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CARD MEDIA INSERTION MECHANISM IN CARD MEDIA HOLDER

The present invention relates to a card media
5 insertion mechanism in a card media holder for :
connecting a card media such as a PC card (commonly
known as an IC card) having a connector at an edge
thereof to a computer terminal, more specifically to a
personal computer, etc.

10 PC cards or card media find wide applications as
memory media or various interfaces in computer
terminals, more specifically personal computers. The
memory capacity of such PC cards increase each year as a
result of technological advancement. Storing large
15 amounts of data on such PC cards is, therefore,
increasingly important to companies and individuals
using computers.

Now, a PC card 1 typically has a connector 10 at
one end as shown in Figures 8 to 10 for making
20 electrical connection with a matable connector in a
computer terminal. In detail, the bottom portion of a
computer terminal is equipped with a connector 20 having
an insertion opening (or mouth) for accommodating a PC
card 1 as shown in Figure 11. Loading or setting
25 operation of the PC card 1 is carried out by inserting
the PC card 1 into the insertion opening at the computer
terminal for interconnecting the connectors 10, 20 at
the bottom of the computer terminal. On the other hand,
after completing the operation, such interconnection can
30 be interrupted by removing or ejecting the PC card 1
from the insertion opening.

It is typical to use an ejection mechanism 60 (a
manual mechanism in the example shown uses a driving
mechanism in some applications) for ejecting the PC card
35 1 from the insertion opening as shown in Figure 12. The
PC card 1 is manually brought to the insertion opening
by the user.

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The insertion operation of such a PC card, mates or interconnects the pair of connectors in which pins or terminals are mated with sockets. At a certain moment during the insertion stroke, the connection of the pins and sockets is achieved, thus establishing an input/output signal flow between the PC card and the computer terminal. In other words, connection of the connector is fully achieved at a certain stage of the insertion stroke.

However, since the above insertion operations are completely carried out manually by the user (operator) who cannot sense the fully connected condition of the PC card to the connector, the operator may push the PC card for some time after the complete connection has been established. This imposes too much burden to the user and also causes excessive friction, abutment, etc. of the PC card to or against the connector in the computer terminal.

The present invention intends to overcome the aforementioned problem of a conventional card insertion mechanism by providing means for the user to immediately confirm the complete connection to the connector when a card media is inserted in a card media holder or compartment in a computer terminal and the like.

A first feature of the card media insertion mechanism in a card media holder according to the preset invention as defined in claim 1, is the provision of a resilient member to directly or indirectly receive the pushing force of the card media under insertion in such a manner to resist the pushing force until a predetermined load is reached, but enhancing the pushing force if it exceeds the predetermined load. The switching point in changing the operation force of the resilient member at the predetermined load, is set to be equal to the load of the card media at or immediately before complete connection to the connector.

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Here, the predetermined load to change the operation force of the resilient member means the timing to change from the resisting force to the enhancing force of the pushing force of the card media to the connector. The load of the card media at the completely connected condition means the sharp increase of the pushing load of the card media to complete connection to the connector (illustrated between X and Y in Figure 1).

Complete connection of the connector means the condition wherein the card media is fully connected to the connector to perform error free signal input/output operation between the card media and the computer terminal and with no fear of disengagement of the connector of the card media from the connector in the computer terminal. The reason for changing the operation force of the resilient member to include the load immediately before the connection completion of the connector, is that the enhanced pushing force on the card media by the resilient member after changing the operation force, may complete the connection of the connector by the enhanced resilient force by the resilient member even if the user may stop the insertion operation immediately before the completion of connection. In other words, this change in operation force is chosen to avoid unnecessarily excessive load to be applied to the card media during insertion into the connector, and also to avoid excessive abutment of the card media against the terminal side connector by the enhanced force. It is therefore particularly beneficial in the case of using a resilient member having a large resilience.

In this configuration, the resilient member is preferably a reversing member to reverse with the enhancing force when the predetermined load is exceeded as defined in claim 1. Naturally, the resilient member may be a spring member as defined in claim 3.

