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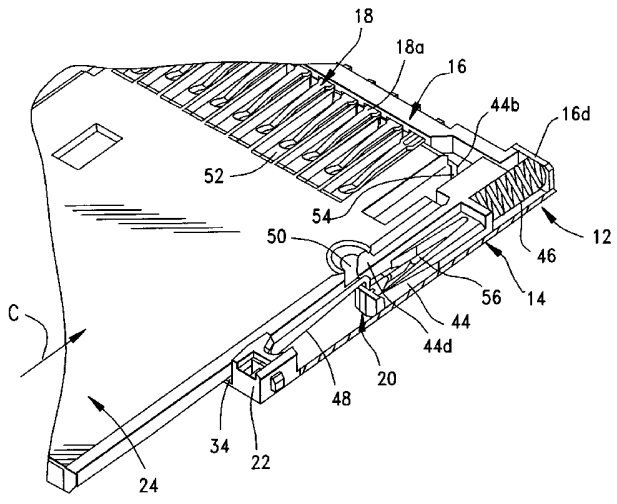
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(54) Title: MEMORY CARD CONNECTOR



(57) Abstract: A memory card connector (12) includes an insulative housing (16) having a terminal-mounting section which mounts a plurality of conductive terminals (18) having contact portions for engaging appropriate contacts on a memory card (24). The housing at least in part defines a card-receiving cavity (26) for receiving the memory card. A card eject mechanism (20) includes a slider (44) movably mounted on the housing. The slider has a hook (44d) releasably engaged in a recess (50) in the memory card for conjoint movement of the slider and memory card into and out of the cavity between an outer initial position and an inner connection position. An ejection spring (46) biases the slider and memory card in an ejection direction (E) toward the initial position. A metal shell (14) is mounted on the housing and combines therewith in defining the cardreceiving cavity. The metal shell includes a leaf spring (60,60A) having a projection (62) engageable with the slider to forcibly retain the hook on the slider in the recess in the memory card.

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MEMORY CARD CONNECTOR

FIELD OF THE INVENTION

This invention generally relates to the art of electrical connectors and, particularly, to a memory card connector.

BACKGROUND OF THE INVENTION

Memory cards are known in the art and contain intelligence in the form of a memory circuit or other electronic program. Some form of card reader reads the information or memory stored on the card. Such cards are used in many applications in today's electronic society, including video cameras, digital still cameras, smartphones, PDA's, music players, ATMs, cable television decoders, toys, games, PC adapters, multi-media cards and other electronic applications. Typically, a memory card includes a contact or terminal array for connection through a card connector to a card reader system and then to external equipment. The connector readily accommodates insertion and removal of the card to provide quick access to the information and program on the card. The card connector includes terminals for yieldingly engaging the contact array of the memory card.

The memory card, itself, writes or reads via the connector and can transmit between electrical appliances, such as a word processor, personal computer, personal data assistant or the like. The card may be used in applications such as mobile or cellular telephones which are actuated and permit data access after identifying an identification code stored on a SIM (subscriber identification module) card. The SIM card has a conductive face with an array of contacts, and the mobile phone has a SIM card connector with terminals for electrical connection with the contacts of the SIM card to ensure the subscriber identification confirmation.

A typical memory card connector includes some form of dielectric housing, which is covered by a metal shell. The metal shell may be stamped and formed of sheet metal material and formed substantially into a box-shape. The metal shell and the housing combine to define a card-receiving cavity. One end of the cavity is open to form a card-insertion opening. The dielectric housing may be generally L-shaped or U-shaped and includes a rear terminal-mounting section at the rear of the cavity, and at least one longitudinal side wall section extends forwardly from one or both ends of the rear section

at one or both sides of the cavity. The metal shell has a top plate substantially covering the dielectric housing, with side plates extending downwardly over the side wall sections of the housing. One or both of the side wall sections of the housing define the sides of the card-receiving cavity. Examples of such connectors can be seen in Japanese Patent Laid-Open Nos. 2002-329553 and 2002-343468.

Some card connectors include a card eject mechanism whereby the memory card is simply inserted into the connector, and the eject mechanism is used to facilitate removal of the card from the connector. Some eject mechanisms include slider members which engage the memory card for movement therewith into and out of the connector. Latches, cams, eject devices and other operative components then are operatively associated with the slider rather than the memory card itself. One type of card eject mechanism includes a heart-shaped cam slot in the slider, with a pin member operatively biased into the heart-shaped cam slot, and with a spring member to normally bias the slider in a direction of withdrawal of the memory card. This type of card eject mechanism is called a "push/push type" ejector in that the memory card first is pushed into the cavity of the connector to a latched operative position, and a second push on the card is effective to release the card and allow the spring to eject the card from its latched position.

FIGS. 18 and 19 show a push/push type memory card connector 70 of the prior art. The connector includes an insulative housing, generally designated 72, which is substantially covered by a metal shell, generally designated 74, which combines with the housing to define a card-receiving cavity for receiving a memory card 76. A card eject mechanism, generally designated 78, is mounted on the housing and is of the push/push type in that the mechanism includes a cam slider 80, a cam pin 82 and a coiled ejection spring 84. The slider moves along a longitudinal side wall 72a of the housing between an outer initial position (FIG. 18) for accepting memory card 72 and an inner connection position at which a plurality of contact pads 76a on the memory card engage a plurality of terminals, generally designated 86, mounted in a rear terminal-mounting section 72b of the housing. Cam slider 80 has a hook 88, which is detachably caught in a recess 76b in memory card 76 so that the memory card moves conjointly with the slider between the outer initial position and the inner connection position.

Metal shell 74 includes a top wall 74a and a side wall 74b. As seen in FIG. 19, hook 88 is arranged with its rear side 90 facing the longitudinal side wall 74a of metal

shell 74. The metal shell has a bridge-like resilient strip 92 formed from side wall 74b. The resilient strip has its opposite ends uncut or continuous with the side wall, and resilient strip 92 is located so that it may push on cam slider 80 on the rear side 90 of hook 88 when the slider is in its outer initial position. When memory card 76 is inserted into the card-receiving cavity, hook 88 first is pushed outwardly, against resilient strip 92, whereafter the hook "snaps" into recess 76b of the memory card, leaving a gap 94 between the rear side 90 of the hook and resilient strip 92.

Such push/push type and other types of eject mechanisms which use spring members to eject the card from its latched position cause various problems. For instance, it is quite difficult to maintain a proper spring constant in the spring member. If the ejection spring is relatively weak, the ejection and removal of the memory card is difficult and unsatisfactory. On the contrary, if the ejection spring is too strong, the card and slide member are driven quickly in the ejection direction, and the memory card actually can jump out of the card connector and fall to the floor. The bridge-like resilient strip 92 of the prior art connector 70 shown in FIGS. 18 and 19 is insufficient to prevent hook 88 from pulling out of recess 76b in the memory card under the ejection force of a strong ejection spring. The present invention is directed to solving these problems by preventing the memory card from coming out of the connector even when using an ejection spring which is strong enough to eject the card with a short, sharp movement.

SUMMARY OF THE INVENTION

An object, therefore, of the invention is to provide a new and improved memory card connector of the character described.

In the exemplary embodiment of the invention, the memory card connector includes an insulative housing having a terminal-mounting section, which mounts a plurality of conductive terminals having contact portions for engaging appropriate contacts on a memory card. The housing at least in part defines a card-receiving cavity for receiving the memory card. A card eject mechanism includes a slider movably mounted on the housing. The slider has a hook releasably engaged in a recess in the memory card for conjoint movement of the slider and memory card into and out of the cavity between an outer initial position and an inner connection position. An ejection spring biases the slider and memory card in an ejection direction toward the initial position. A metal shell is mounted on the housing and combines therewith in defining

the card-receiving cavity. The metal shell includes a leaf spring engageable with the slider to forcibly retain the hook on the slider in the recess in the memory card.

Generally, the leaf spring of the metal shell is configured for engagement with the slider of the eject mechanism and provide a relatively strong resistance against the hook on the slider coming out of the recess in the memory card when the slider is in the outer initial position, and a relatively weak resistance when the slider is in the inner connection position. Specifically, the leaf spring has a projection directed toward and into engagement with the slider to forcibly retain the hook on the slider in the recess in the memory card when in the initial position thereof.

In one embodiment of the invention, the leaf spring is formed by a cantilevered spring arm having one end integral with the metal shell. The projection is located near a distal end of the cantilevered spring arm.

In another embodiment of the invention, the leaf spring is formed by a bridge spring arm having opposite ends integral with the metal shell. The projection is located between the opposite ends of the spring arm.

As disclosed herein, the metal shell is stamped and formed of sheet metal material and includes a top wall and at least one side wall depending along a side edge of the top wall. The leaf spring is stamped and formed from the side wall. In the preferred embodiment, the side wall of the metal shell is generally L-shaped and defines an inner space in which the card eject mechanism is mounted.

