

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

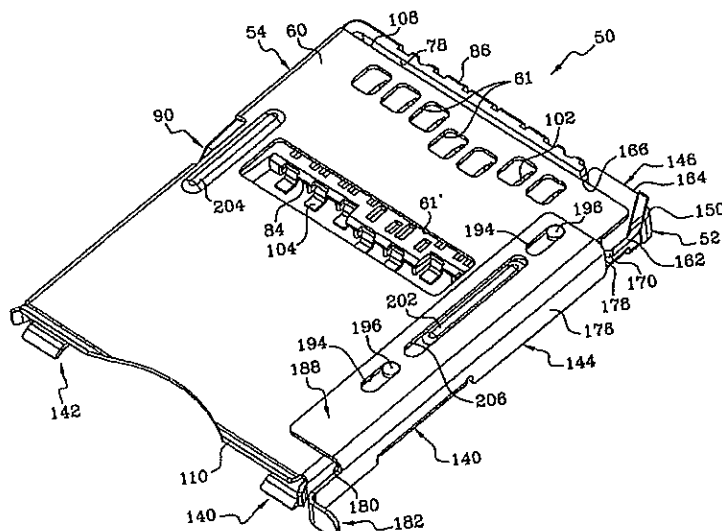
(19) World Intellectual Property Organization
International Bureau(43) International Publication Date
26 April 2001 (26.04.2001)

PCT

(10) International Publication Number
WO 01/29934 A1

- (51) International Patent Classification: **H01R 13/635**
- (21) International Application Number: **PCT/EP00/10261**
- (22) International Filing Date: 18 October 2000 (18.10.2000)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
99/13066 20 October 1999 (20.10.1999) FR
- (71) Applicant (for all designated States except US): **ITT MANUFACTURING ENTERPRISES INC.** [US/US]; 1105 North Market Street, Suite 1217, Wilmington, DE 19801 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **BRICAUD, Hervé** [FR/FR]; 166, avenue Eisenhower, F-39100 Dole (FR). **PIZARD, Yves** [FR/FR]; 106, avenue Georges Pompidou, F-39100 Dole (FR). **VALCHER, Fabrice** [FR/FR]; 3, rue de Bourgogne, F-39500 Damparis (FR).
- (74) Agent: **KOHN, Philippe**; Cabinet Philippe Kohn, 30, rue Hoche, F-93500 Pantin (FR).
- (81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
- (84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
- Published:
— With international search report.
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: ELECTRICAL CONNECTOR FOR A SMART CARD, HAVING A LEVER AND A PUSHER FOR EJECTING THE CARD



(57) Abstract: The invention provides an electrical connector (50) for a chip or smart card (C), of the type comprising a support (52) made of insulating material which defines a housing (58) which receives a card (C), and of the type comprising actuated means (144, 146) for ejecting the card out of the housing, having a card ejection lever (146) which is mounted so as to pivot on the insulating support (52) so that the lever (146) acts on a corresponding corner (64, 66) of the card due to the action of a pusher (144) mounted so as to slide longitudinally with respect to the insulating support (52), characterized in that it includes a metal cover (54) for holding the card (C) in the housing (58) which extends above the upper face (74) of the card and which is mounted on the insulating support, and in that the pusher for actuating the ejection lever is mounted so as to slide along the metal cover.

WO 01/29934 A1

**Electrical connector for a smart card, having a lever and a
pusher for ejecting the card**

The present invention relates to an electrical connector for a contact-type smart card of rectangular overall shape.

5 The invention relates more particularly to a connector of the type comprising a support made of insulating material which defines a housing open in its upper face, bounded laterally by two parallel longitudinal edges and transversely by at least one front bottom edge and which receives at least one front portion of a
10 card which is inserted longitudinally from the rear forwards into the housing in a direction parallel to the general plane of the card and having on its lower main face conducting pads which are provided near the front transverse edge of the card and which interact with the contact ends of electrical contact elements
15 provided in the bottom of the housing of the support when the card is in its contact position in which its front transverse edge butts against the front transverse bottom edge of the housing, in which type the electrical contact elements are borne by the support.

20 Such an example of an electrical connector, sold by ITT, is described and shown in French Patent Application FR-A-2.742.561.

That document provides a connector for the connection of a standardized card of the MICROSIM type, which is a card of
25 small dimensions. Thus, the largest longitudinal part forming the front portion of the card is received in the housing of the support of the connector, that is to say the lower face of the card extends virtually over its entire area facing the bottom of the housing formed in the insulating support, only a small rear longitudinal
30 portion of the card projecting out of the housing, especially so as to make it easier to grip it.