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Additionally, in the invention of claim 1, a stop surface may be used to directly or indirectly receive the pushing force immediately after the resilient member receives the pushing force exceeding the predetermined load as defined in claim 4. Alternatively, in the invention of claim 2, a stop surface is used to directly or indirectly receive the reversing force immediately after reversal of the reversing member as defined in claim 5.

A second feature of the card media insertion mechanism in card media holder according to the present invention is the provision of a coupled or cooperative member to move directly or indirectly in cooperation with the insertion operation of the card media and an abutment member to abut against the cooperative member immediately after completion of connection of the card media to the connector as defined in claim 9. Here the completion of connection is the same as the above.

Also, the coupled or cooperative member receives the pushing force during insertion of the card media and a resilient member can be provided to enhance the pushing force at the predetermined load as defined in claim 10.

Now, embodiments of the invention will be described, by way of reference to the drawings where:

FIGURE 1 shows graphically the required pushing loads to insert a card media into a card media holder in a computer terminal, wherein the graph A represent the embodiment as shown in FIGURES 2 to 4, the graph B represents the embodiment in FIGURES 2 to 4 excluding the spring, and the graph C represents the load of the spring alone.

FIGURES 2 to 4 are plan views in different steps of the PC card to be inserted in a card media holder to demonstrate the basis embodiment of the present invention, wherein FIGURE 2 is a plan view before connection to the connector, FIGURE 3 is a plan view

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immediately before complete connection, and FIGURE 4 is a plan view after complete connection.

FIGURE 5 is a plan view of an alternative embodiment using a spring member as the resilient member.

FIGURE 6 is a plan view of still another embodiment of the present invention using a spring member as the resilient member.

FIGURE 7 is a magnified view in a circle E in FIGURE 6.

FIGURES 8 to 10 show perspective views of various types of PC cards, wherein FIGURE 8 is a version having a thin step on the top surface, FIGURE 9 is a version having a thin step on the top surface and FIGURE 10 is a version having a flat top surface.

FIGURE 11 is a perspective view to describe an insertion operation of a PC card into a connector.

FIGURE 12 is an abbreviated drawing showing the eject mechanism to eject a PC card from a holder into which the PC card is inserted.

The steps of inserting the card media into a card media holder is illustrated in Figure 1 as the required pushing force or load to the card media holder at the edge connector. In Figure 1, graph B is the pushing load when a card media is simply inserted into a card media holder. As is apparent from the graph B, the pushing load increases sharply at the beginning of insertion but increases by a small increment which is initially almost not sensed by the user, and then increases to infinite load at a position Y equal to the maximum insertion stroke position of the connector past the connection completion minimum stroke position X. In other words, although there are some variations in the pushing load in conventional insertion steps, the pushing load keeps increasing and shows a sharp increase past the minimum stroke position X. This makes it impossible to feel completion of the connection. This

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is the reason why there are difficulties in inserting the card media as mentioned hereinbefore.

On the contrary, in the present invention, the
5 predetermined load position to switch over the direction of function of the resilient member is equalized to the connection completion of the card media to the connector or immediately before the completion. As a result, the action force of the resilient member switches from
10 resisting the pushing force to enhancing or assisting the pushing force at least immediately before the connection completion minimum stroke position X of the insertion of the card media. This will be apparent from the graph A in Fig. 1 (representing the operation of the
15 embodiment to be described hereinafter). As the card media is inserted into the holder, a force resisting the pushing force is developed by the resilient member during the stroke up to the switch over point of the action force, thereby increasing the pushing load larger
20 than the conventional load represented by the graph B. (Note that the graph C represents the resisting force developed by the resilient member alone which is added to the pushing load B). However, as the card media is inserted at least immediately before the connection
25 completion minimum stroke X of the connector, the resilient member enhances the pushing force, thereby suddenly reducing the pushing load. This condition immediately before the minimum stroke X is easily sensed or felt by the user. This in turn gives an indication
30 to the user that the card media has been fully connected, i.e., the complete connection between the card media and the connector.

