **152** of the retainer device **150** downwards, resisting any corresponding upward motion due to the movement of the retainer device **150**.

Figures 6A, 6B, 6C, 6D and 6E are section views of the securing device **100** with different embodiments of locking devices. In one embodiment, as illustrated by Figures 6A and 6B, the securing device **100** comprises locking devices which consist of a plurality of protrusions **320a**, **320b** extending inwards from the first extension **111** adjacent to a first side **17** of the connector housing

10 and from the second extension **112** (not shown) adjacent to a second side (not shown) of the connector housing **10** to which the frame **110** is to be attached. The securing device **100** may have either protrusions **320a** or protrusions **320b** or both protrusions **320a** and **320b** depending on how secure the securing device
5 **100** is to be coupled to the connector housing **10**. When the frame **110** is coupled to the connector housing **10**, the protrusions **320a**, **320b** fit into grooves **18** configured on the connector housing **10** adapted to cooperate with the protrusions **320a**, **320b** thus preventing undesirable lateral movement or lifting of the frame **110** from the connector housing **10**, thereby locking the frame **110** firmly to the
10 connector housing **10** of the electrical connector **1**.

Referring to Figures 6C, 6D and 6E, in one embodiment, the securing device **100** comprises locking devices which comprise a plurality of lock windows **310** included in the first extension **111** and the second extension **112** (not shown) of the frame **110** and a plurality of complementary lock catches **315**
15 configured to cooperate with the lock windows **310** and extending from the connector housing **10** of the electrical connector **1** to which the frame **110** is to be attached. When the frame **110** moves towards the connector housing **10** during coupling as shown in Figure 6C, the first extension **111** and the second extension **112** (not shown) slide over the lock catches **315** on the connector housing **10**
20 until the lock windows **310** are coupled to the lock catches **315**, thereby locking the frame **110** firmly to the connector housing **10** of the electrical connector **1**.

In another embodiment, the first extension **111** and the second extension **112** (not shown) of the frame **110** are bent at one end **325** of each extension. When the frame **110** is coupled to the connector housing **10** of the electrical
25 connector **1**, the ends **325** of the first extension **111** and the second extension **112** engage with the grooves **18** configured on the connector housing **10** adapted to cooperate with the ends **325** of the first and the second extensions **111**, **112** thus preventing the frame **110** from lifting off the connector housing **10** of the electrical connector **1**.

The foregoing description of various preferred embodiments of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed, since many modifications or variations thereof are possible in light of the above teaching. All such modifications and variations are within the scope of the invention. The embodiments described herein were chosen and described to best explain the principles of the invention and its practical application, thereby to enable others skilled in the art to utilise the invention in various embodiments and with various modifications as are suited to the particular use contemplated thereof. It is intended that the scope of the invention be defined by the claims appended hereto, when interpreted in accordance with the full breadth to which they are legally and equitably suited.

CLAIMS

1. A securing device comprising:

a frame including a first extension, a second extension and a body connecting the first extension to the second extension;

5 a retainer device comprising a first retainer arm, a second retainer arm and a bridging arm connecting a first end of the first retainer arm to a first end of the second retainer arm;

a plurality of coupling devices extending from the body of the frame, coupling a second end of the first retainer arm of the retainer device and a second

10 end of the second retainer arm of the retainer device to the frame; and

a plurality of locking devices incorporated in the frame capable of locking the frame to an electrical connector to which the frame is to be attached.
2. The securing device as claimed in claim 1, wherein the second end of the first retainer arm and the second end of the second retainer arm are bent at an
- 15 angle.
3. The securing device as claimed in claim 2, wherein the coupling devices include openings configured to receive the second end of the first retainer arm and the second end of the second retainer arm.
4. The securing device as claimed in any of the preceding claims wherein the
- 20 locking devices comprise a plurality of protrusions extending inwards from the first extension adjacent to a first side of the electrical connector and from the second extension adjacent to a second side of the electrical connector to which the frame is to be attached.
5. The securing device as claimed in any of the preceding claims wherein the
- 25 the first extension and the second extension are each bend at one end.
6. The securing device as claimed in any of the preceding claims wherein the locking devices comprise a plurality of lock windows included in the first

extension and the second extension of the frame and a plurality of complementary lock catches configured to cooperate with the lock windows and extending from a connector housing of the electrical connector to which the frame is to be attached.

7. An electrical connector comprising:

5 an insulative connector housing comprising an elongated terminal base defined in the connector housing for receiving a removable mass storage device, the terminal base having a plurality of electrical terminals wherein first ends of the electrical terminals are attached to a printed circuit board and second ends of the electrical terminals are used to establish electrical connection with a plurality of
10 terminal slots extending from a device first end of the removable mass storage device, and a plurality of guiding arms extending from the ends of the connector housing away from the terminal base wherein each guiding arm includes a guiding channel configured for use with the removable mass storage device; and

a securing device comprising a frame including a first extension, a second
15 extension and a body connecting the first extension to the second extension, a retainer device comprising a first retainer arm, a second retainer arm and a bridging arm connecting a first end of the first retainer arm to a first end of the second retainer arm, a plurality of coupling devices extending from the body of the frame, coupling a second end of the first retainer arm of the retainer device and a
20 second end of the second retainer arm of the retainer device to the frame, and a plurality of locking devices incorporated in the frame, locking the frame to the guiding arms of the connector housing to which the frame is to be attached.

8. The electrical connector as claimed in claim 7 wherein the electrical connector comprises a CompactFlash(CF) header or a CFast header.