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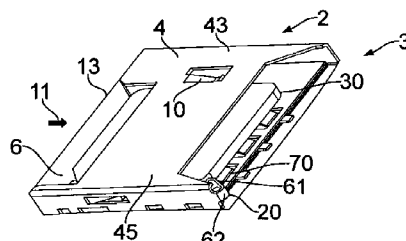


FIG. 5B

(57) Abstract: An apparatus (2) comprising: a housing (4) defining an interior cavity (6) having a length (L), a width (W) and a depth (D), at least one lateral constraint (10) configured to constrain the width (W) of the interior cavity (6) when the apparatus (2) is in a first configuration (3), and at least one longitudinal (20) constraint configured to constrain the length (L) of the interior cavity (6) when the apparatus is in the first configuration (3), wherein, when the apparatus (2) is in the first configuration (3), the cavity (6) is configured for a first card (30), wherein, when the apparatus (2) is in a second configuration (5), the interior cavity (6) is configured for a second card (40), larger than the first card (30), and wherein insertion of the second card (40) into the interior cavity (6) causes depth-wise switching of the apparatus (2) from the first configuration (3) to the second configuration (5) comprising retraction of at least one of the at least one lateral constraint (10) and the at least one longitudinal constraint (20).



APPARATUS INTO WHICH ELECTRONIC CARD MAY BE INSERTED

5 TECHNOLOGICAL FIELD

Embodiments of the present invention relate to an apparatus into which an electronic card may be inserted.

10 BACKGROUND

An electronic card may be used to augment the functionality of an electronic device. Different cards may be used to provide different functionality. For example, a memory card may be used to provide storage whereas a smart
15 card may be used to provide additional processing capability.

BRIEF SUMMARY

According to various, but not necessarily all, embodiments of the invention
20 there is provided an apparatus comprising: a housing defining an interior cavity having a length, a width and a depth; at least one lateral constraint configured to constrain the width of the interior cavity when the apparatus is in a first configuration; and at least one longitudinal constraint configured to constrain the length of the interior cavity when the apparatus is in the first
25 configuration; wherein, when the apparatus is in the first configuration, the cavity is configured for a first card, wherein, when the apparatus is in a second configuration, the interior cavity is configured for a second card, larger than the first card, and wherein insertion of the second card into the interior cavity causes switching of the apparatus from the first configuration to the

second configuration comprising depth-wise retraction of at least one of the at least one lateral constraint and the at least one longitudinal constraint.

According to various, but not necessarily all, embodiments of the invention
5 there is provided an apparatus comprising: a housing defining an interior cavity having a length, a width and a depth; at least one lateral constraint and at least one longitudinal constraint wherein the at least one lateral constraint and at least one longitudinal constraint are configured to position a first card when the first card is inserted in the interior cavity and configured to retract
10 depth-wise when a second card, larger than the first card, is inserted in the interior cavity

According to various, but not necessarily all, embodiments of the invention
there is provided an apparatus comprising: a housing defining an interior
15 cavity having a length, a width and a depth; at least one lateral constraint configured to constrain the width of the interior cavity when the apparatus is in a first configuration; and at least one longitudinal constraint configured to constrain the length of the interior cavity when the apparatus is in the first configuration; wherein, when the apparatus is in the first configuration, the
20 cavity is configured for a first card, wherein, when the apparatus is in a second configuration, the interior cavity is configured for a second card, larger than the first card and wherein insertion of the second card into the interior cavity causes switching of the apparatus from the first configuration to the second configuration comprising retraction of the at least one lateral
25 constraint and the at least one longitudinal constraint, wherein the first longitudinal constraint is configured to retract in response to retraction of the first lateral constraint.

According to various, but not necessarily all, embodiments of the invention
30 there is provided an apparatus comprising: a housing defining an interior

cavity having a length, a width and a depth; at least one lateral constraint configured to constrain the width of the interior cavity when the apparatus is in a first configuration; and at least one longitudinal constraint configured to constrain the length of the interior cavity when the apparatus is in the first
5 configuration; wherein, when the apparatus is in the first configuration, the cavity is configured for a first card, wherein, when the apparatus is in a second configuration, the interior cavity is configured for a second card, larger than the first card and wherein insertion of the second card into the interior cavity causes switching of the apparatus from the first configuration to the
10 second configuration comprising retraction of the at least one lateral constraint and the at least one longitudinal constraint, wherein the housing defines a first aperture configured to receive the first card when inserted in a first direction and a second aperture configured to receive the second card inserted in a second direction opposite to the first direction.

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BRIEF DESCRIPTION

For a better understanding of various examples of embodiments of the present invention reference will now be made by way of example only to the
20 accompanying drawings in which:

- Figs 1A, 1B and 1C illustrate different cross-sectional views through an apparatus when it is in a first configuration;
- Figs 2A, 2B and 2C illustrate different cross-sectional views through the apparatus when it is in a second configuration;
- 25 Figs 3A, 3B, 3C, 3D illustrate an example of a retractable lateral constraint;
- Figs 4A to 4H illustrate a first embodiment of the apparatus in which retraction of the lateral constraint causes retraction of the longitudinal constraint;
- Figs 5A to 5C illustrate a second embodiment of the apparatus in which the lateral constraint and the longitudinal constraint are independent and one
30 does not cause the retraction of the other;

Figs 6A-6F illustrate an additional longitudinal constraint which discourages incorrect insertion of the second card;

Figs 7A to 7D illustrate the apparatus illustrated in Figs 5A-5C without an inserted card; and

- 5 Fig 8 illustrates an electronic device comprising a controller which is operatively coupled to a card reader apparatus.

DETAILED DESCRIPTION

- 10 The Figures illustrate an example of an apparatus 2 comprising: a housing 4 defining an interior cavity 6 having a length L, a width W and a depth D; at least one lateral constraint 10 configured to constrain the width W of the interior cavity 6 when the apparatus 2 is in a first configuration 3; and at least one longitudinal constraint 20 configured to constrain the length L of the interior cavity 6 when the apparatus 2 is in the first configuration 3.
- 15

When the apparatus 2 is in the first configuration 3, the interior cavity 6 is configured for a first electronic card 30.

- 20 When the apparatus 2 is in a second configuration 5, the interior cavity 6 is configured for a second electronic card 40, larger than the first card 30.

- Insertion of the second card 40 into the interior cavity 6 causes depth-wise retraction of the at least one lateral constraint 10 and/or the at least one longitudinal constraint 20 and switching of the apparatus 2 from the first configuration 3 to the second configuration 5.
- 25

- Depth-wise retraction may for example comprise retraction towards a floor of the interior cavity or, alternatively, retraction towards a roof of the interior cavity.
- 30

Figs 1A, 1B and 1C illustrate different cross-sectional views through an apparatus 2 when it is in a first configuration 3. The cross-sectional plane of Fig 1A is perpendicular to the depth-wise direction and parallel to the lateral and longitudinal directions. The cross-sectional plane of Fig 1B is along the lateral section A-A' illustrated in Fig 1A. The cross-sectional plane of Fig 1C is along the lateral section B-B' illustrated in Fig 1A.

Figs 2A, 2B and 2C illustrate different cross-sectional views through the same apparatus 2 when it is in a second configuration 5. The cross-sectional plane of Fig 2A is perpendicular to the depth-wise direction and parallel to the lateral and longitudinal directions. The cross-sectional plane of Fig 2B is along the lateral section A-A' illustrated in Fig 2A. The cross-sectional plane of Fig 2C is along the lateral section B-B' illustrated in Fig 2A.

In Figs 1A-1C and 2A-2C, the apparatus 2 comprises a housing 4. The housing 4 defines an interior cavity 6. The cavity 6 has a length L in the longitudinal dimension, a width W in the lateral dimension and a depth D in the depth-wise dimension.

The housing 4 comprises an aperture to the interior cavity 6. In the first configuration, a first card 30 is inserted by a user through an aperture into the interior cavity 6. In the second configuration, a second card 30 is inserted by a user through an aperture into the interior cavity 6. In this example, but not necessarily all examples, a common aperture 13 is used for inserting/removing, at different times, the first card 30 and the second card 40. The second card is larger than the first card 30.