Also, if a stop surface is provided to directly or indirectly receive the pushing force immediately after
35 the pushing force to the resilient member exceeds the predetermined load, the card media or an intermediate member moving in coupled relationship therewith to abut

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against the stop surface to prevent further insertion of the card media. This will effectively avoid an undesirable load for insertion and also an excessive collision of the card media with the terminal side connector due to the enhanced force.

Now, the second feature of the invention as defined in claim 9 will be described hereunder. In the steps of inserting the card media into the card media holder in this invention mechanism, the cooperative member is provided to move in harmony with the insertion operation. When the card media is inserted into the connection completion stroke position, the cooperative member hits the abutment member immediately after reaching the position to generate a click for notifying the user of the connection completion.

If the cooperative member is provided with a resilient member to resist the pushing force of the card media until a predetermined load but enhancing the pushing force exceeding the predetermined load, thereby providing not only the enhancing force to the pushing force applied by the user at the collision of the cooperative member with the abutment member but also increasing the shock of the collision to magnify the click for ease and convenience of the confirmation of complete connection.

Now, an example of the present invention as applied to a card media holder (accommodation section) in a computer terminal will be described by reference to the accompanying drawings. It is to be noted, however, that the present invention should not be limited only to such embodiment and various modifications may be made without departing from the scope and spirit intended by the present invention.

Illustrated in Figures 2 to 4 are plan views of a card media or a PC card into a card media holder. Figure 2 is a plan view before connection completion of the PC card to the connector; Figure 3 is a plan view

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immediately before connection completion of the PC card to the connector; and Figure 4 is a plan view after connection completion of the PC card to the connector.

5 Figures 2 to 4 illustrate a representative PC card 1 having a connector 10 at one end thereof. A holder 2 has a card insertion opening at a front end and a connector 20 at the bottom or inner end thereof. The PC card 1 is inserted in the direction as shown by an arrow

10 D and is ejected or removed in the opposite direction.

Disposed in the holder 2 is a pivotal lever 3 pivotally supported on a shaft 30 which is biased slightly from the center toward one side. An abutment portion 31 at one side of the shaft 30 abuts against the

15 insertion or leading end of the PC card. A projecting portion 32 is formed at the opposite side of the shaft 30 extending from the inner end of the insertion opening of holder 2. The projecting portion 32 is formed with a cutting groove 33 to engage a latch engaging projection

20 41 of a pushing plate 4 which will be described hereinafter. The pivotal lever 3 receives the primary pushing force at the time of insertion of the PC card 1 and transfers the pushing force to other members. The pivotal lever 3 may be replaced by any other means

25 including a second lever mechanism having another shaft outside of the first lever mechanism and other link mechanism as long as such mechanism has a similar function.

Mounted on the other side on the bottom of the

30 holder 2 at the projection side of the projecting portion 32 of the pivotal lever 3 is a chassis 5 formed with a linear guide groove 50 extending in the direction of insertion of the PC card 1. The latch projection 40 of the pushing plate 4 and the engaging projection 41,

35 which are mounted to slide in the longitudinal direction, are received into the linear guide groove 50. The forward end portion of the linear guide groove 50 into which the engaging projection is inserted is

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substantially equal in length to the rearward end such that the forward end thereof abuts the engaging projection 41 moving in accordance with the stroke immediately after connection completion between the PC card 1 and the connector. In other words, the end of the linear guide groove 50 closer to the engaging projection 41 is designed to limit the movement thereof. The inserting operation of the PC card 1 is coordinated with the engaging projection 41 by way of the pivotal movement of the pivotal lever 3. As a result, the end of the linear guide groove 50 at the engaging projection 41 side acts as a stop surface to limit the insertion stroke of the PC card 1.