Other objects, features and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The features of this invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with its objects and the advantages thereof, may be best understood by reference to the following description taken in conjunction with the accompanying drawings, in which like reference numerals identify like elements in the FIGS. and in which:

FIG. 1A is a top perspective view of a memory card connector embodying the concepts of the invention, with a memory card shown inserted into the connector;

FIG. 1B is a perspective view looking at the bottom of FIG. 1;

FIG. 2 is a bottom perspective view of the connector, with the memory card

removed;

FIG. 3 is a top perspective view of the metal shell of the connector;

FIG. 4 is a perspective view of the card-insertion guide piece;

FIG. 5 is a perspective view of the elongated terminal block;

FIG. 6 is an enlarged, fragmented perspective view of one side of the connector, with the metal shell removed to show the card eject mechanism;

FIG. 7 is a fragmented, top perspective view of a portion of the connector showing the card eject mechanism and a memory card in an initial position of insertion;

FIG. 8 is a view similar to that of FIG. 7, with the memory card in its extreme inserted position;

FIG. 9 is a view similar to that of FIGS. 7 and 8, with the memory card in its locked/connected position;

FIG. 10 is a view similar to that of FIGS. 7-9, with the memory card being pushed back to its extreme inserted position and the card eject mechanism about to be released to eject the card;

FIG. 11 is an enlarged, fragmented perspective view of the area of the connector where the leaf spring of the metal shell engages the slider, showing a first embodiment of the leaf spring;

FIG. 12 is a fragmented, somewhat schematic top plan view of the leaf spring engaging the slider in the outer initial position of the slider;

FIG. 13 is a view similar to that of FIG. 12, with the slider in its inner connection position;

FIG. 14 is a view similar to that of FIG. 12, but with the projection on the leaf spring having an alternative configuration;

FIG. 15 is a view similar to that of FIGS. 12 and 14, but with the projection on the leaf spring having another alternative configuration;

FIG. 16 is a view similar to that of FIG. 11, but of a second embodiment of the leaf spring;

FIG. 17 is a perspective view of the connector having the leaf spring configuration of FIG. 11; and

FIGS. 18 and 19 are views of the prior art connector described in the Background, above.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings in greater detail, and first to FIGS. 1A-2, the invention is embodied in a memory card connector, generally designated 12, which includes a metal shell, generally designated 14, and an insulative housing, generally designated 16, which mounts a plurality of terminals, generally designated 18. A card eject mechanism, generally designated 20, is mounted within one side of the metal shell, and a card-insertion guide piece, generally designated 22, is mounted within one front corner of the metal shell. A memory card, generally designated 24, is insertable into the connector in the direction of arrow "C" (FIG. 1A).

More particularly, referring to FIG. 3 in conjunction with FIGS. 1A-2, metal shell 14 is stamped and formed of thin sheet metal material. The metal shell defines a card-receiving cavity, generally designated 26 (FIG. 2), for receiving memory card 24. The metal shell includes a top plate or wall 28 and a pair of generally L-shaped side walls 30 and 32 depending along opposite side edges of the top wall and combining therewith to define the top and sides of cavity 26. The cavity has a front insertion opening 34.

As best seen in FIGS. 1B and 2, the L-shaped side wall 30 has a vertical section 30a bent at a right-angle to top wall 28, and a horizontal bottom section 30b bent at a right angle to the vertical section and extending inwardly therefrom. A bottom-section guide piece 30c is formed at a front end of side wall 30 to guide memory card 24 into cavity 26. Side wall 30 has a stamped and formed mounting flange 30d which projects outwardly for securing the metal shell to a mounting pad on a printed circuit board, as by soldering. Finally, a window 30e is formed in side wall 30 at a rear end thereof.

Similarly, the L-shaped side wall 32 includes a vertical wall section 32a bent at a right angle along an edge of top wall 28 of the metal shell. A horizontal bottom section 32b is bent at a right angle to the vertical section and extends inwardly therefrom. A mounting flange 32c is stamped and formed out of the side wall for mounting to the printed circuit board. An elongated guide rail 32d is stamped and formed out of horizontal section 32b of the L-shaped side wall 32. The guide rail projects upwardly from the horizontal section for guiding a slide member of eject mechanism 20 as will be described hereinafter. As best seen in FIG. 2, an engagement flange 36 is bent downwardly at the rear of the metal shell. The engagement flange has an engagement opening 36a, along with a mounting flange 36b for mounting to the printed circuit board. As best seen in FIG. 3, an engagement flange 38 is bent downwardly at the front of the

metal shell inside side wall 32. Finally, a resilient leaf spring 40 is stamped and formed out of top wall 28 of the metal shell, immediately inside side wall 32.

Referring to FIG. 4 in conjunction with FIGS. 1A-3, guide insertion piece 22 is mounted inside the front end of the L-shaped side wall 32 of metal shell 14 at one side of front insertion opening 34. Engagement flange 38 (FIG. 3) which depends from top wall 28 of the metal shell, is press-fit into a catch hole 22a (FIG. 4) in the top of the guide piece which may molded of plastic material. A cam pin engagement hole 22b also is formed in the top of the guide piece, for purposes described hereinafter. Finally, the guide piece has an inwardly directed guide plate 22c which is contiguous with bottom wall 32b of side wall 32, whereby memory card 24 is guided into cavity 26 by guide plate 22c and a chamfered inside surface 22d of the card-insertion guide plate 22.

Referring to FIG. 5 in conjunction with FIGS. 1A-2, dielectric housing 16 is a one-piece structure molded of plastic material or the like in the form of an elongated terminal block which mounts terminals 18. The terminals are mounted within a plurality of through holes 16a in the terminal block. The terminals have contact portions 18a, which are cantilevered forwardly into cavity 26 for engaging appropriate contacts on memory card 24. The terminals have tail portions 18b (FIGS. 1B and 2) for connection, as by soldering, to appropriate circuit traces on the printed circuit board. Tail portions 18b of the terminals are coplanar with mounting flanges 30d, 32c and 36b of the metal shell for simultaneous soldering to the circuit board. The terminal block has an engagement boss 16b at one end thereof for engagement within window 30e of side wall 30 of the metal shell, as seen in FIG. 2. The terminal block has a rear engagement boss 16c (FIG. 2) for engagement within opening 36a of engagement flange 36 of the metal shell. FIG. 5 shows that the terminal block has an abutment wall 16d at one end thereof, with a spring keeper boss 16e projecting forwardly from the abutment wall. In essence, elongated terminal block 16 is mounted between the side walls of metal shell 14, spanning the side walls of the shell, and forming the rear of card-receiving cavity 26.

Referring to FIG. 6, card eject mechanism 20 is fitted into an inner space defined by the L-shaped side wall 32 (FIG. 2) of metal shell 14. The card eject mechanism is of a push/push type as is known in the art and includes a cam slider 44, a coil spring 46 and a cam pin 48. The slider has a slide slot 44a which receives guide rail 32d to guide movement of the slider in a front-to-rear direction as indicated by double-headed arrow "D". Coil spring 46 is positioned over spring keeper boss 16e (FIG. 5) of terminal block

16 and constantly biases the slider in a forward or eject direction indicated by arrow "E". The slider moves back and forth on top of horizontal section 32b of the side wall of the metal shell. It can be seen in FIG. 6 that the horizontal section of the side wall can be of a substantial size or area and not increase the height profile of the connector because the sheet metal material from which the shell is stamped and formed, is quite thin. The slider has an angled surface 44b, which engages an angled polarizing edge of memory card 24. The slider has an arm 44c which projects forwardly and terminates in a hook portion 44d which engages in a side edge of the memory card whereby, when the card is inserted into cavity 26, the hook portion "snaps" into engagement with the card recess and the card and slider 44 move in unison within the connector. Cam pin 48 has a forward end fixed within the cam pin engagement hole 22b of the card-insertion guide piece 22. An opposite end of the cam pin is inserted into and is operatively associated with a heart-shaped cam slot in the top of slider 44, as will be seen below.

FIGS. 7-10 show the operation of card eject mechanism 20 as memory card 24 is inserted into and ejected from connector 12. But first, FIG. 7 shows that memory card 24 has a recess 50 in a side edge thereof for receiving hook portion 44d of slider 44 and for conjoint movement of the memory card with the slider. The memory card has a plurality of contacts 52 recessed in the top of the card along a leading edge of the card, for engaging the forwardly cantilevered contact portions 18a of terminals 18. One corner of the card has an angled polarizing surface 54 for engaging angled surface 44b of slider 44. The slider has a heart-shaped cam slot 56 in the top thereof, as is known in the art, for receiving one end 48a of cam pin 48. An opposite end 48b of the cam pin is inserted into hole 22b of guide piece 22, as described hereinafter. Leaf spring 40 (FIG. 3) which is stamped and formed out of top wall 28 of metal shell 14 pushes downwardly on the cam pin and maintains the cam pin in its operative position as shown in FIG. 7.

FIG. 7 shows memory card 24 inserted into connector 12 in the direction of arrow "C" to an outer initial position of insertion. It can be seen that contacts 52 on the memory card are not yet engaged with contact portions 18a of terminals 18. However, hook portion 44d of slider 44 has resiliently "snapped" into recess 50 in the side edge of the memory card. Therefore, the memory card and the slider are joined for conjoint movement further into the connector.

FIG. 8 shows memory card 24 and cam slider 44 having been inserted in the direction of arrow "C" to an extreme inserted position of the memory card, whereat the

leading edge of the card abuts against terminal block 16. This sometimes is called a state of being over-inserted to allow the heart-shaped cam slot 56 to operationally position cam pin 48 as is known in the art.