The housing 4 is sized to accommodate within the cavity 6 at any time either the first card 30 or the second card 40 but not both the first card 30 and the second card 40 at the same time.

- 5 In this example, but not necessarily all examples, the width W and the length L of the interior cavity 6 is different in the first configuration 3 and the second configuration 5.

When the apparatus 2 is in the second configuration 5 the interior cavity 6
10 may have a depth D , length L and width W that closely matches and snugly fits the dimensions of the second card 40 but not the first card 30.

When the apparatus 2 is in the first configuration 3 the interior cavity 6 may
15 have a depth D , length L and width W that closely matches and snugly fits the dimensions of the first card 30 but not the second card 40.

The width W and the length L of the interior cavity 6 are constrained to be
shorter in the first configuration 3 of the apparatus 2 than in the second
configuration 5 of the apparatus 2.

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In this example, but not necessarily all examples, a lateral constraint 10 is
positioned within the housing 4 towards a lateral edge of the housing 4. The
lateral constraint 10 is configured to constrain the width W of the interior cavity
6 when the apparatus 2 is in a first configuration 3 as illustrated in Figs 1A
25 and 1B but not when the apparatus 2 is in the second configuration 5 as
illustrated in Figs 2A and 2B.

In this example, but not necessarily all examples, a longitudinal constraint 20
is positioned within the housing 4 towards a longitudinal edge of the housing 4
30 that opposes the aperture 13. The longitudinal constraint 20 is configured to

constrain the length L of the interior cavity 6 when the apparatus 2 is in a first configuration 3 as illustrated in Figs 1A and 1C but not when the apparatus 2 is in the second configuration 5 as illustrated in Figs 2A and 2C.

- 5 Insertion of a second card 40 into the interior cavity 6 through the aperture 13 switches the apparatus 2 from the first configuration 3 to the second configuration 5 by, for example, causing depth-wise retraction of the lateral constraint 10 and/or the longitudinal constraint 20 so that they no longer constrain the width W and length L of the interior cavity 6.

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An example of a retractable lateral constraint 10 is illustrated in Figs 3A, 3B, 3C, 3D. Figs 3A and 3B illustrate a cross-section where the cross-sectional plane is along the lateral section A-A' for the first configuration 3 (Fig 3A) and the second configuration 5 (Fig 3B). Figs 3A and 3B illustrate a cross-section
15 where the cross-sectional plane is along the longitudinal section C-C' for the first configuration 3 (Fig 3C) and the second configuration 5 (Fig 3D).

As illustrated in Figs 3A and 3C, when the apparatus 2 is in the first configuration 3, the lateral constraint 10 constrains the width W of the interior
20 cavity 6 so that it is sized to snugly fit the first card 30.

The lateral constraint 10 is configured such that when a second card 40, which is wider than the first card 30, is inserted into the interior cavity 6, the second card 40 causes depth-wise retraction of the lateral constraint 10 so
25 that it no longer constrains the width W of the interior cavity 6 (Figs 3B and 3D). This depth-wise retraction switches the configuration of the apparatus 2 from the first configuration 3 to the second configuration 5.

In the illustrated example, the lateral constraint 10 retracts depth-wise towards a floor of the housing 4. Alternatively, in other examples, the lateral constraint 10 may retract depth-wise towards a roof of the housing 4.

- 5 It will be appreciated that although Figs 3A-3D illustrate a lateral constraint 10 in transverse section for the first configuration (Fig 3A), longitudinal section for the first configuration (Fig 3C), transverse section for the second configuration (Fig 3B) and longitudinal section for the second configuration (Fig 3D), a similar arrangement may be provided for the longitudinal constraint 20 such
- 10 that when a second card 40, which is wider than the first card 30, is inserted into the interior cavity 6, the second card 40 causes depth-wise retraction of the longitudinal constraint 20 so that it no longer constrains the length L of the interior cavity 6. This depth-wise retraction switches the configuration of the apparatus 2 from the first configuration 3 to the second configuration 5. The
- 15 longitudinal constraint 20 may retract depth-wise towards a floor of the housing 4 or towards a roof of the housing 4.

The retractable lateral constraint 10 may be resiliently biased so that by default it extends or protrudes into the cavity 6 when the apparatus 2 is in the

20 first (stable) configuration 3. The second card 40 retracts the lateral constraint 10 against this bias when the apparatus 2 is in the second (unstable) configuration 5.

The retractable longitudinal constraint 20 may be resiliently biased so that by

25 default it extends or protrudes into the cavity 6 when the apparatus 2 is in the first (stable) configuration 3. The second card 40 retracts the longitudinal constraint 20 against this bias when the apparatus 2 is in the second (unstable) configuration 5.

In some examples, but not necessarily all examples, the lateral constraint 10 may comprise a cantilevered spring. A cantilevered spring is, a cantilever that, in its rest position, protrudes into the interior cavity 6. A cantilever is a member that is supported at one of four sides.

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In some examples, but not necessarily all examples, the lateral constraint 10 may be an integral part of the housing 4 such that the lateral constraint 10 is formed as a part of the housing 4 as opposed to attached to the housing 4.

10 In some examples, but not necessarily all examples, the longitudinal constraint 20 may comprise a cantilevered spring. A cantilevered spring comprises a cantilever that, in its rest position, protrudes into the interior cavity 6. A cantilever may comprise a member that is supported at one of four sides.

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In some examples, but not necessarily all examples, the longitudinal constraint 20 may be an integral part of the housing 4 such that the longitudinal constraint 20 is formed as a part of the housing as opposed to attached to the housing 4.

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Figs 4A to 4H illustrate a first embodiment of the apparatus 2, for example as previously described, in which retraction of the lateral constraint 10 causes retraction of the longitudinal constraint 20.

25 Fig 4A illustrates a plan view of the upper side (roof) 41 of the housing 4 of the apparatus 2. Fig 4B illustrates a perspective view of the upper side (roof) 41 of the housing 4 of the apparatus 2 illustrated in Fig 4A. Fig 4C illustrates a more detailed view of the lateral constraint 10 and the longitudinal constraint 20 illustrated in Fig 4B.

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Fig 4D illustrates a perspective view of the upper side 41 of the housing 4 of the apparatus 2 illustrated in Fig 4A, when the apparatus 2 is in a first configuration 3 and the first card 30 is inserted. Fig 4E illustrates a cross-sectional view along the cross-sectional plane defined by the section A-A in Fig 4D. Fig 4F illustrates a cross-sectional view along the cross-sectional plane defined by the section B-B in Fig 4D.

Fig 4G illustrates a perspective view of the upper side 41 of the housing 4 of the apparatus 2 illustrated in Fig 4A, when the apparatus 2 is in a second configuration 5 and the second card 40 is inserted. Fig 4H illustrates a cross-sectional view along the cross-sectional plane defined by the section C-C in Fig 4G.

In the example of Figs 4A-4H, the housing 4 of the apparatus 2 defines an aperture 13 that is configured to receive the first card 30 when inserted in a first direction 11 and configured to receive the second card 40 when inserted in the same first direction 11.

In the example of Figs 4A-4H, a first lateral constraint 10 at a first side 43 of the cavity 6 is configured to constrain, at the first side 43, the width of the interior cavity 6 when the apparatus 2 is in the first configuration 3.

In this example, the first lateral constraint 10 is configured to retract depth-wise, into an upper side (roof) 41 of the housing 4 when abutted by the second card 40 on insertion of the second card 40. The first lateral constraint 10 is biased to protrude depth-wise, from the upper side 41 of the housing 4 into the interior cavity 6 at the first side 43 when the second card 40 is removed.

In the example of Figs 4A-4H, a second lateral constraint 10 at a second side 45 of the cavity 6, opposing laterally the first side 43 of the cavity 6, is configured to constrain, at the second side 45, the width of the interior cavity 6 when the apparatus 2 is in the first configuration 3.

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The second lateral constraint 10 is configured to retract depth-wise, into an upper side (roof) 41 of the housing 4 when abutted by the second card 40 on insertion of the second card 40. The second lateral constraint 10 is biased to protrude depth-wise, from the upper side 41 of the housing 4 into the interior cavity 6 at the second side 45 when the second card 40 is removed.