Disposed in a cooperative manner at the card insertion side of the chassis 5 are the pushing plate 4 and the eject actuation lever 6 to move in the card insertion and ejection directions. The pushing plate 4 is provided with the latch projection 40 at one end, the engaging projection 41 at substantially the center portion and the engaging strip 42 at the other end. Under the condition where the latch projection 40 and the engaging projection 41 are received into the linear guide groove 50, the latch projection 40 pivotally supports one end of a toggle spring 7 of a return coil spring which will be described hereinafter. The engaging projection 41 engages the cutting groove 33 in the projection portion 32 of the pivotal lever 3. The engaging strip 42 abuts against the end of the eject actuation lever 6 which is an elongate member having one end extending to the side of the card insertion opening of holder 2. When the end of the eject actuation lever 6 proximate to the card insertion opening of holder 2 is depressed, the pivotal lever 3 is ultimately moved in a pivotal manner to eject the PC card 1 inserted in the card insertion opening. Although the pushing operation is carried out manually in this particular embodiment,

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it is, of course, possible to use an automatic driving mechanism.

The spring 7 is pivotally supported by the latch
5 projection 40 at one end and is also pivotally supported
by a fixed latch portion 51 to push the latch projection
40 toward the outer side of the insertion opening of
holder 2 and out of two inner side edges of the guide
groove 50. The spring 7 has a toggle function because
10 the fixed latch portion 51 of the pushing plate 4 is
positioned on a line perpendicular to the linear moving
stroke of the pushing plate 4. In other words, as the
PC card 1 is inserted, the spring 7 receives and resists
the pushing force by way of the pivotal lever 3 and the
15 pushing plate 4 and moves the one end with the latching
projection 41 along the guide groove 50 to store the
energy by being compressed in accordance with the
movement. The deformation will be the maximum when the
pushing force reaches the predetermined load and the
20 stored energy will be released at once when the
predetermined load is exceeded. This will enhance the
movement of the PC card 1 by the energy stored in the
spring 7 at the final stage of the moving stroke of the
pushing plate 4. The timing of maximizing the
25 distortion of deformation of the spring 7 is equalized
in the present embodiment to the load condition
immediately before connection completion of the PC card
1 to the connector. Accordingly, when the maximum
deformation of the spring 7 is released to reverse the
30 action, the insertion stroke of the PC card 1
corresponds to the condition of connection completion.
It is to be noted here that in case of having a certain
width in the insertion stroke (between X-Y in Figure 1)
of the PC card 1 to bring it into connection completion
35 condition, the load condition to maximize the
deformation of the spring 7 is equal to the connection
completion between the PC card 1 and the connector.

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Now the operation of the present embodiment will be described by reference to Figures 2 to 4. The PC card is pushed to bring it in the insertion opening 2 (in the direction of the arrow D). As shown in Figure 2 the insertion or leading end of the PC card 1 abuts against the abutment portion 31 of the pivotal lever 3 for pushing. The main body of the pivotal lever 3 moves in a pivotal manner to push the projecting portion 32 in the opposite direction to the insertion direction. The engaging projection 41 of the pushing plate 4 is in engagement with cutting groove 33 in the projection portion 32 for pushing and sliding in the opposite direction to the insertion direction within the guide groove 50. Similarly, the latch projection 40 slides with the movement of the main body of the pushing plate 4. The spring 7 pivotally supported to the latch projection 40 resists the movement in the sliding direction and is gradually compressed thereby storing energy.

When the PC card 1 is pushed further, the load condition immediately before connection completion to the connector is reached. Then, further energy is stored in the spring 7 by the sliding operation of the latch projection 40 to maximize the deformation as shown in Figure 3.