After memory card 24 is inserted to its extreme inserted position shown in FIG. 8, the card is released, whereupon coil spring 46 pushes slider 44 and the memory card back forwardly in the direction of arrow "E" to a locked, inner connection position shown in FIG. 9. In this position, the one end 48a of cam pin 48 catches within a portion of the heart-shaped cam slot 56 to hold the slider and the memory card in this inner position whereat contacts 52 are maintained in engagement or connected to contact portions 18a of terminals 18.

When it is desired to eject memory card 24 from its inner connection position, the card again is pushed inwardly in the direction of arrow "C" in FIG. 10 so that the card moves back to its extreme inserted position. During this second pushing operation, the one end 48a of cam pin 48 is moved out of its catching position within cam slot 56 and is now free to move lengthwise within the slot. Coil spring 46 then becomes operational to push slider 44 and memory card 24 back outwardly in the direction of arrow "F" (FIG. 10) to the initial position of insertion as shown in FIG. 7.

As stated in the Background, above, ejection spring 46 of eject mechanism 20 has a tendency to push the memory card completely out of the connector under the inertia of ejection spring 46. This could cause the memory card to fall out of the connector. FIG. 11 shows one embodiment of a means to prevent this occurrence.

Specifically, FIGS. 11 and 12 show one embodiment of a resilient leaf spring 60 which is stamped and formed out of side wall 32 of metal shell 14. The leaf spring is a bridge-like member having opposite ends 60a integral with side wall 32. The leaf spring has an inwardly extending projection 62 which is directed toward and into engagement with a back side 64 of arm 44c behind hook 44d of cam slider 44. The engagement of projection 62 behind hook 44d forcibly retains the hook in recess 50 of memory card 24 and prevents ejection spring 46 of the eject mechanism from moving memory card 24 outwardly of its initial position shown in FIG. 12. The slider has a tendency to incline outwardly in the direction of arrow "G" (FIG. 12), but projection 62 prevents this movement and retains hook 44d within recess 50.

FIG. 13 shows memory card 24 in its inner connection position. It can be seen that the back side 64 of hook 44d has moved inwardly or away from projection 62 so that

lesser forces are applied to retain the hook of the slider within the recess of the memory card. Therefore, if it is desired to withdrawn memory card 24 completely from the connector, the memory card is pushed inwardly to its inner connection position whereat eject mechanism 20 locks slider 44 in the connection position. The memory card then can be pulled out of the connector because of the lesser forces on the slider. In other words, leaf spring 60 is configured for engagement of projection 62 with the slider to provide a relatively strong resistance against hook 44d coming out of recess 50 when the slider is in its outer initial position shown in FIG. 12. However, a weaker resistance is provided when the slider is moved inwardly away from projection 62 to its inner (locked) connection position whereat the memory card can be much more easily removed from the connector.

FIGS. 14 and 15 show alternative versions of projection 62 on resilient leaf spring 60. In FIG. 14, projection 62 is formed at a more acute angle or V-shape than the version of the projection shown in FIGS. 12 and 13. FIG. 15 shows projection 62 in a generally U-shape, again projecting further inwardly than the version of FIGS. 12 and 13. Both the V-shaped and the U-shaped projections 62 in FIGS. 14 and 15 would further increase the forces of retaining hook 44d of the slider within recess 50 in the side edge of memory card 24.

FIG. 16 shows an alternative embodiment of a resilient leaf spring 60A versus the bridge-type leaf spring 60 in FIG. 11. In the embodiment of FIG. 16, leaf spring 60A again is stamped and formed out of side wall 32 of metal shell 14. However, leaf spring 60A is a cantilevered spring arm which has one end 65 integral with side wall 32 and which has projection 62 located near a free distal end 66 of the arm.

FIG. 17 shows card eject mechanism 20 positioned within the inner space of the L-shaped side wall 32 of metal shell 14. The resilient leaf spring 40 which is stamped and formed out of top wall 28 of the metal shell biases the cam pin of the eject mechanism into the heart-shaped cam slot of slider 44. The resilient leaf spring 60 which is stamped and formed out of side wall 32 of the metal shell biases its projection 62 into engagement with the back side of arm 44c of slider 44.

It will be understood that the invention may be embodied in other specific forms without departing from the spirit or central characteristics thereof. The present examples and embodiments, therefore, are to be considered in all respects as illustrative and not restrictive, and the invention is not to be limited to the details given herein.

CLAIMS

1. A memory card connector (12), comprising:

an insulative housing (16) having a terminal-mounting section which mounts a plurality of conductive terminals (18) having contact portions for engaging appropriate contacts on a memory card (24) and which at least in part defines a card-receiving cavity (26) for receiving the memory card;

a card eject mechanism (20) including a slider (44) movably mounted on the housing and having a hook (44d) releasably engaged in a recess (50) in the memory card for conjoint movement of the slider and memory card into and out of the cavity between an outer initial position and an inner connection position, and an ejection spring (46) to bias the slider and memory card in an ejection direction (E) toward said initial position; and

a metal shell (14) mounted on the housing and combining therewith in defining said card-receiving cavity, the shell including a leaf spring (60,60A) having a projection (62) directed toward and into engagement with the slider of the card eject mechanism (20) to forcibly retain the hook (44d) on the slider in the recess (50) in the memory card.

2. The memory card connector of claim 1 wherein said leaf spring is formed by a cantilevered spring arm (60A) having one end (65) integral with the metal shell (14) and with said projection (62) being located near a distal end (66) of the spring arm.

3. The memory card connector of claim 1 wherein said leaf spring is formed by a bridge spring arm (60) having opposite ends (60a) integral with the metal shell (14), and with said projection (62) being located between the opposite ends of the spring arm.

4. The memory card connector of claim 1 wherein said metal shell (14) includes a top wall (28) and at least one side wall (32) depending along a side edge of the top wall, and said leaf spring (60,60A) is on said side wall.

5. The memory card connector of claim 4 wherein said side wall (32) of the metal shell (14) is generally L-shaped and defines an inner space in which the card eject mechanism (20) is mounted.

6. The memory card connector of claim 1 wherein said metal shell (14) is stamped and formed of sheet metal material.

7. A memory card connector (12), comprising:

an insulative housing (16) having a terminal-mounting section which mounts a plurality of conductive terminals (18) having contact portions for engaging appropriate contacts on a memory card (24) and which at least in part defines a card-receiving cavity (26) for receiving the memory card;

a card eject mechanism (20) including a slider (44) movably mounted on the housing and having a hook (44d) releasably engaged in a recess (50) in the memory card for conjoint movement of the slider and memory card into and out of the cavity between an outer initial position and an inner connection position, and an ejection spring (46) to bias the slider and memory card in an ejection direction (E) toward said initial position; and

a metal shell (14) mounted on the housing and combining therewith in defining said card-receiving cavity, the shell including a leaf spring (60,60A) which is configured for engagement with the slider (44) of the card eject mechanism and providing a relatively strong resistance against the hook (44d) on the slider coming out of the recess in the memory card when the slider is in said outer initial position and a relatively weak resistance when the slider is in said inner connection position.

8. The memory card connector of claim 7 wherein said leaf spring is formed by a cantilevered spring arm (60A) having one end (65) integral with the metal shell (14).

9. The memory card connector of claim 7 wherein said leaf spring is formed by a bridge spring arm (60) having opposite ends (60a) integral with the metal shell (14).

10. The memory card connector of claim 7 wherein said metal shell (14) includes a top wall (28) and at least one side wall (32) depending along a side edge of the top wall, and said leaf spring (60,60A) is on said side wall.

11. The memory card connector of claim 10 wherein said side wall (32) of the metal shell (14) is generally L-shaped and defines an inner space in which the card eject mechanism (20) is mounted.

12. The memory card connector of claim 7 wherein said metal shell (14) is stamped and formed of sheet metal material.

13. A memory card connector (12), comprising:

an insulative housing (16) having a terminal-mounting section which mounts a plurality of conductive terminals (18) having contact portions for engaging appropriate contacts on a memory card (24) and which at least in part defines a card-receiving cavity (26) for receiving the memory card;

a card eject mechanism (20) including a slider (44) movably mounted on the housing and having a hook (44d) releasably engaged in a recess (50) in the memory card for conjoint movement of the slider and memory card into and out of the cavity between an outer initial position and an inner connection position, and an ejection spring (46) to bias the slider and memory card in an ejection direction (E) toward said initial position; and

a metal shell (14) stamped and formed of sheet metal material and mounted on the housing and combining therewith in defining said card-receiving cavity, the shell including a top wall (28) and at least one side wall (32) depending along a side edge of the top wall, and a leaf spring (60,60A) formed from the side wall and having a projection (62) directed toward and into engagement with the slider of the card eject mechanism (20) to forcibly retain the hook (44d) on the slider in the recess (50) in the memory card.

14. The memory card connector of claim 13 wherein said leaf spring is formed by a cantilevered spring arm (60A) having one end (65) integral with the side wall (32) of the metal shell (14) and with said projection (62) being located near a distal end (66) of the spring arm.

15. The memory card connector of claim 13 wherein said leaf spring is formed by a bridge spring arm (60) having opposite ends (60a) integral with the side wall

(32) of the metal shell (14), and with said projection (62) being located between the opposite ends of the spring arm.