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In the example of Figs 4A-4H, a first longitudinal constraint 20 at the first side 43 of the cavity 6 is configured to constrain, at the first side 43, the length of the interior cavity 6 when the apparatus 2 is in a first configuration 3. The first longitudinal constraint 20 is configured to retract depth-wise, into the upper side (roof) 41 of the housing 4, at the first side 43, in response to the depth-wise retraction of the first lateral constraint 10 when the second card 40 is inserted.

15

The first lateral constraint 10 is configured to abut the first longitudinal constraint 20 and retraction of the first lateral constraint 10 towards the upper side (roof) 41 of the housing 4 forces retraction of the first longitudinal constraint 20. The first longitudinal constraint 20 may be biased to protrude depth-wise, from the upper side 41, into the interior cavity 6, when the second card 40 is removed and the first lateral constraint is no longer retracted and no longer forces the first longitudinal constraint 20 to retract.

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In the example of Figs 4A-4H, a second longitudinal constraint 20 at the second side 45 of the cavity 6 is configured to constrain, at the second side 45, the length of the interior cavity 6 when the apparatus 2 is in a first

30

configuration 3. The second longitudinal constraint 20 is configured to retract depth-wise, into the upper side (roof) 41 of the housing 4, at the second side 45, in response to the depth-wise retraction of the second lateral constraint 10 when the second card 40 is inserted.

5

The second lateral constraint 10 is configured to abut the second longitudinal constraint 20 and retraction of the second lateral constraint 10 towards the upper side (roof) 41 of the housing 4 forces retraction of the second longitudinal constraint 20. The second longitudinal constraint 20 may be

10 biased to protrude depth-wise, from the upper side 41, into the interior cavity 6, when the second card 40 is removed and the second lateral constraint 10 is no longer retracted and no longer forces the second longitudinal constraint 20 to retract.

15 Referring in particular to Fig 4C, the figure illustrates one example implementation of a co-operating pair of constraints including the lateral constraint 10 and the longitudinal constraint 20.

The lateral constraint 10 comprises a lateral member 51 that extends
20 longitudinally in the first direction 11 (the direction of insertion of a card) from a connection point 52 to the housing 4 at one end of the lateral member 51. The lateral member 51 is otherwise free-standing in this example and is otherwise unconnected with the housing 4. The lateral member 51, in its rest state, makes a shallow ($<45^\circ$) acute angle with the upper side 41 of the
25 housing from the connection point 52 and protrudes, at that angle, into the cavity 6 from the upper side 41 of the housing, suspended from the connection point 52. The lateral member 51 thus forms a cantilever. The lateral member 51 is configured to pivot about the connection point 52 when the second card 40 is inserted and retract away from the cavity 6 into an
30 aperture or receptacle 53 in the upper surface (roof) 41 of the housing 4.

As illustrated in Figs 4D and 4E, the inside lateral edge 54 of the lateral member 51 provides a restraining surface that restrains the lateral dimension of the cavity 6 and controls a position of the first card 30 in the cavity 6 when the first card 30 is inserted (first configuration). As illustrated in Figs 4G and 4H, the lateral member 51 is retracted and does not provide a restraining surface that restrains the lateral dimension of the cavity 6 when the second card 40 is inserted (second configuration).

10 In Fig 4C, the longitudinal constraint 20 comprises a longitudinal member 61 that extends longitudinally in a second direction 12 (opposite the first direction 11 and opposite the direction of insertion of a card) from a connection point 62 to the housing 4 at one end of the longitudinal member 61.

15 The longitudinal member 61 is otherwise free-standing in this example and is otherwise unconnected with the housing 4. The longitudinal member 61, in its rest state, makes a shallow ($<45^\circ$) acute angle with the upper side 41 of the housing 4 from the connection point 62 and protrudes, at that angle, into the cavity 6 from the upper side 41 of the housing, suspended from the connection point 62. The longitudinal member 61 thus forms a cantilever. The longitudinal member 61 is configured to pivot about the connection point 62 when the second card 40 is inserted and retract away from the cavity 6 into an aperture or receptacle 63 in the upper surface (roof) 41 of the housing 4.

25 In this example, the longitudinal member 61 is rigid. It comprises a longitudinal part 64 that extends laterally and a lateral part 65 that extends longitudinally. The longitudinal part 64 and the lateral part 65 have a fixed relationship and do not move relative to each other. The lateral part 65 is used as an actuator to move the longitudinal part 64

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The lateral part 65 overlaps and overlies the lateral member 51 of the lateral constraint 10. On insertion of the second card 40, the lateral member 51 of the lateral constraint 10 rotates about the pivot point 52 and retracts towards the upper side 41 of the housing 4 away from the cavity 6. The lateral member 51 of the lateral constraint 10 abuts the overlying and overlapping lateral part 65 of the longitudinal member 61 of the longitudinal constraint 20, and as it retracts from the cavity 6, it forces the longitudinal constraint 20 including the longitudinal part 64 and the lateral part 65 of the longitudinal member 61 to retract away from the cavity 6 into the aperture or receptacle 63 in the upper surface (roof) 41 of the housing 4.

As illustrated in Figs 4D, an inside lateral edge 66 of the lateral part 65 of the longitudinal member 61 may provide a restraining surface that restrains the lateral dimension of the cavity 6 and controls a position of the first card 30 in the cavity 6 when the first card 30 is inserted (first configuration). As illustrated in Figs 4G and 4H, the longitudinal member 61 is retracted and does not provide a restraining surface that restrains the lateral dimension of the cavity 6 when the second card 40 is inserted (second configuration).

As illustrated in Figs 4D and 4F, an inside longitudinal edge 67 of the longitudinal part 64 of the longitudinal member 61 provides a restraining surface that restrains the longitudinal dimension of the cavity 6 and controls a position of the first card 30 in the cavity 6 when the first card 30 is inserted (first configuration). As illustrated in Figs 4G and 4H, the longitudinal member 61 is retracted and does not provide a restraining surface that restrains the longitudinal dimension of the cavity 6 when the second card 40 is inserted (second configuration).

Figs 5A to 5C illustrate a second embodiment of the apparatus 2, as previously described, in which the lateral constraint 10 and the longitudinal

constraint 20 are independent and one does not cause the retraction of the other.

Fig 5A illustrates a plan view of the upper side (roof) 41 of the housing 4 of the apparatus 2. Fig 5B illustrates a perspective view of the upper side 41 of the housing 4 of the apparatus 2 illustrated in Fig 5A, when the apparatus 2 is in a first configuration 3 and the first card 30 is inserted. Fig 5C illustrates a perspective view of the upper side 41 of the housing 4 of the apparatus 2 illustrated in Fig 5A, when the apparatus 2 is in a second configuration 5 and the second card 40 is inserted.

In the example of Figs 5A-5C, the housing 4 of the apparatus 2 defines a first aperture 13 that is configured to receive the first card 30 when inserted in a first direction 11 and comprises a second aperture 15 that is configured to receive the second card 40 when inserted in the second direction 12 that is opposite the first direction. The first aperture 13 and the second aperture 15 oppose each other at opposite longitudinal ends of the housing 4.

The first aperture 13 has a width that is narrower than the second aperture 15. The width of the first aperture is greater than a width of the first card 30 but less than a width of the second card 40.

A portion 7 of the housing 4 adjacent the first aperture 13 defines the width of the first aperture 13 and provides a longitudinal stop for the second card 40 when inserted.

In the example of Figs 5A-5C, a lateral constraint 10 at a first side 43 of the cavity 6 is configured to constrain, at the first side 43, the width of the interior cavity 6 when the apparatus 2 is in the first configuration 3.

In this example, the lateral constraint 10 is configured to retract depth-wise, into an upper side (roof) 41 of the housing 4 when abutted by the second card 40 on insertion of the second card 40 through the second aperture 15. The lateral constraint 10 is biased to protrude depth-wise, from the upper side 41 of the housing 4 into the interior cavity 6 at the first side 43 when the second card 40 is removed.