Moreover, the ends for connecting the contact elements extend by longitudinal groups towards the front and towards the rear of the insulating support, respectively, beyond the front and

rear transverse faces of the latter, in order to engage with conducting tracks on a printed circuit board which receives the connector.

Finally, that document also provides a metal cover which is mounted so as to slide along the support and which retains the card in the housing of the insulating support by virtue of its upper plate-shaped main part which extends above the upper face of the card when the latter is in place in the housing.

Proposed in French Patent Application N° 98/11789 of 22 September 1998 is a connector suitable especially for connecting another type of card, also standardized, which especially allows a large amount of data to be stored in order thus to form a removable data medium which is overall small in size and has a large storage capacity. Several embodiments of such a memory card, also called a "flash" card, are known, the dimensions of which are becoming smaller and smaller and the storage capacities of which are becoming greater and greater in size.

This is especially the case with the card called an "MMC" card (MultiMediaCard) sold by SANDISK, the dimensions of its body containing the integrated circuits and the position of its conducting contact pads being precisely defined by its manufacturer and by a users' association so as to have a standardized-type definition of such a card. This definition forms, for example, the subject of the publication MultiMediaCard System Specification Version 2.11 Official Release @ June 1999 MMCA.

This type of MMC card is generally similar in its shape and its proportions to a MICROSIM card, especially in that it includes polarization means for correctly and unambiguously positioning it in a connector and/or in a read/write device, which consist of a cut corner formed at one of the corners of the card, which is of rectangular overall shape.

On the other hand, the contact pads of the MMC card consist of a series of substantially adjacent conducting pads,

some of which are aligned transversely along the short transverse front end edge of the MMC card, in which edge the polarization cut corner is also formed.

5 The overall dimensions of the MMC card, or of other cards of the same type, are, however, larger than those of a MICROSIM card and the design of a connector proposed in the above-mentioned French patent application is not perfectly suited to this type of card in so far as it results in the connector being of a very large overall size which is a considerable disadvantage in so far
10 as the area occupied by the insulating support of the connector on the upper face of a printed circuit board on which it is mounted is large, this area being, of course, then no longer available for the mounting of other electronic components on the printed circuit board.

15 In order to eject the card, a connector has already been proposed, for example in document EP-A-0.580.983, which is of the type comprising actuated means for ejecting the card out of the housing, having a card ejection lever which is mounted so as to pivot on the insulating support near a bottom corner of the housing, bounded by a longitudinal edge and by the transverse
20 bottom edge, so that the lever acts on a corresponding edge of the card due to the action of a pusher mounted so as to slide longitudinally with respect to the insulating support. According to that design, the pusher is mounted so as to slide along the
25 insulating support, the design of which is therefore particularly complex and the transverse space required for which is large.

The invention therefore aims to provide a novel design of an electrical connector of the above-mentioned type which is suitable for connecting a smart card, especially a card of the MMC
30 type, and which includes means for ejecting the card from its housing, the design of which allows the design of the insulating support to be standardized for the purpose of having a range of connectors using the same insulating support of minimum size.

According to the present invention, there is provided an electrical connector for a contact-type memory smart card (C) of rectangular overall shape, of the type comprising a support made of insulating material which defines a housing open in its upper face, bounded laterally by two parallel longitudinal edges and transversely by at least one front bottom edge and which receives at least one front portion of a card (C) which is inserted longitudinally (I) from the rear forwards into the housing in a direction parallel to the general plane of the card and having on its lower main face conducting pads which are provided near a front transverse edge of the card and which interact with contact ends of electrical contact elements provided in a bottom of the housing of the support when the card is in its contact position in which its front transverse edge butts against the front transverse bottom edge of the housing, in which type the electrical contact elements are borne by the support, and of the type comprising actuated means for ejecting the card out of the housing, having a card ejection lever which is mounted so as to pivot on the insulating support near a bottom corner of the housing, bounded by a longitudinal edge and by the transverse bottom edge, so that the lever acts on a corresponding corner of the card due to the action of a pusher mounted so as to slide longitudinally with respect to the insulating support, characterized in that it includes a metal cover for holding the card (C) in the housing which extends above the upper face of the card and which is mounted on the insulating support, and in that the pusher for actuating the ejection lever is mounted so as to slide along the metal cover.