16. The memory card connector of claim 13 wherein said side wall (32) of the metal shell (14) is generally L-shaped and defines an inner space in which the card eject mechanism (20) is mounted.

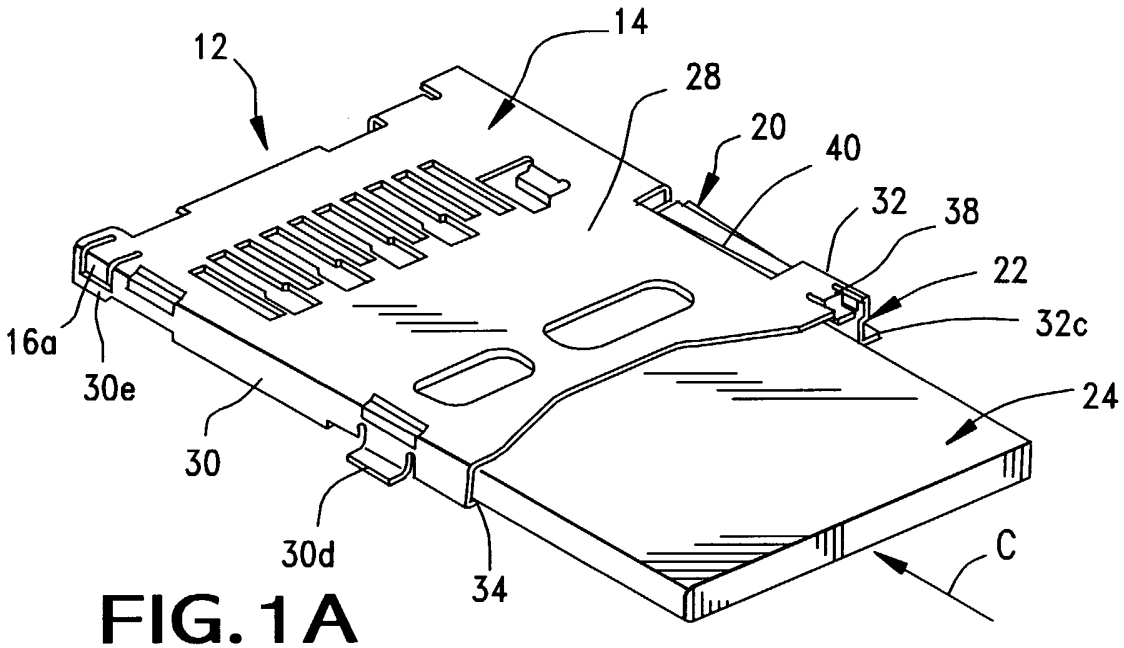

12
14
28
20
40
32
38
22
32c
24
16a
30e
30
30d
34
C

FIG. 1A

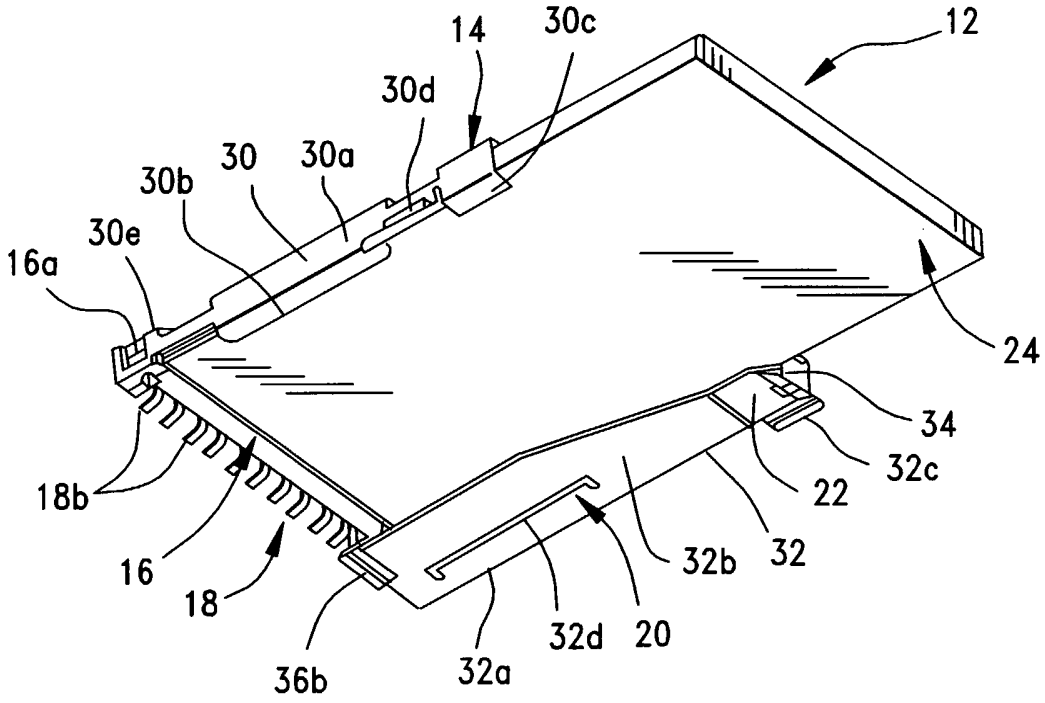

14
30c
12
30d
30
30a
30b
30e
16a
24
34
32c
22
18b