In this particular example (other examples are possible), the lateral constraint 10 comprises a lateral member 51 that extends longitudinally in the first direction 11 (the direction of insertion of the first card 30) from a connection point 52 to the housing 4 at one end of the lateral member 51.

In an alternative embodiment the lateral member 51 extends longitudinally in the second direction 12 (the direction of insertion of the second card 40). The lateral member 51 is otherwise free-standing in this example and is otherwise unconnected with the housing 4. The lateral member 51, in its rest state, makes a shallow ($<45^\circ$) acute angle with the upper side 41 of the housing from the connection point 52 and protrudes, at that angle, into the cavity 6 from the upper side 41 of the housing, suspended from the connection point 52. The lateral member 51 thus forms a cantilever. The lateral member 51 is configured to pivot about the connection point 52 when the second card 40 is inserted and retract away from the cavity 6 into an aperture or receptacle 53 in the upper surface (roof) 41 of the housing 4.

The inside lateral edge of the lateral member 51 provides a restraining surface that restrains the lateral dimension of the cavity 6 and controls a position of the first card 30 in the cavity 6 when the first card 30 is inserted (first configuration). The lateral member 51, when retracted, does not provide a restraining surface that restrains the lateral dimension of the cavity 6 when the second card 40 is inserted (second configuration).

In the example of Figs 5A-5C, a longitudinal constraint 20 at the second side 45 of the cavity 6 is configured to constrain, at the second side 45, the length of the interior cavity 6 when the apparatus 2 is in a first configuration 3. The longitudinal constraint 20 is configured to retract width-wise, into the sidewall of the housing 4, when abutted by the second card 40 on insertion of the second card 40 through the second aperture 15 in the second direction 12.

The longitudinal constraint 20 may be positioned adjacent the second aperture 15 such that the lateral separation distance between the lateral constraint 10 and the longitudinal constraint 20 is less than a width of the first card 30. This will discourage insertion of the first card 30 into the second aperture 15.

In this particular example (other examples are possible), the longitudinal constraint 20 comprises a longitudinal member 61 that extends longitudinally in a second direction 12 (opposite the first direction 11) from a connection point 62 to the housing 4 at one end of the longitudinal member 61. The longitudinal member 61 is otherwise free-standing in this example and is otherwise unconnected with the housing 4. The longitudinal member 61, in its rest state, makes a shallow ($<45^\circ$) acute angle with the sidewall of the housing 4 from the connection point 62 and protrudes, at that angle, into the cavity 6 from the sidewall of the housing, suspended from the connection point 62. The longitudinal member 61 thus forms a cantilever. The longitudinal member 61 is configured to pivot about the connection point 62 when the second card 40 is inserted and retract away from the cavity 6 towards the sidewall from which it depends.

Although in this embodiment, the longitudinal member 61 depends from a sidewall and retracts laterally towards the sidewall, in other examples, the

longitudinal member 61 may depend from a roof (or floor) of the housing and retract depth-wise.

In the illustrated example, a chamfer 42 of the second card 40 abuts the
5 longitudinal member 61 when the second card 40 is correctly inserted. The longitudinal member 61 is configured so that it is easily retracted by a chamfered corner of the second card 40 inserted in the second direction 12 but less easily retracted by an un-chamfered corner of the second card 40 inserted in the second direction 12. A chamfer or chamfered corner is an
10 oblique surface formed by, for example, cutting-off a corner of a rectangle, perhaps at 45°.

It will be appreciated that the lateral constraint 10 and the longitudinal
constraint 20 are configured to retract when abutted by different parts of a
15 second card 40.

The chamfer 42 of the second card 40, when correctly positioned, results in an area adjacent the first aperture 13 being unoccupied by the second card 40 when it is correctly inserted. This area may be occupied by an additional
20 longitudinal constraint 60, as illustrated in Figs 5C and 6A-6F which discourages incorrect insertion of the second card 40.

As illustrated in plan view in Fig 6A and side view in Fig 6B, when a second card 40 is incorrectly orientated and inserted through the second aperture 15
25 an un-chamfered corner of the second card 40 abuts the additional longitudinal constraint 60 preventing full insertion of the second card 40 into the cavity 6.

As illustrated in plan view in Fig 6C and side view in Fig 6D, when a second
30 card 40 is correctly orientated and inserted through the second aperture 15 a

chamfer 42 62 of the second card 40 abuts or approaches the additional longitudinal constraint 60 enabling full insertion of the second card 40 into the cavity 6.

- 5 As illustrated in plan view in Fig 6E and side view in Fig 6F, when a first card is inserted through the first aperture 13, the first card 30 abuts the additional longitudinal constraint 60 and causes it to retract enabling full insertion of the first card 30 into the cavity 6.
- 10 The additional longitudinal constraint 60 positioned adjacent the first aperture 13 is retractable on insertion of first card 30 but not retractable on insertion of second card 40.

- Figs 7A illustrates the apparatus 2 illustrated in Figs 5A-5C without an inserted card. Figs 7B, 7C, 7D illustrate respectively in closer detail, the lateral
- 15 constraint 10, a sidewall spring member used to grip an inserted card, and the longitudinal constraint 20.

- The apparatus 2 described in the preceding examples may be a card
- 20 reader or a housing for a card reader. A card reader comprises a plurality of electrical contacts that are positioned to match corresponding contacts of a correctly inserted card.

- A common set of electrical contacts may be used to connect with the contacts
- 25 of the correctly inserted first card 30 and the correctly inserted second card 40.

- It should be appreciated that the apparatus 2 may receive, at different times (not simultaneously) the first card 30 or the second card 40 and that the
- 30 smaller first card 30 can be directly inserted into the apparatus 2 without the

need to first insert the first card 30 into an adaptor or cradle. Thus the insertion of a card in the above described examples may comprise direct insertion, that is, insertion of the card directly into the apparatus 2 without any intermediate carrier, adaptor etc

5

The apparatus 2 may be configured to only receive the first card 30 and the second card 40. Alternatively the apparatus 2 may be configured to receive the first card 30 and the second card 40 and one or more additional cards.

10 The first electronic card 30 may be an electronic device shaped as a card or carried on a card shaped substrate. A card is substantially planar. The first card 30 may perform one or more functions. For example, the first card 30 may be a memory card that comprises a memory, it may be a smart card that comprises processing circuitry, it may be a telecommunications card that
15 enables telecommunications, it may be a security card that enables authentication, it may be a security card that enables encryption, it may be a security card that enables financial transactions, it may comprise a secure memory and a secure processor.

20 The second card 40 may be an electronic device shaped as a card or carried on a card shaped substrate. A card is substantially planar. The second card 40 may perform one or more functions. For example, the second card 40 may be a memory card that comprises a memory, it may be a smart card that comprises processing circuitry, it may be a telecommunications card that
25 enables telecommunications, it may be a security card that enables authentication, it may be a security card that enables encryption, it may be a security card that enables financial transactions, it may comprise a secure memory and a secure processor.

30 The second card 40 may be wider and longer than the first card 30.

The second card 40 and the first card 30 may, for example, be cards such as, for example,

5 an ISO 7816 card such as:

ID-1 having dimensions 54mm x 85.6mm

Visa Mini having dimensions 40mm x 66mm

ID-00 having dimensions 33mmx66mm

ID-000 [Subscriber Identity Module (SIM)] having dimension 15mm x 25mm x

10 0.76mm

Mini-UICC [Micro SIM] having dimensions 12mmx15mmx0.76mm

ETSI TS 102 221 [Nano-SIM] having dimensions 8.8mm x 12.3mm x 0.67mm.

It is expected that the apparatus 2 may be configured for use with any two or
15 more of the second form factor (2FF) SIM (15mm x25mm); the 3FF SIM
(12mm x15mm); the 4FF SIM (8.8mm x 12.3mm x0.67mm) or a later
generation SIM.

Fig 8 illustrates an electronic device 100 comprising a controller 102 which is
20 operatively coupled to a card reader apparatus 2 as described in one of the
preceding examples. The controller 102 is configured to use functionality
provided by a card inserted in the card reader 2.

The controller 102 may comprise a processor 106 and a memory 104. The
25 processor 106 may be configured to read from and write to the memory 104.