When further pushing force is applied, the deformation of the spring 7 is suddenly released to provide the enhancing force to make the PC card 1 into the connection completion condition to the connector as shown in Figure 4. At this time, the engaging projection 41 hits the end of the linear guide groove 50 in the chassis 5 to generate a click or collision noise by the enhanced force before stopping the sliding-operation. The stopping operation also causes the insertion of the PC card 1 to stop. On the other hand, in order to eject the inserted PC card 1, the eject actuation lever 6 is depressed in the card insertion

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direction. The lever 6, then pushes the latch projection 40 as well as the pushing plate 4 by way of the engaging projection 42. The above operation is reversed to provide the enhancing force of the spring 7 to the pivotal lever 3. As a result of a series of operations, the PC card 1 is ejected from the insertion opening of holder 2.

As apparent from the above description, in the present embodiment, the spring 7 is deformed to store energy until immediately before the connection completion of the PC card 1 to the connector, thereby enabling the user to insert the PC card 1 against and to feel the resilience of the spring 7. Subsequently, the spring 7 reverses to release its stored energy. The user, then, feels at his or her fingers the sudden reduction in the pushing force from the relatively large load required to overcome the resiliency of the spring 7. This indication is accompanied by the completion of the connection of the PC card 1 so that the user can confirm the connection completion by the sudden reduction in the pushing load. Additionally, the engaging projection 41 is designed to hit or abut against the end of the linear guide groove 50 with the enhanced force, thereby causing a collision noise before stopping the sliding operation. The user can also confirm the connection completion by the noise. Additionally, it is to be noted that undesired further insertion is effectively prevented and any trouble or adverse effect due to excessive insertion operation is effectively prevented.

Although the connection completion condition is detected in the present embodiment by two means, sudden reduction in the required pushing load and the collision noise, as described hereinbefore, it is understood that either one of the above two means may be eliminated if desired. For example, the spring 7 may not be fixed to provide complete connection confirmation only by the

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collision noise (this will also provide some feeling of the abutment). Alternatively, the spring force of the spring 7 may be used only for magnifying the collision noise.

Also in the above embodiment, the resilient member that receives the pushing force during insertion of the PC card 1 is configured to reverse the toggle spring 7. However, one end of a coil spring 8 may be attached directly to the pivotal lever 3 while mounting the other end to another member for directly applying the enhancing force to the pivotal lever 3 as illustrated in Figure 5. Rather than the coil spring configuration, a torsion spring 9 can be abutted to one end of the pivotal lever 3 to utilize its recovery force as shown in Figures 6 and 7. In this and other ways, it is possible to utilize different construction, members and mechanisms for the resilient member.

In the embodiment as shown in Fig. 2, the pushing plate 4, slidable in the direction of insertion of the PC card 1, is coupled to the pivotal lever 3 to push the pushing plate 4 by the operation lever 6. The pushing plate 4 may be eliminated if the end of the pivotal lever 3 is designed to directly push against the operation lever 6. In this case, one end of the spring 7 may be directly provided to the pivotal lever 3. Additionally, the inserted PC card 1 is received at the abutment portion 31 at the end of the pivotal lever 3 so as to eject the PC card 1 by the abutment portion 31. It is also possible to provide a holder member having an abutment portion (or at least a plurality of abutment portions designed to abut against right/left ends of the connector 10) to abut against the entire end of the connector 10 of the PC card 1 independent of the pivotal lever 3 but slidable in the insertion/ejection of the PC card 1. The holder member is coupled to (or cooperable with) the pivotal lever. When pushing the PC card 1,

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the PC card 1 can be pushed evenly (without biasing) thereby providing smooth ejection of the PC card 1 without causing a rotary movement.

5 As apparent from the foregoing description, the present invention provides the following technical advantages.

10 In one embodiment of the invention as defined in claim 1, as the user attempts to insert the card media, the user can feel or recognize that the card media is immediately before the connection completion to the connector due to sudden reduction of the insertion force, thereby providing the user with a reference of complete connection of the card media to the connector.

15 Also, if a stop surface is used, a collision noise is generated when the stop surface is hit to recognize the complete connection.