16
18
32b
32
32d
20
36b
32a

FIG. 1B

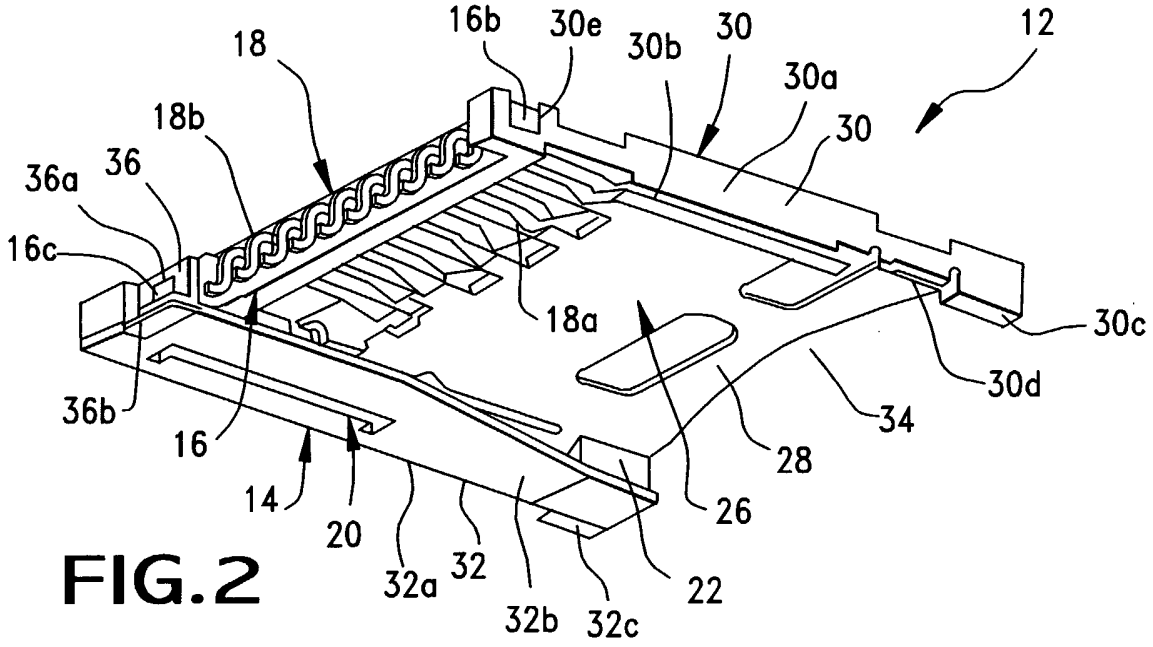


FIG.2

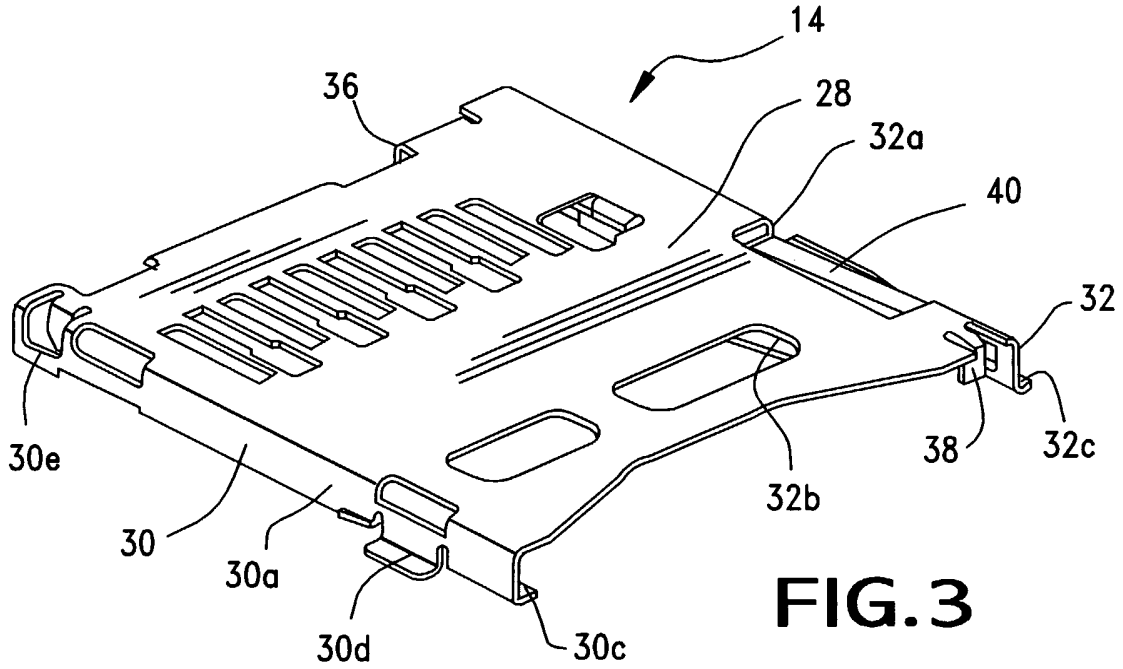


FIG.3

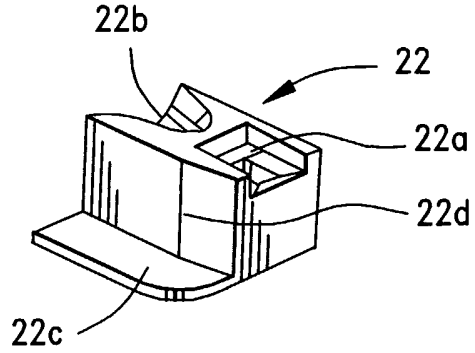


FIG.4

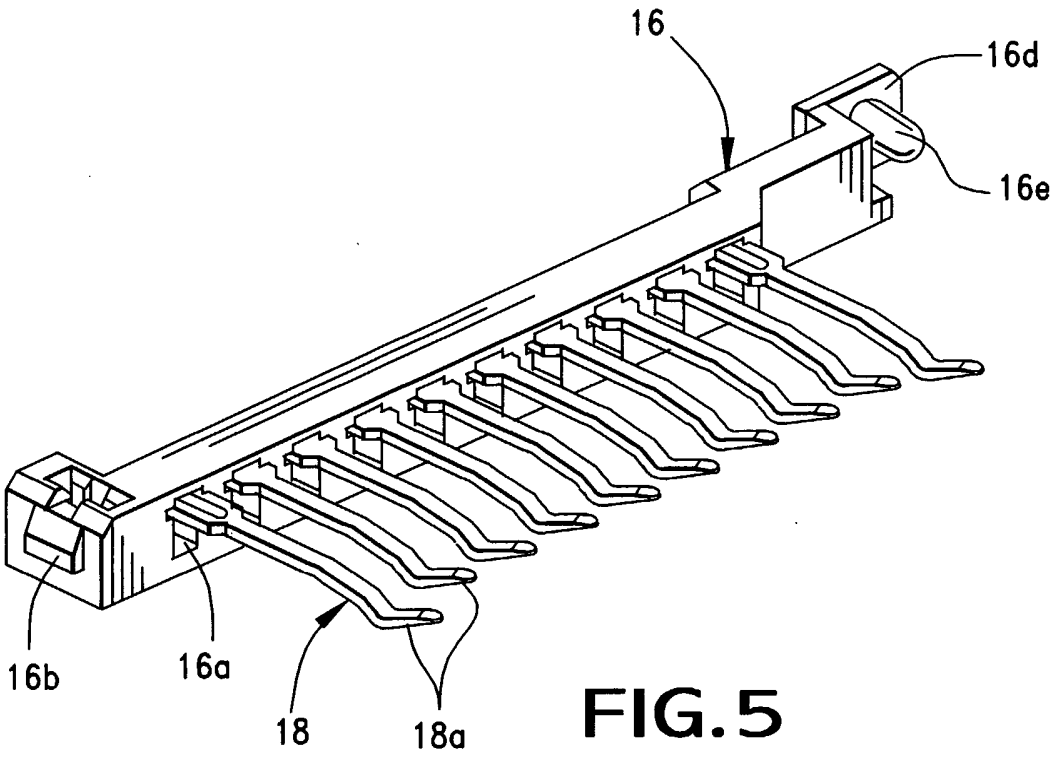

16
16d
16e
16b
16a
18
18a

FIG.5

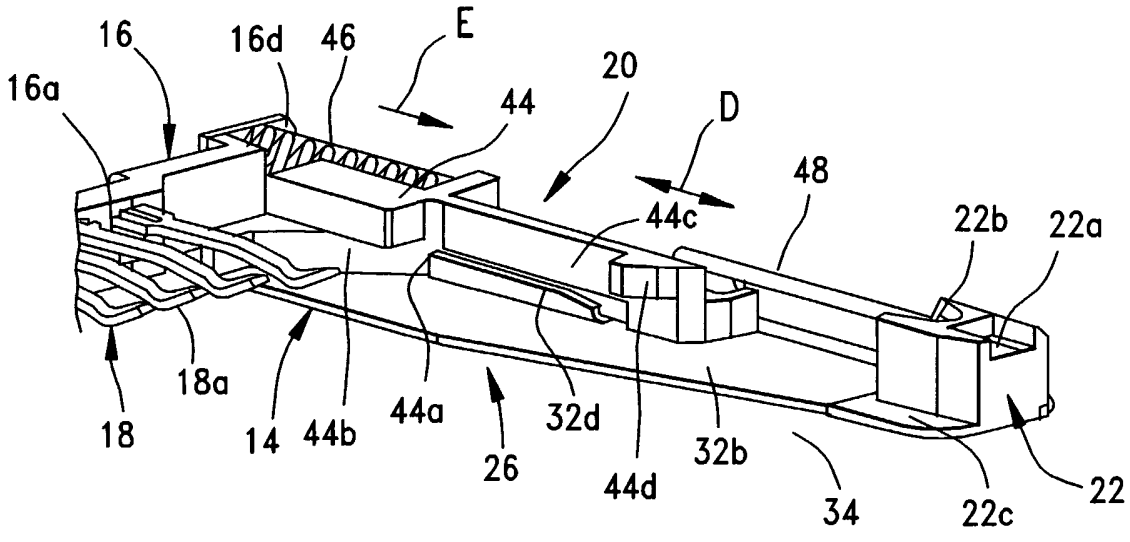

16
16d
46
E
20
16a
44
D
48
44c
22b
22a
18a
18
14
44b
44a
32d
26
44d
32b
34
22c
22