The controller 102 is also configured to receive input commands from the user
input 108, provide output to the user output 110.

Optionally, the electronic device may comprise a radio transmitter and/or receiver 112. This may, in some but not necessarily all embodiments, be a cellular radio telephone transceiver.

- 5 In some embodiments, but not necessarily all embodiments, the electronic device 100 may be a hand-portable electronic device which is sized to be carried in the palm of the hand or an inside jacket pocket.

- 10 In some embodiments, but not necessarily all embodiments, the electronic device 100 may be a terminal device in a cellular radio telephone network. A card inserted in the card reader apparatus 2 may be used, for example, to authenticate a user in the network and/or create an encryption key for encryption and/or decrypting data communicated in the network.

- 15 Some embodiments of the invention provide a mechanically simple, low volume and reduced size multi-card reader.

- As used here 'module' refers to a unit or apparatus that excludes certain parts/components that would be added by an end manufacturer or a user. The
20 apparatus 2 may, in some examples, be a module.

- Although embodiments of the present invention have been described in the preceding paragraphs with reference to various examples, it should be appreciated that modifications to the examples given can be made without
25 departing from the scope of the invention as claimed.

Features described in the preceding description may be used in combinations other than the combinations explicitly described.

Although functions have been described with reference to certain features, those functions may be performable by other features whether described or not.

- 5 Although features have been described with reference to certain embodiments, those features may also be present in other embodiments whether described or not.

- 10 Whilst endeavoring in the foregoing specification to draw attention to those features of the invention believed to be of particular importance it should be understood that the Applicant claims protection in respect of any patentable feature or combination of features hereinbefore referred to and/or shown in the drawings whether or not particular emphasis has been placed thereon.

WHAT IS CLAIMED IS:

1. An apparatus comprising:
 - 5 a housing defining an interior cavity having a length, a width and a depth;
at least one lateral constraint configured to constrain the width of the interior
cavity when the apparatus is in a first configuration; and
at least one longitudinal constraint configured to constrain the length of the
interior cavity when the apparatus is in the first configuration;
 - 10 wherein, when the apparatus is in the first configuration, the cavity is
configured for a first card,
wherein, when the apparatus is in a second configuration, the interior cavity is
configured for a second card, larger than the first card, and
wherein insertion of the second card into the interior cavity causes switching
 - 15 of the apparatus from the first configuration to the second configuration
comprising depth-wise retraction of at least one of the at least one lateral
constraint and the at least one longitudinal constraint.
2. An apparatus as claimed in claim 1, wherein the at least one lateral
20 constraint is configured to retract depth-wise from the interior cavity defined
by the housing when the second card is inserted into the interior cavity.
3. An apparatus as claimed in any preceding claim, wherein the at least one
lateral constraint is resiliently biased to protrude into the interior cavity.
- 25 4. An apparatus as claimed in any preceding claim, wherein the at least one
lateral constraint is a cantilevered spring.
5. An apparatus as claimed in any preceding claim, wherein the at least one
30 lateral constraint is an integral part of the housing.

6. An apparatus as claimed in any preceding claim, wherein the at least one longitudinal constraint is configured to retract depth-wise from the interior cavity defined by the housing when the second card is inserted into the interior cavity.

5

7. An apparatus as claimed in any preceding claim, wherein the at least one longitudinal constraint is resiliently biased to protrude into the interior cavity.

8. An apparatus as claimed in any preceding claim, wherein the at least one
10 longitudinal constraint is a cantilevered spring.

9. An apparatus as claimed in any preceding claim, wherein the at least one longitudinal constraint is an integral part of the housing.

15 10. An apparatus as claimed in any preceding claim, wherein the housing defines an aperture configured to receive at a first time the first card when inserted in a first direction and configured to receive at a second time, different to the first time, the second card when inserted in the first direction.

20 11. An apparatus as claimed in any preceding claim, comprising: a first lateral constraint at a first side of the interior cavity configured to constrain at the first side the width of the interior cavity when the apparatus is in a first configuration and a second lateral constraint at a second side of the interior cavity, opposing the first side of the interior cavity, configured to constrain at
25 the second side the width of the interior cavity when the apparatus is in a first configuration.

12. An apparatus as claimed in claim 11, wherein the first lateral constraint is configured to retract depth-wise when abutted by a second card on insertion
30 of the second card.

13. An apparatus as claimed in claim 11 or 12, wherein the second lateral constraint is configured to retract depth-wise when abutted by the second card on insertion of the second card.

5

14. An apparatus as claimed in any preceding claim, comprising a first longitudinal constraint at a first side of the interior cavity configured to constrain at the first side the length of the interior cavity when the apparatus is in a first configuration and a second longitudinal constraint at a second side of
10 the interior cavity, opposing the first side of the interior cavity, configured to constrain at the second side the length of the interior cavity when the apparatus is in a first configuration.

15. An apparatus as claimed in claim 14, wherein the first longitudinal
15 constraint is configured to retract depth-wise in response to depth-wise retraction of the first lateral constraint.

16. An apparatus as claimed in claim 14 or 15, wherein the first lateral constraint is configured to abut the first longitudinal constraint.

20

17. An apparatus as claimed in any of claims 14 to 16, wherein the second longitudinal constraint is configured to retract depth-wise in response to depth-wise retraction of the second lateral constraint.

25 18. An apparatus as claimed in any of claims 14 to 17, wherein the second lateral constraint is configured to abut the second longitudinal constraint.

19. An apparatus as claimed in any of claims 1 to 9, wherein the housing defines a first aperture configured to receive the first card when inserted in a

first direction and a second aperture configured to receive the second card inserted in a second direction opposite to the first direction.

20. An apparatus as claimed in claim 19, wherein the first aperture has a
5 width that is narrower than the second aperture.

21. An apparatus as claimed in claim 19 or 20, wherein the at least one lateral
constraint is configured to retract depth-wise when abutted by a second card
on insertion of the second card.

10

22. An apparatus as claimed in any of claims 19 to 21, wherein the at least
one longitudinal constraint is configured to retract when abutted by a second
card.

15 23. An apparatus as claimed in claim 22, wherein the at least one longitudinal
constraint is configured to retract when abutted by a chamfer at a leading
corner of the second card on insertion of the second card.

24. An apparatus as claimed in any of claims 19 to 23, wherein the at least
20 one lateral constraint and the at least one longitudinal constraint are
configured to retract independently when abutted by different parts of a
second card.

25. An apparatus as claimed in any of claims 19 to 24, wherein the at least
25 one lateral constraint and the at least one longitudinal constraint are
positioned adjacent the second aperture and wherein the lateral distance
between them is less than a width of the first card.

26. An apparatus as claimed in any of claims 19 to 25, wherein the portion of the housing adjacent the first aperture defines a fixed longitudinal stop for the second card when inserted.

5 27. An apparatus as claimed in any preceding claim, further comprising an additional longitudinal constraint configured to retract on insertion of the first card but not retract on insertion of the second card and positioned at a position corresponding to a chamfer of the second card when the second card is correctly inserted.

10

28. An apparatus as claimed in any preceding claim, further comprising a common set of electrical contacts configured for contact with respective contacts of the first card and the second card.

15

29. An apparatus comprising:
a housing defining an interior cavity having a length, a width and a depth;
at least one lateral constraint and at least one longitudinal constraint
wherein the at least one lateral constraint and at least one longitudinal
constraint are configured to position a first card when the first card is inserted
20 in the interior cavity and configured to retract depth-wise when a second card,
larger than the first card, is inserted in the interior cavity.

20

30. An apparatus comprising:
a housing defining an interior cavity having a length, a width and a depth;
25 at least one lateral constraint configured to constrain the width of the interior
cavity when the apparatus is in a first configuration; and
at least one longitudinal constraint configured to constrain the length of the
interior cavity when the apparatus is in the first configuration;
wherein, when the apparatus is in the first configuration, the cavity is
30 configured for a first card,

30

wherein, when the apparatus is in a second configuration, the interior cavity is configured for a second card, larger than the first card and

wherein insertion of the second card into the interior cavity causes switching of the apparatus from the first configuration to the second configuration

- 5 comprising retraction of the at least one lateral constraint and the at least one longitudinal constraint, wherein the first longitudinal constraint is configured to retract in response to retraction of the first lateral constraint.