According to other features of the invention :

- the cover is made in the form of an upper plate which extends above the upper face of the card and the parallel lateral edges of which are extended by two lateral turned-down rims which are extended horizontally under the insulating support

by lower horizontal arms which are bent inwards so as to form slideways for mounting the cover on the insulating support;

- the pusher has a lateral plate, adjacent to the lateral rim of the cover close to the said bottom corner of the housing,
5 which belongs to a yoke of cross section in the form of a U lying horizontally and which straddles the corresponding slideway of the cover;

- the yoke has two parallel flanges, an upper flange and a lower flange, which are joined together by the vertical
10 lateral plate forming the pusher, and the upper flange is adjacent to the upper plate of the cover;

- means for guiding and transversely retaining the yoke on the cover are provided between the yoke and cover;

- the upper flange, or alternatively the facing part of
15 the upper plate of the cover, has at least one longitudinal slot for guiding and transversely retaining the yoke on the metal cover which slidably accommodates a vertical finger formed so as to project from the facing part of the cover, or alternatively under the upper flange of the yoke;

20 - the upper plate of the cover extends longitudinally rearwards so as to cover approximately the entire card when the latter is in the contact position;

- each lateral edge of the cover extends approximately over the entire length of the cover ;
- the main portion of the body of the card extends in a cantilever fashion rearwards beyond a rear transverse face of the insulating support ;
- beyond the said rear transverse face of the insulating support, each lateral edge of the cover is extended horizontally under the upper plate by a lower horizontal cheek bent inwards so as to form a channel for accommodating the corresponding longitudinal edge of the card ;
- the lower flange of the yoke extends opposite the corresponding lower flange of the cover ;
- the lower flange, or alternatively the facing part of the lower flange of the yoke, has at least one longitudinal slot for guiding and transversely retaining the yoke on the metal cover which slidably accommodates a vertical finger formed so as to project from the facing part of the lower cheek of the cover, or alternatively from the lower flange of the yoke ;
- the insulating support is extended longitudinally rearwards beyond the said rear transverse face by two opposed lateral extensions in which the rear parts of the parallel longitudinal edges of the housing for guiding the card laterally are formed ;
- the front transverse edge of the card has a cut corner, cut at approximately 45° , intended to engage with a corresponding surface inclined at 45° and formed at one of the ends of the front transverse bottom edge of the housing in order to constitute polarization means defining a correct position of the card in the housing of the connector and the ejection lever acts on the cut corner of the card ;
- the insulating support has, in the said bottom corner of the housing, a recess formed in its upper face which accommodates the ejection lever ;
- the pusher is a part made of cut and folded sheet metal ;

- the metal cover for holding the card in the housing has tabs for fastening it by soldering to the upper face of a plate which bears the connector, especially to conducting tracks connected to the earth plane of a printed circuit board, said metal
5 cover possibly being formed in the thickness of the plate ;

- the connector according to the invention includes means for superposing another connector according to the invention immediately above it ;

- the said means have holes and complementary studs of
10 the front part of the insulating support of the connector ;

- the said means include loops and complementary prongs of the rear part of the metal cover ;

- the upper connector has output tabs which extend vertically downwards beyond the front transverse face of its
15 insulating support ;

- the output tabs of the upper connector are electrically connected to the output tabs of the connector which is immediately below it ;

- the cover and the ejection pusher include retractable
20 means for retaining the card in the inserted contact position in the connector ;

- closure means are provided for at least partially closing off the slot for inserting the card into the connector ;

- the closure means are elastically deformable means
25 which, at rest, extend opposite the insertion slot and which are capable of automatically moving aside during insertion of the card.

Further features and advantages of the invention will appear on reading the detailed description which follows, for the
30 understanding of which reference will be made to the appended drawings in which :

- Figure 1 is a perspective top and three-quarter rear view which illustrates a connector according to the invention, shown in

the set-back rear position of the ejection pusher and with the ejection lever in the retracted position ;

- Figure 2 is a view similar to that of Figure 1 in which the connector is shown together with an MMC-type card during
5 insertion into the connector, or during ejection, with the ejection pusher in the pushed-in forward position and the ejection lever in the out position ;

- Figure 3 is a bottom view of the connector of Figure 2 ;

- Figure 4 is a detailed view of Figure 2 on a large scale,
10 with the cover and the upper flange of the yoke forming the pusher partially cut away ;

- Figure 5 is a top view of the connector of Figure 2 ;

- Figure 6 is a side view along the arrow F6 of Figure 5 ;

- Figure 7 is a rear end view along the arrow F7 of Figure
15 5 ;

- Figure 8 is a longitudinal sectional view on the line 8-8 of Figure 5 ;

- Figures 9 to 15 are views similar to those of Figures 2 to 8, in which the card is in the fully inserted contact position, with
20 the pusher in the set-back rear position and the ejection lever in the retracted position ;