FIG.6

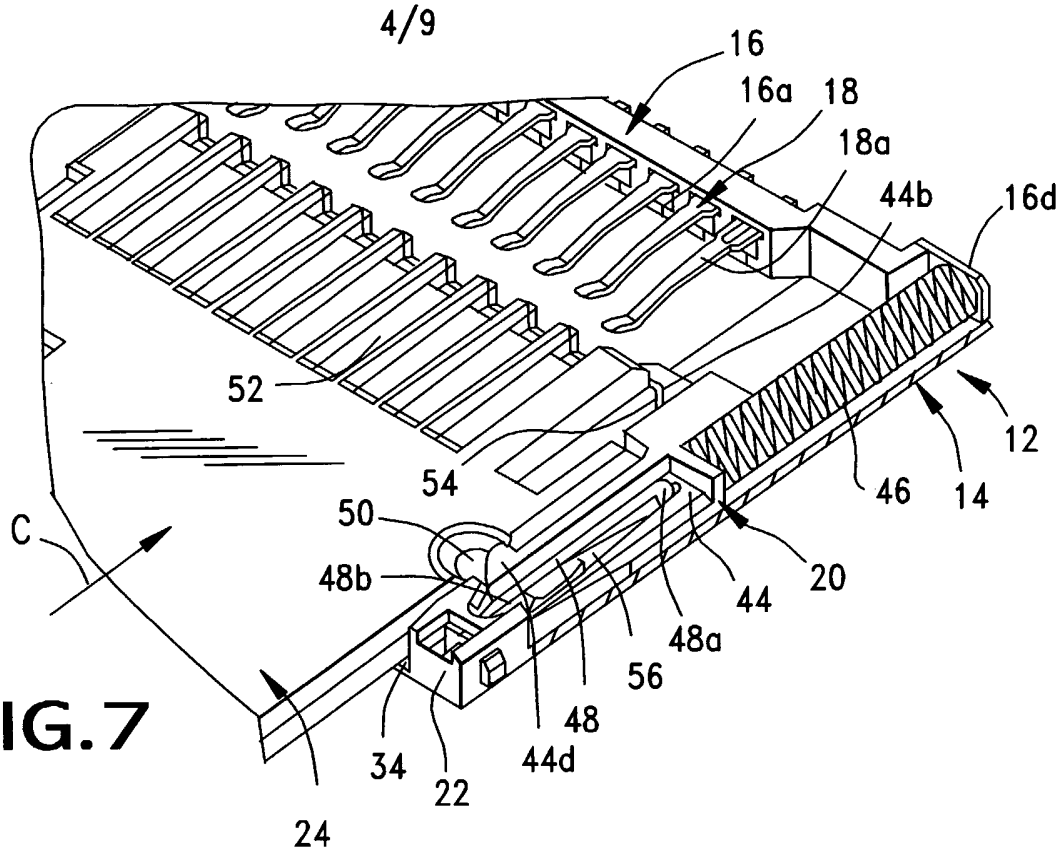

16
16a
18
18a
44b
16d
52
54
12
46
14
50
C
48b
20
44
48a
56
48
34
44d
22
24

FIG.7

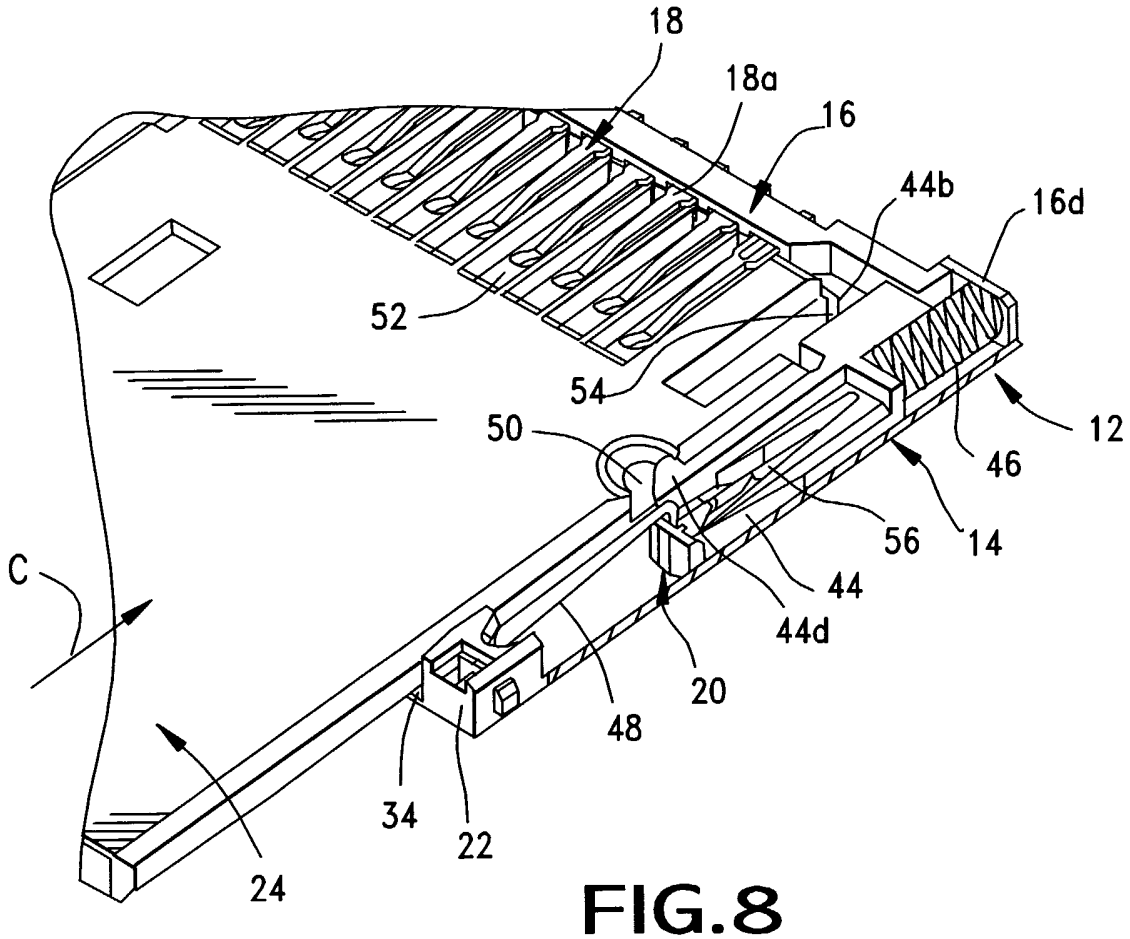

18
18a
16
44b
16d
52
54
12
50
46
56
14
C
44
44d
20
48
34
22
24

FIG.8

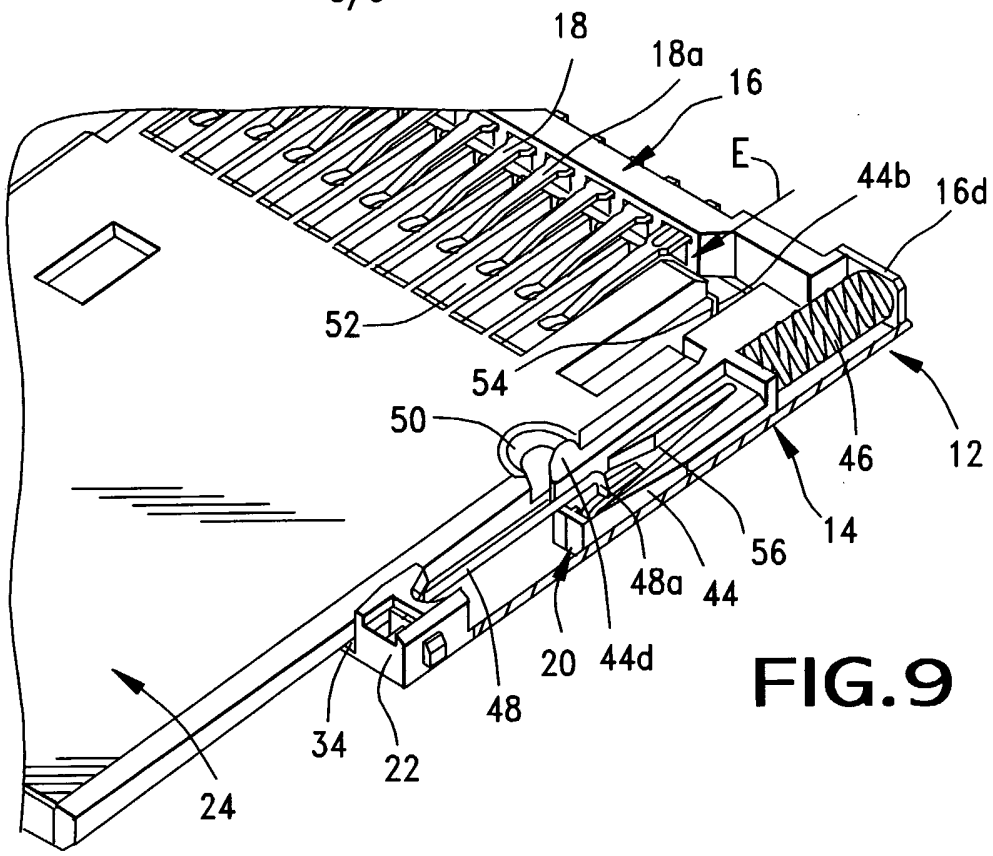

18
18a
16
E
44b
16d
52
54
50
46
12
14
56
48a
44
20
44d
48
34
22
24

FIG.9

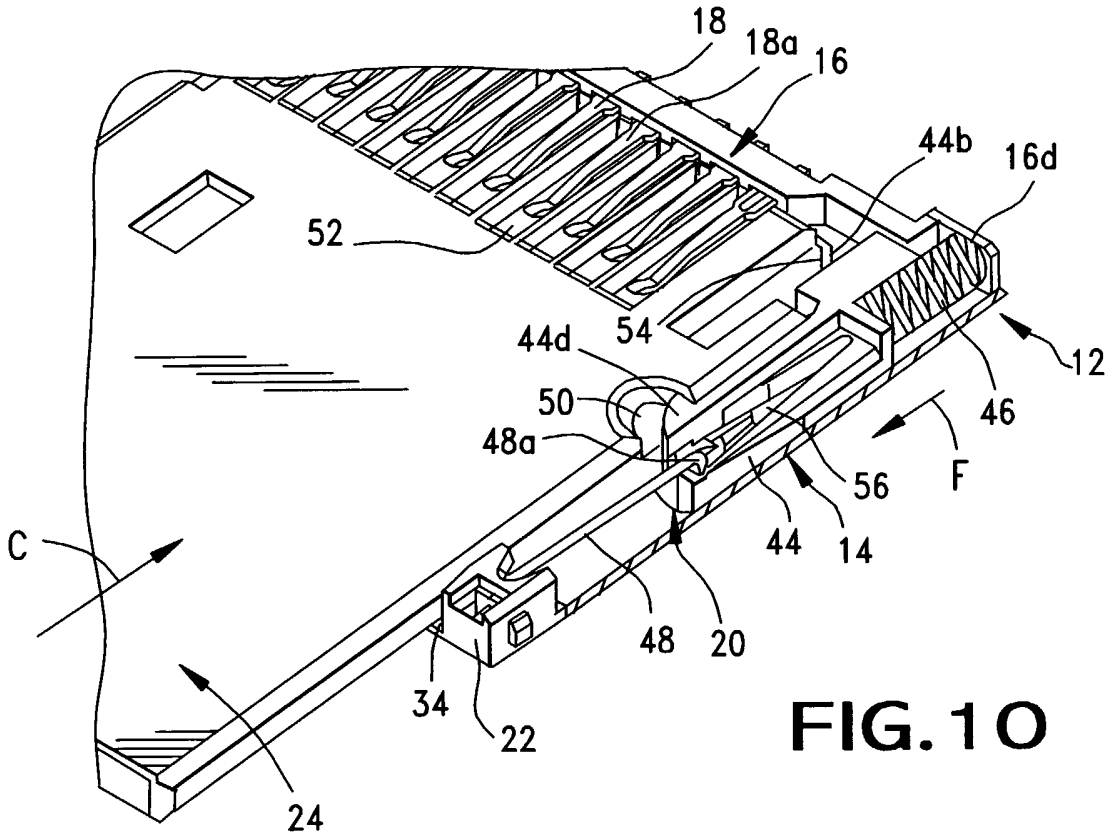

18
18a
16
44b
16d
52
54
44d
12
50
46
48a
56
F
C
44
14
48
20
34
22
24

FIG.10

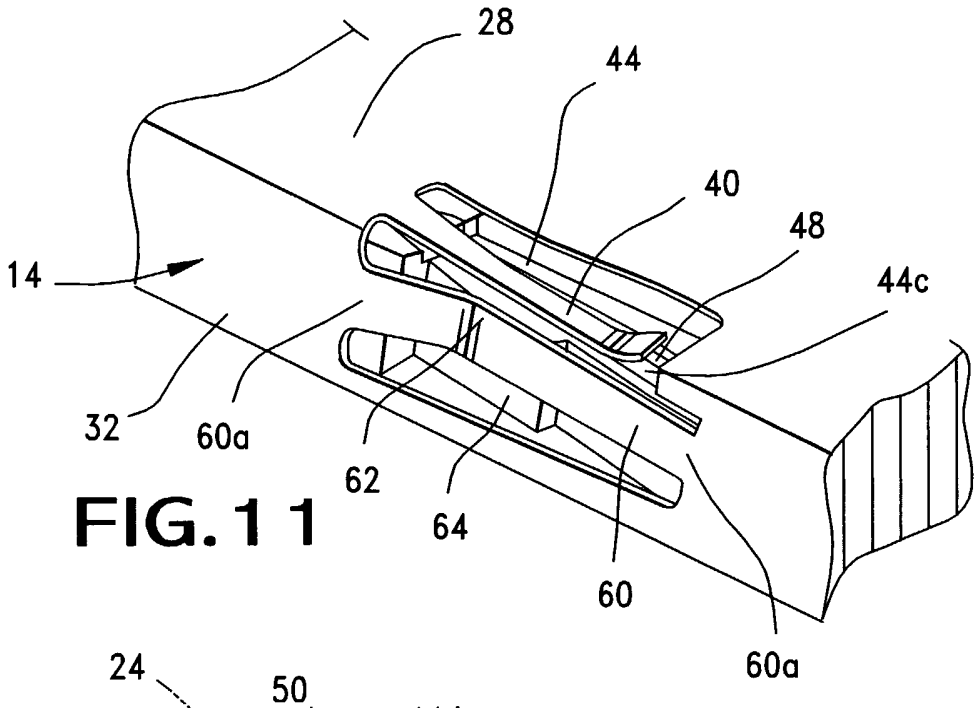


FIG. 11

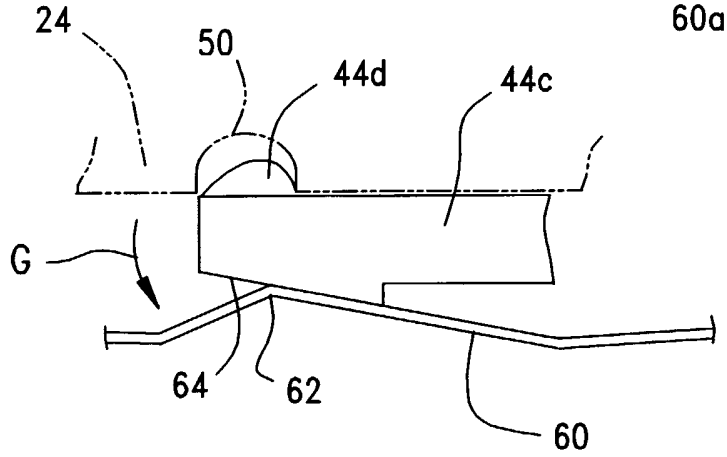


FIG. 12

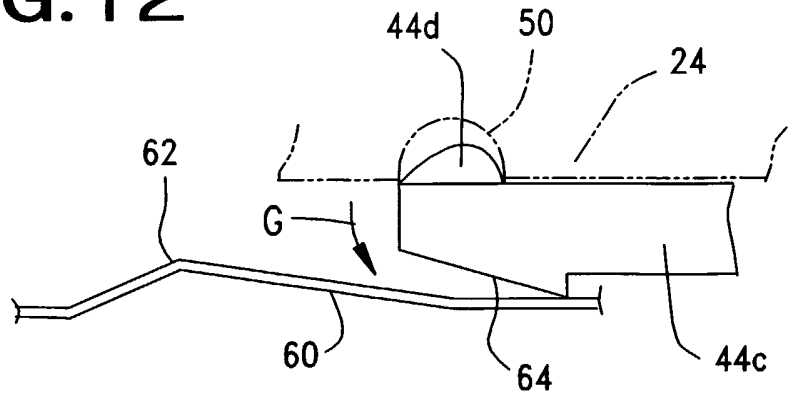


FIG. 13

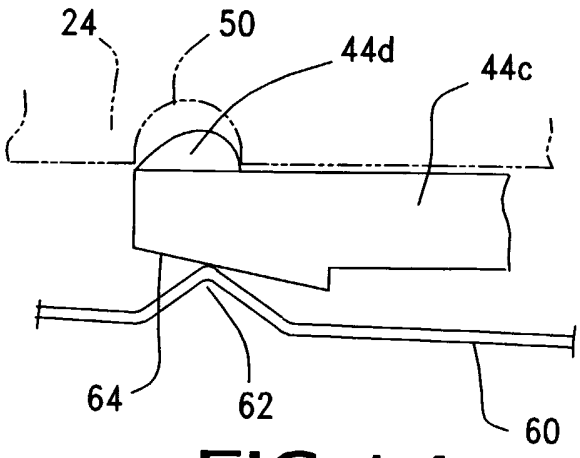


FIG. 14

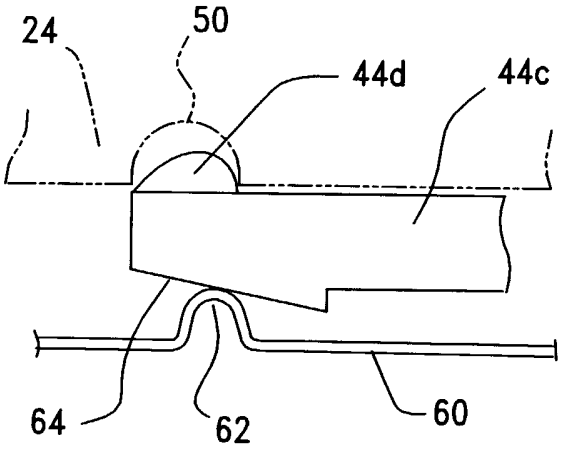