31. An apparatus comprising:

- 10 a housing defining an interior cavity having a length, a width and a depth;
at least one lateral constraint configured to constrain the width of the interior cavity when the apparatus is in a first configuration; and
at least one longitudinal constraint configured to constrain the length of the interior cavity when the apparatus is in the first configuration;
- 15 wherein, when the apparatus is in the first configuration, the cavity is configured for a first card,
wherein, when the apparatus is in a second configuration, the interior cavity is configured for a second card, larger than the first card and
wherein insertion of the second card into the interior cavity causes switching
- 20 of the apparatus from the first configuration to the second configuration
comprising retraction of the at least one lateral constraint and the at least one longitudinal constraint, wherein the housing defines a first aperture configured to receive the first card when inserted in a first direction and a second aperture configured to receive the second card inserted in a second direction
- 25 opposite to the first direction.

32. An apparatus as claimed in claim 31, wherein the at least one lateral constraint and the at least one longitudinal constraint are positioned adjacent the second aperture and wherein the lateral distance between them is less
- 30 than a width of the first card.

33. An apparatus as claimed in claim 31 or 32, wherein the portion of the housing adjacent the first aperture defines a fixed longitudinal stop for the second card when inserted.

5

34. An apparatus as claimed in claim 31, 32 or 33, further comprising an additional longitudinal constraint configured to retract on insertion of the first card but not retract on insertion of the second card and positioned at a position corresponding to a chamfer of the second card when the second card
10 is correctly inserted.

35. A hand-portable electronic device comprising the apparatus as claimed in any preceding claim as a receptacle for a card used to augment the functionality of the hand-portable electronic device.