- Figure 16 is a cross-sectional view on the line 16-16 of Figure 11 ;

- Figure 17 is a view similar to that of Figure 1, in which
25 the connector is shown without the ejection pusher ;

- Figure 18 is a perspective rear three-quarter view of the metal cover of the connector ;

- Figure 19 is a bottom view of Figure 18 ;

- Figure 20 is a perspective rear three-quarter view of the
30 ejection pusher ;

- Figure 21 is a bottom view of Figure 20 ;

- Figure 22 is a rear three-quarter view of the insulating support with the contact blades ;

- Figure 23 is a perspective rear three-quarter view of the ejection lever ;
- Figure 24 is a view similar to that of Figure 22, with the ejection lever in the position mounted on the insulating support ;
- 5 - Figure 25 is a view similar to that of Figure 18, which illustrates an alternative embodiment of the cover ;
- Figure 26 is a view on a larger scale of the detail D26 of Figure 25 ;
- Figure 27 is a view similar to that of Figure 1, which
10 illustrates an alternative embodiment of a raised connector ;
- Figure 28 is a bottom view of the connector of Figure 27 ;
- Figure 29 is a longitudinal sectional view through a vertical mid-plane of the connector of Figures 27 and 28 ;
- Figure 30 is a view similar to that of Figure 1, which
15 illustrates an alternative embodiment of the tab for manoeuvring the ejection pusher ;
- Figure 31 is a perspective rear three-quarter view which illustrates a stack of two vertically superposed connectors according to the teachings of the invention ;
- 20 - Figure 32 is a bottom view of the whole of Figure 31 ;
- Figure 33 is a view on a larger scale of the detail D33 of Figure 32 ;
- Figure 34 is a side view of the left of the stack of Figure 31 ;
- 25 - Figure 35 is a view similar to that of Figure 1, which illustrates a connector according to the invention modified so as to form the first, lower connector of the stack of Figures 31 to 34 ;
- Figure 36 is a bottom view of Figure 35 ;
- Figure 37 is a view on a larger scale of the detail D37 of
30 Figure 36 ;
- Figure 38 is a view similar to that of Figure 22, which illustrates the insulating support, without its contact blades, of the first connector of Figures 35 to 37 ;
- Figure 39 is a bottom view of Figure 38 ;

- Figure 40 is a view similar to that of Figure 1, which illustrates a connector according to the invention modified so as to form the second, upper connector of the stack of Figures 31 to 34 ;
- 5 - Figure 41 is a bottom view of Figure 40 ;
- Figures 42 to 44 are views on a larger scale of the details D42 to D44 of Figure 41 ;
- Figures 45 and 46 are views similar to those of Figures 38 and 39, which illustrate the insulating support of the second
- 10 connector of Figures 40 and 41 ;
- Figures 47 to 50 are views similar to those of Figures 31 to 34, which illustrate a stack of three vertically superposed connectors according to the teachings of the invention, that is to say the stacked first two connectors of Figures 31 to 34 plus a
- 15 third, upper connector ;
- Figure 51 is a perspective front three-quarter view of the three- connector stack of Figure 47 ;
- Figure 52 is a detailed view on a larger scale of the detail D52 of Figure 51 ;
- 20 - Figure 53 is a perspective front three-quarter view of the third, upper connector of the stack of Figures 47 to 52 ;
- Figure 54 is a view on a larger scale of the detail D54 of Figure 53 ;
- Figure 55 is a bottom view of the connector of Figure 53 ;
- 25 - Figures 56 to 58 are views similar to those of Figures 50 to 52, which illustrate another example of a stack of three connectors according to the teachings of the invention, which differs from the previous stack by the means for connecting the three connectors to the apparatus that they equip ;
- 30 - Figure 59 is a view similar to that of Figure 2, which illustrates an alternative embodiment of the cap and of the ejection pusher having a lip for retaining the card in the inserted contact position, the card here being shown in the course of being inserted or extracted ;

- Figure 60 is a detailed view on a larger scale, in section on the line 60-60 of Figure 59 ;

- Figures 61 and 62 are views similar to those of Figures 59 and 60, in which the card is shown in the inserted contact position ;

- Figure 63 is a view similar to that of Figure 18, which shows the cover of the connector illustrated in Figures 59 to 62 ;

- Figure 64 is a view on a larger scale of the detail D64 of Figure 63 ;

10 - Figure 65 is a view similar to that of Figure 20, which shows the ejection pusher of the connector illustrated in Figures 59 to 62 ;

- Figure 66 is a view on a larger scale of the detail D66 of Figure 65 ;

15 - Figures 67 to 72 are views similar to those of Figures 59 to 64, which illustrate an alternative embodiment of the stop means for retaining the card in the connector ;

- Figure 73 is a partial view similar to that of Figure 3, in which the modifications made to the insulating support and to the cover, in order to allow the sealing and closure means to be mounted, have been shown ;

- Figure 74 is a perspective bottom view of the sealing means which include a sealing lip and are intended to be mounted in the connector of the previous figure ; and

25 - Figure 75 is a partial view similar to that of Figure 29, which illustrates the connector with the closure means in the position mounted on the connector.