FIG. 15

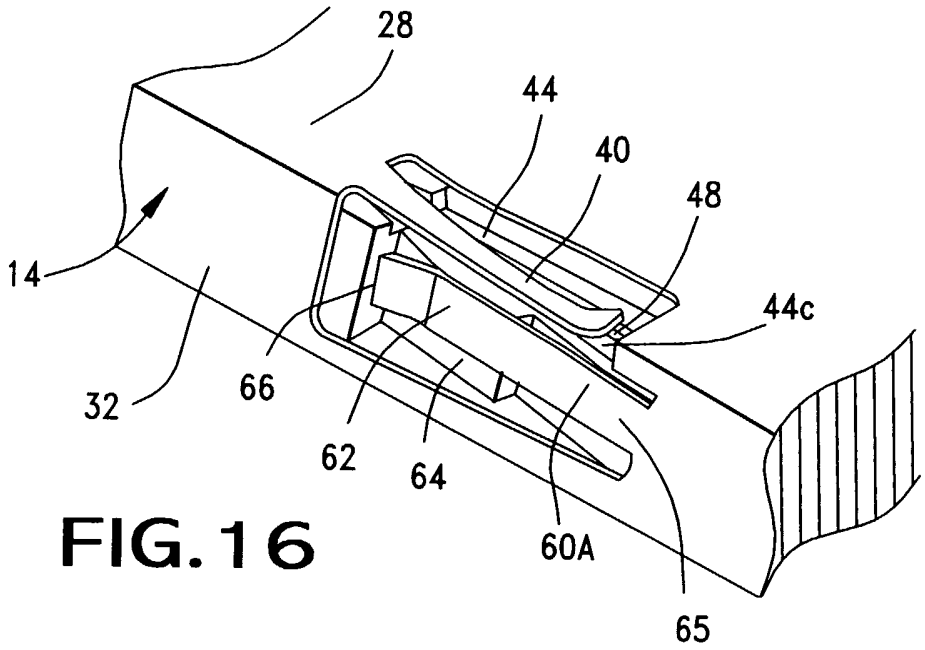


FIG. 16

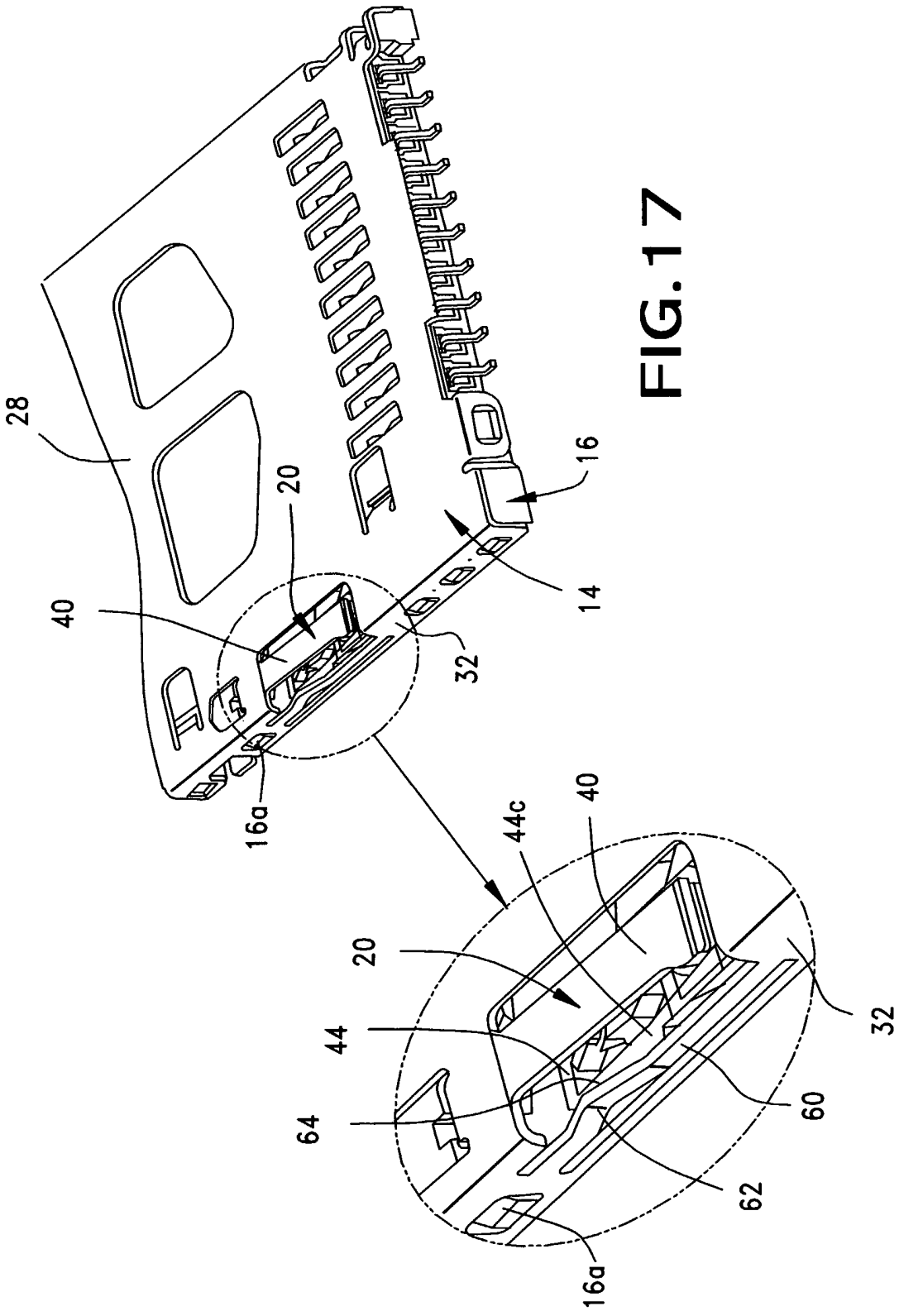


FIG. 17

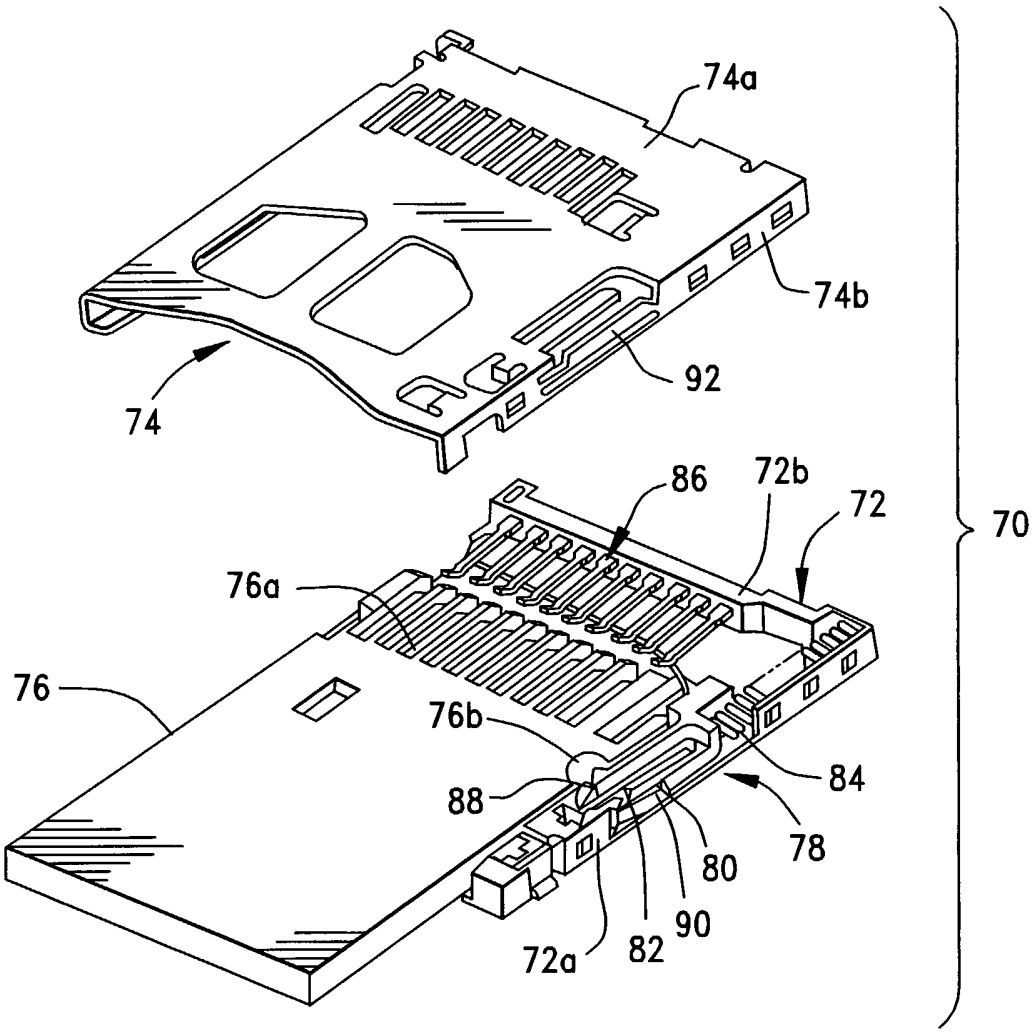


FIG. 18
(PRIOR ART)

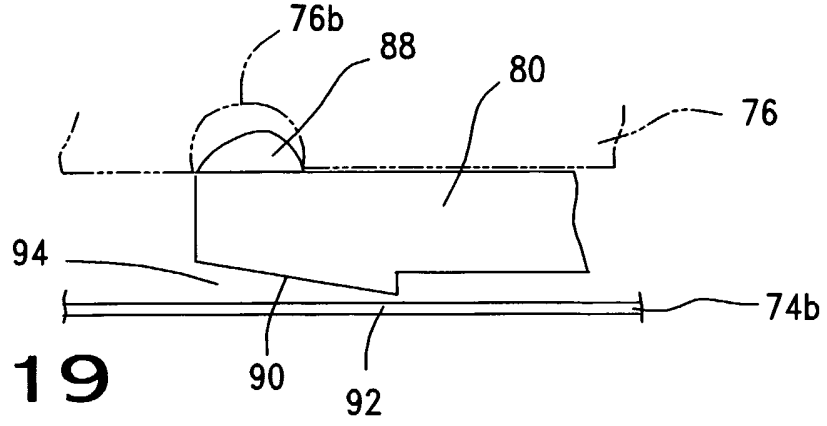


FIG. 19
(PRIOR ART)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2005/003275

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06K13/08

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 7 G06K

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 practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2001/008813 A1 (NISHIOKA TORU) 19 July 2001 (2001-07-19) paragraph '0062! - paragraph '0069!; figures 19-28	1,7,13
A	US 6 315 583 B1 (NISHIOKA TORU) 13 November 2001 (2001-11-13) column 7, line 7 - column 8, line 58; figure 1	1,7,13

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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"P" document published prior to the international filing date but later than the priority date claimed

"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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 May 2005	07/06/2005

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Chiarizia, S

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US2005/003275

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2001008813 A1	19-07-2001	JP 2001203034 A	27-07-2001
		TW 466805 B	01-12-2001
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		TW 521459 B	21-02-2003