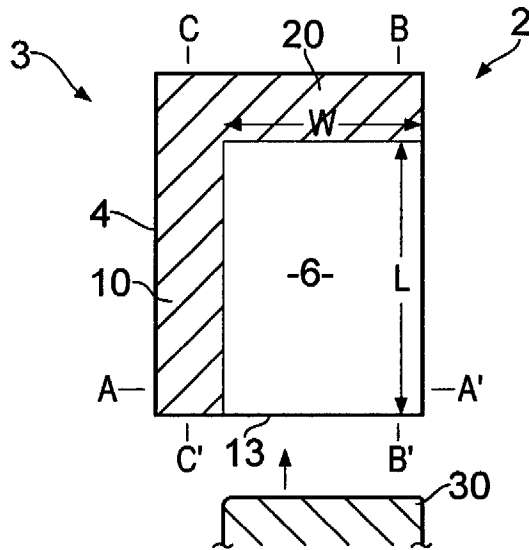


FIG. 1A

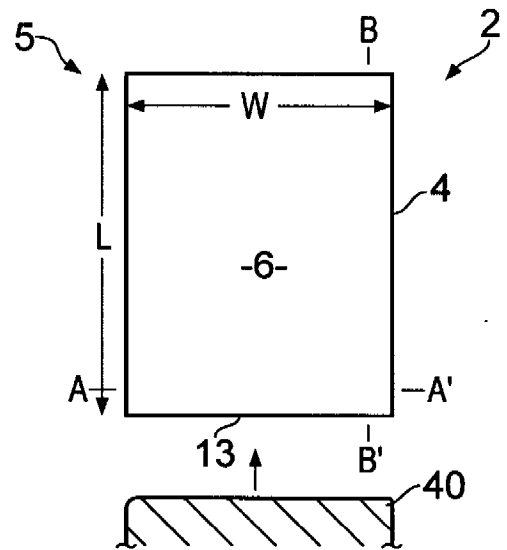


FIG. 2A

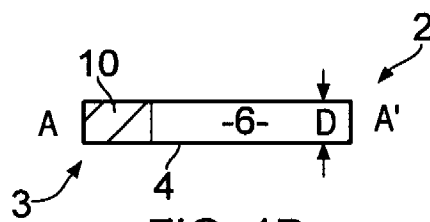


FIG. 1B

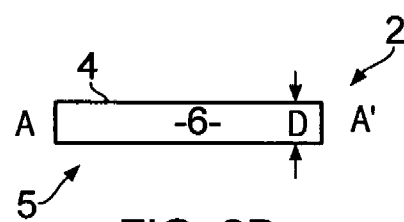


FIG. 2B

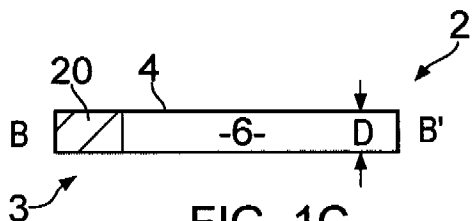


FIG. 1C

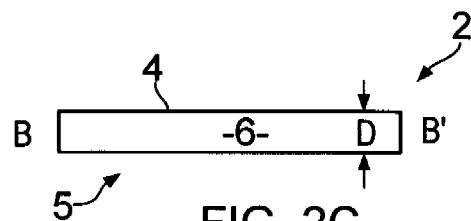


FIG. 2C

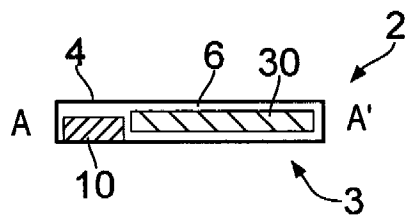


FIG. 3A

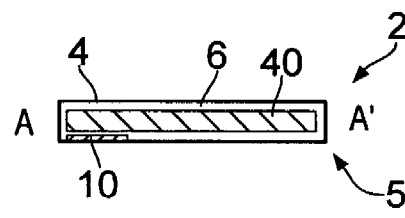


FIG. 3B

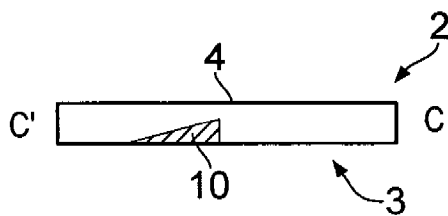


FIG. 3C

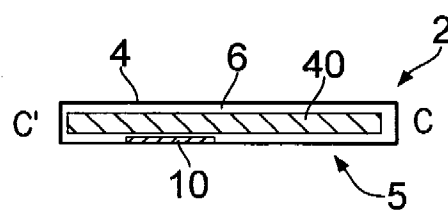
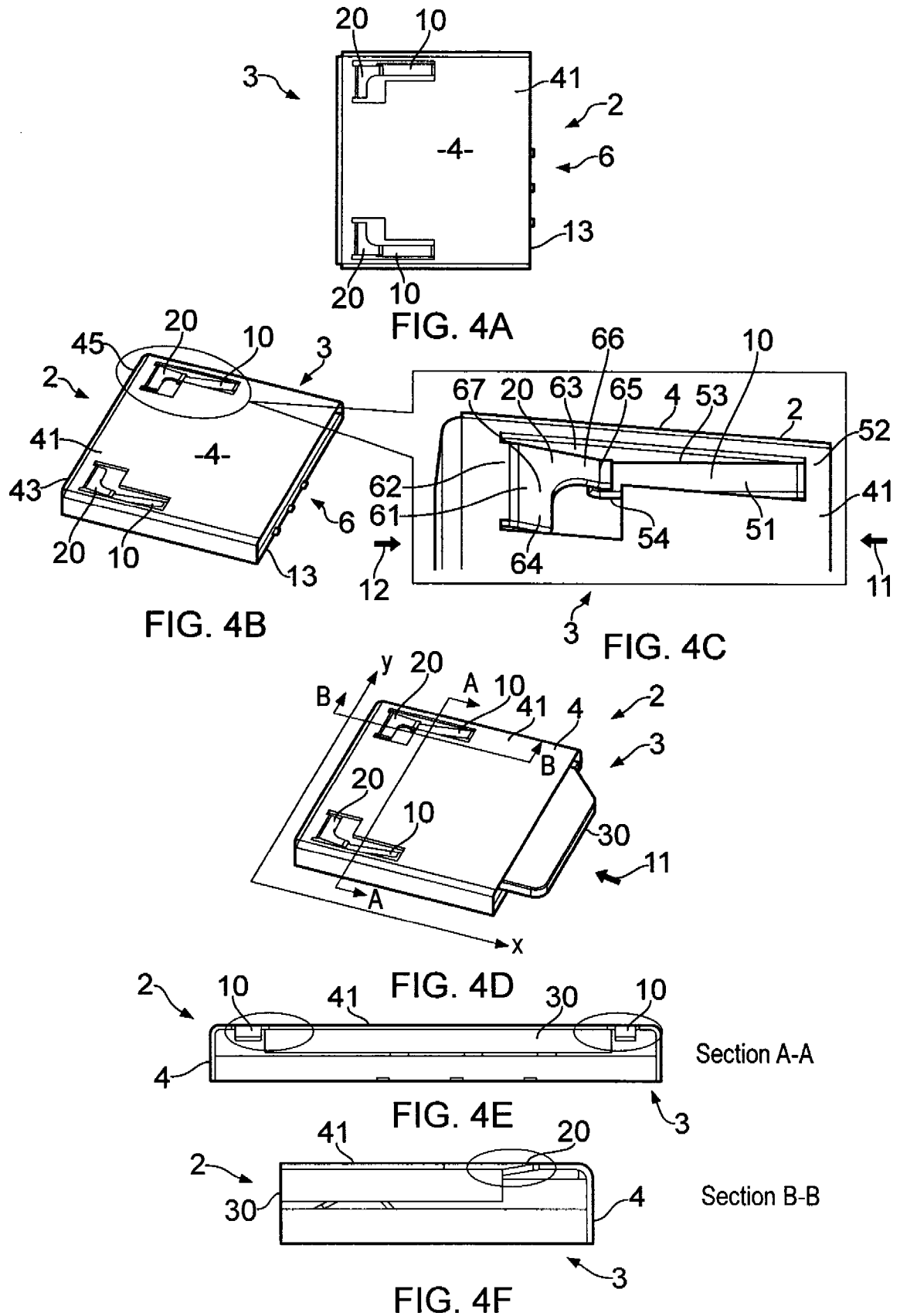


FIG. 3D



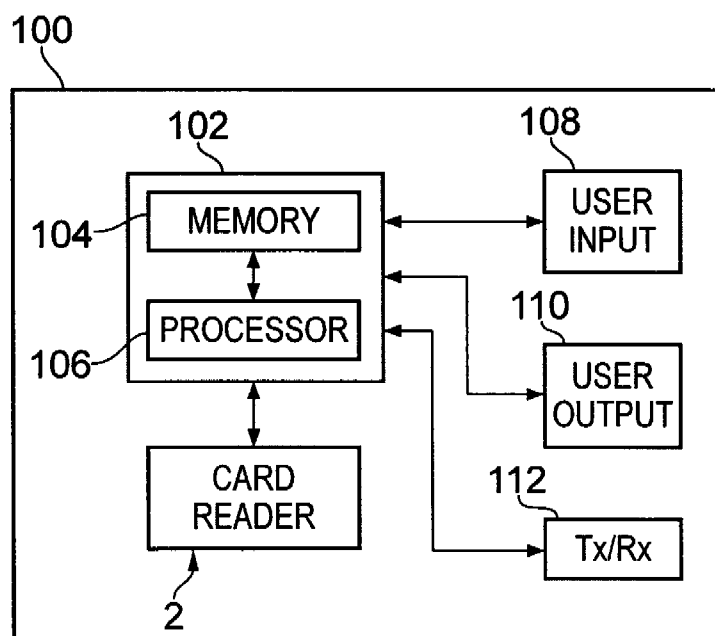
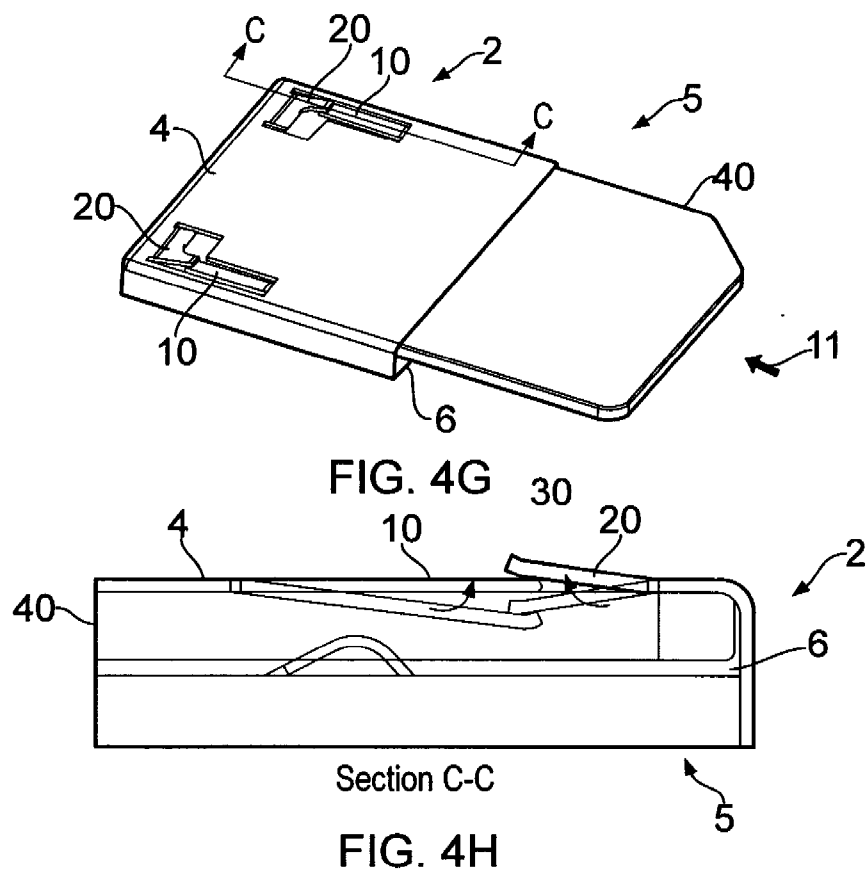