In the description which follows, identical, similar or analogous components will be denoted by the same reference numbers.

30 Figures 1 to 16 show an electrical connector 50 which essentially consists of an overall plate-shaped plastic insulating support 52 and a metal or metallized lid or cover 54 which especially extends above the plane horizontal upper face 56 of

the insulating support 52, in which face a card housing 58 is formed, this housing being open vertically upwards opposite the main upper plate-shaped part 60 of the cover 54.

5 The housing 58 is bounded vertically downwards by a horizontal lower bottom wall 62 and it is open longitudinally rearwards so as to have a slot for the longitudinal insertion of the front portion of an electronic memory card or smart card C which is, for example, an MMC-type card.

10 The card C, of known design, has a rectangular overall shape bounded longitudinally by a transverse front end edge 66, by a transverse rear end edge 68 and by two parallel and opposed lateral edges 70 and 72.

15 The front right corner corresponding to the intersection of the edges 66 and 70 has a cut corner 64 cut at the standardized 45° for polarizing the position and orientation of the card C.

Moreover, the card C has a horizontal upper face 74 and an opposed parallel lower face 76 which is oriented downwards towards the printed circuit board and which has, near its transverse front end edge 66, a series of conducting contact pads, 20 here seven in number which are all transversely aligned, are substantially adjacent to the transverse front end edge 66 and are oriented downwards towards the printed circuit board (not shown) which bears the connector on its upper face.

25 The card C is thus capable of being inserted, in the direction I indicated in Figure 5, from the rear forwards into the housing 58 until its front transverse edge 66 butts against a front transverse bottom edge 78 which defines the housing 58 towards the front.

30 The opposed lateral edges 70 and 72 of the card C are guided so as to slide in the housing 58 by parallel and opposed longitudinal edges 80 and 82 respectively (see Figure 22) which define the housing 58 transversely.

As may be seen in the figures, the housing 58 proper, which receives the front portion of the card C, is bounded

transversely forwards by the front transverse bottom edge 78 and transversely towards the rear by a transverse rear end face 84 of the insulating support 52.

Moreover, the insulating support 52 is bounded
5 transversely forwards by a front transverse face 86.

In order to improve the lateral guiding of the card C as it slides during its insertion into or its extraction from the housing 58, the body of the insulating support 52 has two opposed longitudinal extensions 88 and 90 which extend longitudinally
10 rearwards beyond the rear transverse face 84 in order to increase the length of the longitudinal guiding edges 80 and 82.

The extensions 88 and 90 also have horizontal parts 92 and 94 which extend the plane of the bottom 62 with an insertion chamfer 96.

15 In order to fulfil the function of polarizing the position and orientation of the card C, the corner of the housing 58 corresponding to the intersection of the front transverse bottom edge 78 and the longitudinal edge 80 has a vertical face 98 inclined at 45°, which is complementary to the shape and the size
20 of the cut corner 64, as may be seen in Figure 15, when the card C is inserted into a correct position.

According to a technique known in the field of connectors for connecting smart cards, the insulating support 52 bears a series of electrical contact elements 100 which are made in the
25 form of elastically deformable blades, a free contact end 102 of which projects vertically above the plane of the bottom 62 in order to engage with the conducting pads on the lower face 76 of the card C.

In the example illustrated in the figures, the resilient
30 contact blades 100 are seven in number, five of these blades being aligned transversely near the front transverse bottom edge 78 of the housing 58 whereas two other blades are longitudinally offset rearwards so that their two contact ends 102 are longitudinally offset rearwards.

All the contact blades 100 are identical and each has a rear free connection end 104 in the form of a tab which terminates approximately in line with the rear transverse face 84, each end 104 here being designed in the form of a tab to be soldered to the surface of the upper face of the printed circuit board.

Each tab here is bent at 90° for soldering it to a track on a printed circuit board, but it may also be of the type suitable for insertion into plated-through holes.