20 In another embodiment of the invention as defined in claim 9, when the card media is inserted to a connection completion stroke position, the cooperative member hits the abutment member immediately after reaching the position to generate a collision noise for confirmation of complete connection. Also, if a resilient member is provided to enhance the pushing

25 force at the predetermined load condition, the enhanced force by the coupled or cooperative member is added to the pushing force by the user to enhance the force to hit the abutment member, thereby magnifying the impact of collision to provide a larger collision noise for

30 ease of confirmation of complete connection.



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We claim:

1. A card media insertion mechanism in a card media holder having a resilient member to receive
5 directly or indirectly a pushing force of inserting a card media in such a manner to resist the pushing force until a predetermined load is reached and then to enhance the pushing force when the predetermined load is exceeded, characterized in that the predetermined load
10 to change the force to said resilient member is made equal to the load when the card media is fully or almost fully connected to the connector.
2. The card media insertion mechanism of claim 1, wherein a reversing member is used as said resilient
15 member to reverse and to apply an enhancement force if the predetermined load is exceeded.
3. The card media insertion mechanism of claim 1 or 2, wherein said resilient member is a spring member.
4. The card media insertion mechanism of claim 1,
20 wherein a stop surface is positioned to directly or indirectly receive the pushing force immediately after when said resilient member receiving the pushing force exceeds the predetermined load.
5. The card media insertion mechanism of claim 2,
25 wherein a stop surface is disposed to directly or indirectly receive a reversing force immediately after reversing said reversing member.
6. A card media insertion mechanism in a card media holder, comprising:
30 a moving member having an abutment portion to move in the ejecting direction of a card media by receiving a pushing force during insertion of the card media;
a chassis having a card media holder; and
a spring coupled to said moving member at one end
35 and to said chassis at the other end to release its



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maximum deformation for reversal at a predetermined position of said moving member,

wherein the load of said moving plate at the
5 predetermined position to maximize the deformation of said spring is set to be equal to the load at the completion or immediately before completion of connection between said card media a connector.

7. A card media insertion mechanism in a card
10 media holder, comprising:

a pivotal lever to pivot upon receiving a pushing force during insertion of the card media;

a pushing plate formed with an engaging projection to be coupled to an end of said pivotal lever; and

15 a chassis formed with a linear guide groove to slide said engaging projection along the insertion and ejection direction of the card media; and a toggle spring pivotally mounted to said pushing plate at one end and to said chassis at the other end and releasing
20 the compressed maximum deformation for reversal at a predetermined position of said pushing plate as a result of the sliding operation of said engaging projection,

wherein the load at the predetermined position of said pushing plate to maximize the deformation of said
25 toggle spring is set to be equal to the load of complete or immediately before complete connection between the card media and a connector.

8. The card media insertion mechanism of claim 7, wherein said linear guide groove terminates at one end
30 to abut against said engagement projection at the sliding position immediately after completion of connection of the card media to the connector.

9. A card media insertion mechanism in a card media holder, comprising:
35 a cooperative member to move directly or indirectly with the insertion operation of the card media; and an abutment member to abut against said



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cooperative member immediately after complete connection of the card media to a connector.

10. The card media insertion mechanism holder of claim 9, wherein said cooperative member is formed with a resilient member to receive a pushing force of inserting the card media and also to provide an enhancement force to the pushing force at a predetermined load.

11. A card media insertion mechanism in a card media holder, comprising:

a pivotal lever for pivoting on receiving a pushing force during insertion of the card media;

a pushing plate formed with an engagement projection to be coupled to an end of said pivotal lever;

a chassis formed with a linear guide groove to receive said engagement projection and slide along the insertion/ejection direction of the card media; and

a toggle spring pivotally mounted to said pushing plate at one end and to said chassis at the other end and to reverse by releasing the maximum deformation at a predetermined position of said pushing plate along with sliding operation of said engagement projection,

wherein said linear guide groove is terminated at one end to abut against said engagement projection at the sliding position immediately after complete connection of said card media to said card media, and the reversing force of said toggle spring at the instance of abutment is added.