FIG. 8

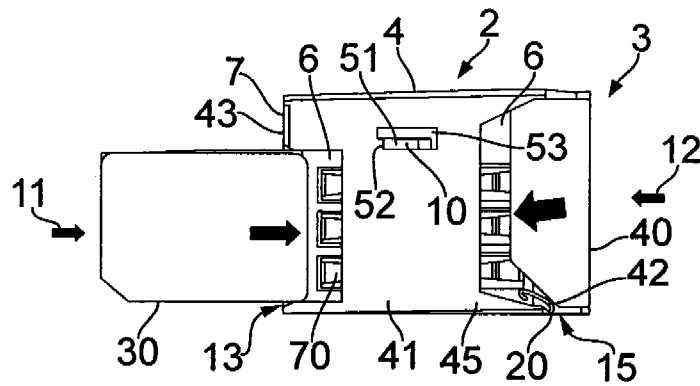


FIG. 5A

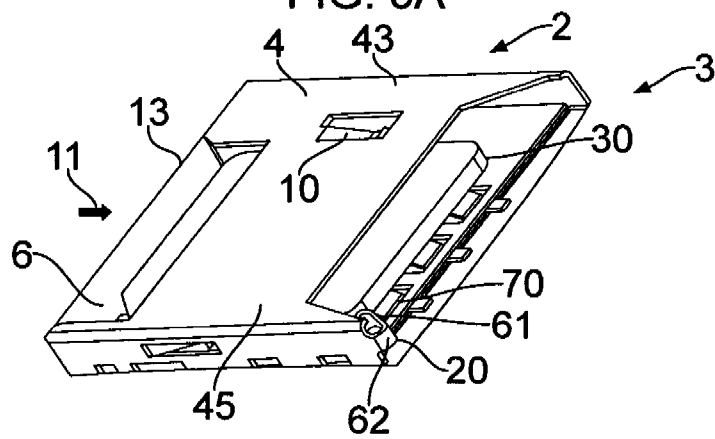


FIG. 5B

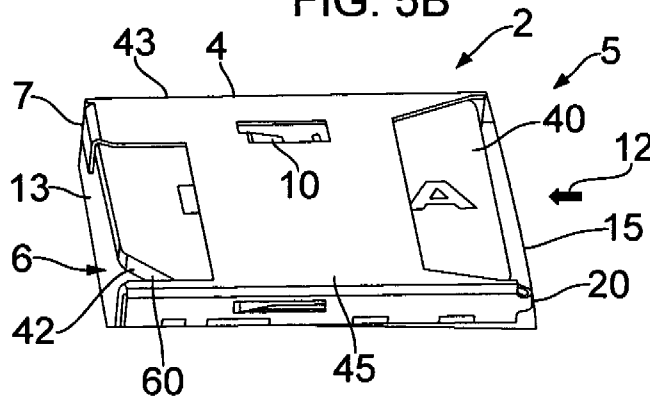


FIG. 5C

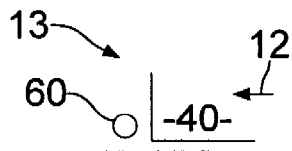


FIG. 6A

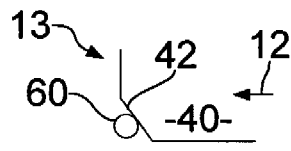


FIG. 6C

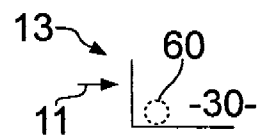


FIG. 6E

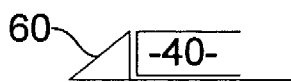


FIG. 6B

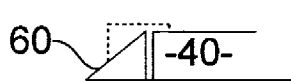


FIG. 6D

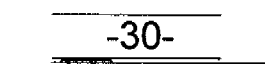
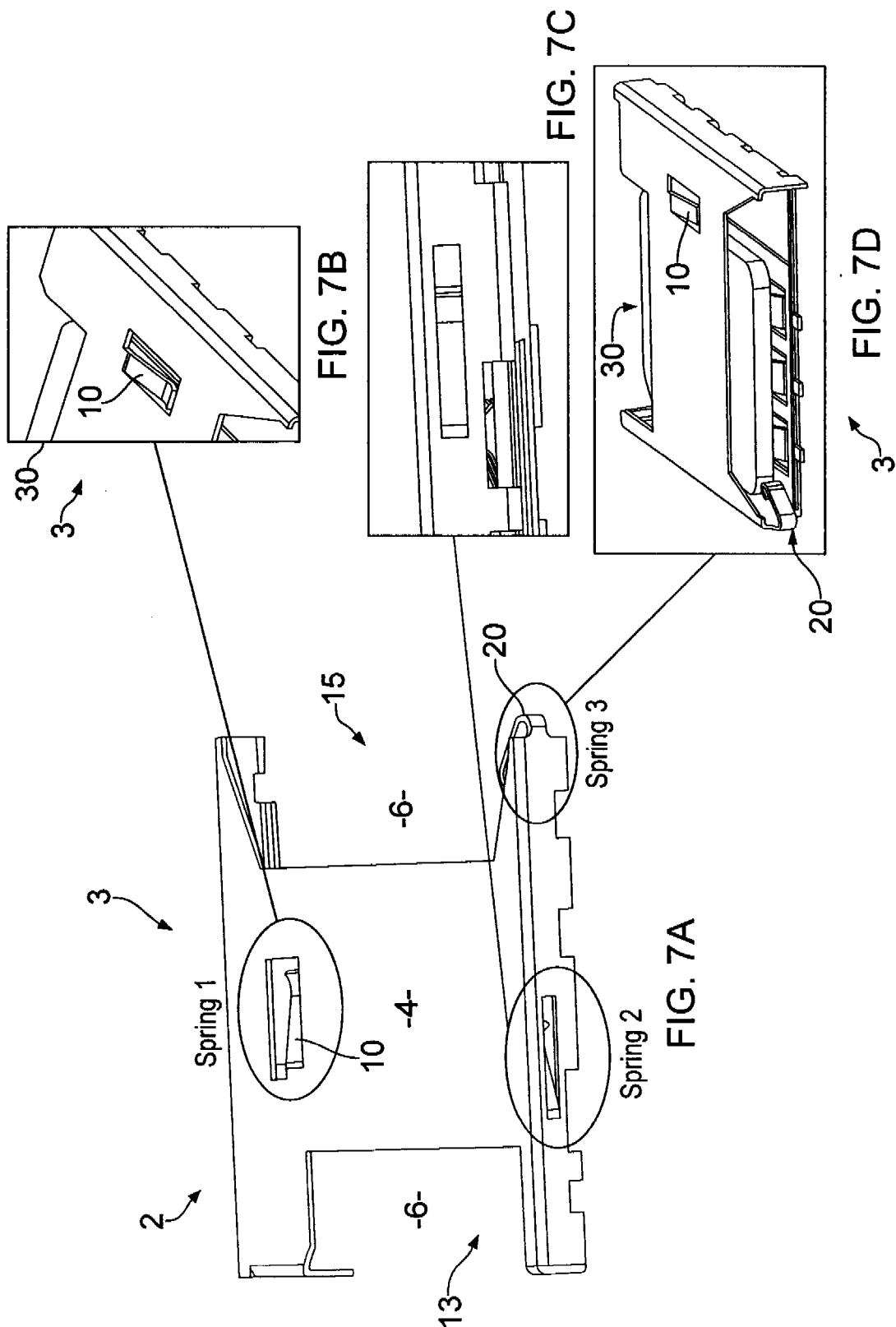


FIG. 6F



INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2012/083301

A. CLASSIFICATION OF SUBJECT MATTER

see extra sheet

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC:H01R13/46, H01R13/00,H01R12/72, H01R12/71, H01R12/70, H01R12/00,H04M1/02,H04M1/725,H04M1/00
FT:5B058/CA04,5E023/AA21

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

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

WPI, EPODOC, CNKI, CNPAT:SIM,card,slot,two,large,small,size,dimension,adapt,insert,house,converse,switch,spring

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US2001/0036770A1(SAITO Masaaki et al.) 01 Nov. 2001 (01.11.2001) description, paragraphs [41]-[75], figures 10-12	1-35
A	US5336877A(AMPHENOL-TUCHEL ELECTRONICS GMBH) 09 Aug. 1994 (09.08.1994) the whole document	1-35
A	JP2004-206963A(YAMAICHI DENKI K.K.) 22 July 2004 (22.07.2004) the whole document	1-35
A	JP2007-12348A(NIPPON ATSUCHIYAKU TANSI SEIZO K.K.) 18 Jan. 2007 (18.01.2007) the whole document	1-35
A	CN202308536U(ZHANG Yusong) 04 July 2012 (04.07.2012) the whole document	1-35
A	KR10-0717740B1(MOLEX KOREA CO., LTD.) 18 May 2007 (18.05.2007) the whole document	1-35

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:	“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
“A” document defining the general state of the art which is not considered to be of particular relevance	“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
“E” earlier application or patent but published on or after the international filing date	“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
“L” document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified)	“&”document member of the same patent family
“O” document referring to an oral disclosure, use, exhibition or other means	
“P” document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
27 June 2013 (27.06.2013)Date of mailing of the international search report
15 Aug. 2013 (15.08.2013)Name and mailing address of the ISA/CN
The State Intellectual Property Office, the P.R.China
6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China
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Facsimile No. 86-10-62019451Authorized officer
LIU, Yanwei
Telephone No. (86-10)62413192

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2012/083301

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
US2001/0036770A1	01.11.2001	JP3396457B2	14.04.2003
US5336877A	09.08.1994	JP06500874 T	27.01.1994
		DE4029576 C2	01.12.1994
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JP2004-206963A	22.07.2004	None	
JP2007-12348A	18.01.2007	None	
CN202308536U	04.07.2012	None	
KR10-0717740B1	18.05.2007	None	

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2012/083301

Continuation of : CLASSIFICATION OF SUBJECT MATTER

H01R13/46 (2006.01) i

H01R12/72 (2006.01) i

H04M1/725 (2006.01) i

H04M1/72 (2006.01) i