So-called "solderless" versions may also be provided, in which the output tabs are in elastic bearing contact against the corresponding tracks on the printed circuit board. The vertical bearing is provided by the equipment which receives the connector, part of which bears on the cover 54, or else the connector is fixed to the printed circuit board by snap-fastening the earth tabs 132, 134, 136 and 138 (see earlier in the description) which are then, for example, designed in the shape of harpoons housed in plated-through holes in the printed circuit board.

The length bounded by the front transverse bottom edge 78 and the rear transverse face 84 is in this case roughly equal to about 1/3 of the total length of the card C.

Thus, as may more particularly be seen in Figure 3, about two thirds of the card C extends longitudinally rearwards out of the housing 58 in a cantilever fashion above the facing portion of the upper face of the printed circuit board.

As may also be seen in Figures 9 and 10, the length of the upper plate 60 of the cover 54, bounded by its front transverse edge 108 and rear transverse edge 110, is roughly equal to the length of the card C in the housing 58, that is to say its edges 108 and 110 lie approximately in line with the front transverse bottom edge 78 and the rear transverse edge 68 of the card C.

As may be seen in particular in Figure 3, the free connection ends 104 lie approximately in the plane of the lower plane face 57 of the insulating support 52.

In a general design, known for example from the above-mentioned French patent application, the metal cover 54 has, in order to mount it on the insulating support 52, two parallel and opposed lateral rims 120 and 122 which are extended vertically downwards along corresponding portions 116 and 118 of the vertical and external longitudinal faces of the insulating support 52 (see, for example, Figures 1 and 22).

The rims 120 and 122 are shaped in the form of slideways, that is to say they are extended horizontally under the insulating support 52 by horizontal arms 124 and 126 which are bent inwards and are received in corresponding housings formed in the lower face 57 of the insulating support 52 so as not to project from the plane of the latter.

Near its front transverse edge 108, the cover 54 may have two front lower horizontal tabs 132 and 134 which extend from the rims 120 and 122 so that the tabs 132, 134 can be soldered, for example by reflow, to the corresponding conducting tracks on the printed circuit board which are preferably connected to the earth plane of the electrical circuit of the printed circuit board so as to electrically connect the metal cover 54 to this earth plane.

Mechanically fastening, by soldering, the cover 54 by its solder tabs allows the connector 50 to be mechanically held in place at its front part without making use of any additional piece or component. In addition, this fastening of the front part balances the fastening of the rear part, provided by soldering the outputs 104. The vertical clearance existing between the cover 54 and the insulating support 52 provides automatic height adjustment when the connector is put into place in order for it to be soldered with its front part having the solder tabs which are always in contact.

The cover 54 also withstands the forces if a user tries to lift the card C which then bears against the plate of the cover 54 which is soldered to the plate P, no force being transmitted either to the support 52 or to the outputs 104.

As may especially be seen in Figure 1, the upper plate 60 of the cover 54 has a series of holes 61 which, like the contact ends 102, are oriented upwards, allowing the equipment to be tested after the components and the connectors have been soldered, by being directly connected to the ends which are accessible when a card C is absent.

A transverse slot 61' allows the output tabs 104 to be soldered and the soldered joints to be checked.

If it is desired to be able to view the upper face 74 of the card, in order to read its label, it is then possible to increase the slot 61', especially forwards, so as to expose the region facing the label.

If it is desired to improve the electromagnetic screening that the cover provides, it is possible to make the upper plate without any holes 61 or a slot 61'.

The rear part of the metal cover 54 is narrower than its front part which extends above the insulating support 52. Its reduced transverse width corresponds to the distance which separates the rear parts 120' and 122' of the vertical lateral rims.

As may especially be seen in Figures 3, 10 and 17, the metal cover 54 also has two lower horizontal cheeks 140 and 142 which are bent inwards and which extend the rear parts 120' and 122' of the lateral rims 120 and 122 at the rear of the extensions 88 and 90, in order to define two channels 141 and 143 for receiving and guiding the card, and which also help to seal the connector from the standpoint of electromagnetic screening.

Near its rear end, the cover 54 also has two rear solder tabs 136 and 138 similar to the two front lower horizontal tabs 132 and 134 which extend from the rims 120' and 122' under the cheeks 140 and 142 so that the tabs 136, 138 can be soldered, for example by reflow, to corresponding conducting tracks on the printed circuit board.

As may be seen for example in Figures 7 and 13, the cheeks 140 and 142 are vertically offset upwards with respect to

the plane in which the lower tabs 124 and 126 lie and also above the lower faces 89 and 91 of the extensions 88 and 90.

According to the teachings of the invention, the connector 50 includes card ejection means which are means actuated by manually acting on a pusher 144 which acts on an ejection lever 146 which engages with the upper portion of the 45° part forming the cut corner 64 of the front transverse edge 66 of the card C.

More specifically, near the inclined vertical face 98 of the housing 58, that is to say in the corner corresponding to the intersection of the rear transverse face 86 and the longitudinal face to the right (when considering Figure 1) of the insulating support 52, the upper face 56 of the latter has a recess or cavity 148 bounded by a horizontal bottom 150 which is open laterally in all directions and which houses the ejection lever 146.

The bottom 150 has a vertical hole 152 for mounting the lever 146 so that it pivots about a vertical pivot axis A1.

The lever 146 essentially consists of a triangular horizontal plate 154 bounded by a lower face 156 which bears on the bottom 150 of the recess 148 and below which extends a vertical pivot 158 which is housed so as to rotate in the hole 152.

As a variant (not shown), the pivot may consist of or be supplemented by a boss formed in the upper plate 60 of the cover 54. According to another variant, the pivot may be a boss formed so as to project from the upper face of the lever and which is housed so as to rotate in a hole in the upper plate of the cover.

The plate 154 is also bounded by an upper face 160 and by two perpendicular edges, a longitudinal edge 162 and a front transverse edge 164, and by an edge 166 inclined at 45°. The axis A1 is provided near the right front corner of the support 52.

The dimensions of the various elements are such that, when the lever is in its retracted position illustrated for example in Figures 11, 15 and 24, the edge 166 is in the vertical extension of the inclined face 98 of the housing 58 and the front transverse edge 164 is in the plane of the front transverse face 86 of the

support 52, whereas the plate 154 extends transversely outwards with respect to the plane of the right longitudinal face of the support 52 so that its corner 170 projects so as to be able to be "attacked" by the pusher 144 and to make it pivot, anticlockwise
5 when considering Figure 11, until it reaches its out position which is defined by the butting, against the front transverse edge 108 of the cover 54, of the vertical face 172 of a lug 174 formed so as to project from the upper face 160 of the plate 154.

The ejection lever 146 is preferably made of stamped metal
10 and it thus has sufficient strength if an excessive force is applied to the pusher 144.

The ejection pusher 144 is a part made of cut and folded sheet metal which is in the form of a yoke of longitudinal orientation and of cross section in the form of a U lying
15 horizontally, which straddles the right lateral edge of the connector.

The central arm of the U thus consists of a vertical lateral plate 176 forming the pusher proper, which extends longitudinally approximately over the entire length of the cover 54 and which is
20 adjacent to the longitudinal rim 120 of the cover.

The vertical front end edge 178 of the plate 176 engages with the corner or step 171 adjacent to the tip 170 of the plate 154 which projects transversely.

At its other, rear, longitudinal end 180, the plate 154 is
25 extended by a right-angled tab 182 for operating or actuating the pusher 144, which tab extends here, by way of example, transversely outwards.

As an alternative embodiment shown in Figure 30, the operating tab 182 may extend towards the rear and in the
30 extension of the plate 176 with a free end 183 which extends vertically upwards in order to be accessible from the top, for example through a slot made in a wall of the equipment or apparatus which receives the connector.

As may also be seen in Figure 30, the rear and upper part of the insulating support 52 has a recess 216 which is formed in the upper face 56 and which emerges longitudinally in the front transverse face 86 and in the housing 58.

5 This recess thus constitutes an opening formed in the rear face of the connector 50 which makes it possible to introduce a tool (not shown) into it in order to extract, from the housing 58, a foreign body or else a card which has been jammed in the housing, and/or a card of a non-standard type, which could not be
10 extracted by the ejection means 144 and 146. This recess 216 is, of course, also useful in the case of a connector without any ejection means and it is advantageously formed in the standard insulation common to the connectors with or without ejection means.

15 Each of the edges, upper edge 184 and lower edge 186 respectively, of the plate 176 is extended horizontally inwards by an upper flange 188 and a lower flange 190.

The upper flange 188 extends approximately over the entire length of the pusher and of the cover above the facing part
20 of the upper plate 60 of the cover 54, whereas the lower flange 190 is shorter and extends below the facing part of the lower cheek 140 of the cover 54.

Thus, the pusher is guided without any clearance in the vertical direction with respect to the cover 54 that it straddles,
25 that is to say with respect to the connector.

The total height of the connector is not increased over a connector without a card ejector since the thickness of the upper flange 188 is housed in the space for the card entry chamfer formed at the front transverse edge 110 of the plate 60 of the
30 cover 54, and the horizontal lower flange 190 is housed vertically between the lower face 57 of the insulating support and the cheek of the cover.

In order to guide the pusher so as to slide longitudinally and to retain it transversely, the upper horizontal flange 188 has

two aligned longitudinal slots 194, produced by cutting, each of which houses, so as to slide longitudinally, a vertical finger 196 which extends above the upper face of the plate 60 of the cover 54 and which is produced by drawing in the form of a plunged
5 boss.

Likewise, the lower flange 190 has a slot 198 which houses, so as to slide longitudinally, a vertical finger 200 which extends vertically below the lower face of the cheek 140 of the cover 54 and which is produced by drawing in the form of a
10 plunged boss.

Thus, the pusher 144 is perfectly guided and retained with respect to the cover 54. In addition, the interaction of each finger with the opposed longitudinal ends of the slot which houses it constitutes stop means which limit the longitudinal travel in both
15 directions of the pusher with respect to the cover.

As may be especially seen in Figure 1, the main upper plate of the cover 54 has two upwardly projecting reinforcing ribs 202 and 204. In line with the rib 202, the upper flange 188 has a slot 206 into which the rib 202 extends.

20 In order to mount the pusher 144 on the connector, and more specifically on the cover 54, the flanges 188 and 190 are moved slightly apart, by elastic deformation, and the pusher is fitted transversely inwards.

The operation of the ejection means is as follows.

25 Starting from the position illustrated in Figure 1, the card is inserted longitudinally, from the rear forwards, with its front transverse edge inserted into the channels 141 and 143 and then into the housing 58, so that its front transverse edge 64 butts against the front bottom edge 78 of the housing 58. If the card is
30 not correctly oriented, it cannot be inserted correctly and its rear part projects from the connector beyond the rear transverse edge 110 of the cover.

If during insertion, as may be seen in Figures 2 to 4, the ejection lever 146 is in its out position, in which it extends

inwards from the housing 58, the front transverse edge 64 of the card strikes the inclined edge 166 of the plate 154 so as to cause the lever 146 to pivot about its axis A1 in the anticlockwise direction when considering Figure 5.

5 This pivoting continues until the lever 146 is entirely retracted and the card reaches its fully inserted contact position. If the pusher 144 were also in the pushed-in rear position, the pivoting of the ejection lever 146 towards its retracted position would simultaneously cause the pusher to move back
10 longitudinally rearwards towards its set-back rear position because of the interaction of the step 171 of the tip 170 with the front edge 178 of the plate 176 and more particularly because of the interaction of the step 171 adjacent to the tip 170 with the edge 178.

15 To extract the card, starting from the position illustrated in Figures 9 to 15, the user pushes on the pusher 144, longitudinally from the rear forwards, by acting on the right-angled tab 182 for example.

 Pushing the pusher 144 longitudinally inwards causes the
20 edge 178 to move forwards, which edge firstly acts on the rounded tip 170 in order to allow gradual pivoting in the anticlockwise direction of the lever 146, the inclined edge 166 of which engages with the cut corner 64 and to cause the card to move back from being partially outside the connector until it again
25 occupies its position illustrated in Figure 2, in which the user can grip its rear end portion which projects beyond the rear transverse edge 110 of the cover 54.

 To prevent the card from being fully ejected, it is possible to provide card-braking means. As may be seen in the
30 embodiment of the cover illustrated in Figures 25 and 26, the braking means may consist of two blades 210 cut from the upper plate 60 of the cover 54 and the front free ends 211 of which blades 210, which extend vertically downwards, constitute card brake pads which interact with the upper face 74 of the card C.

This design is particularly advantageous since the card brakes interact with a portion of the longitudinal edges of the upper face of the card which has no electrical contact pads, especially in the case of a nine-pad MMC card which may have at least one pad
5 which is longitudinally offset rearwards.

According to an embodiment not shown, a spring may be provided for returning the pusher 144 to its set-back rear position which, when a card is absent, brings the right-angled tab 180 back into a rest position. The spring may, for example, be placed
10 in the space between the rim 120' and the plate 176.

As will have been understood, the same insulating support can be used to produce a connector without any ejection means, as illustrated in French Patent Application No. 98/11789, or a connector with manually operated ejection means as in the case
15 of the invention. In fact, all that is required is to provide a pusher 144 and an ejection lever 146.

In the case of a connector without any ejection means, the cover may be long, as described above, so as to maintain the electromagnetic screening properties over the entire extent of the
20 cover, or it may be short as in French Patent Application No. 98/11789. The connector then corresponds to the illustration in Figure 17 with a long cover but, of course, without the ejection lever 146.

A long cover may also serve for guiding the card into the
25 apparatus when the insulating support is far from the opening in the front wall of the equipment via which the card is inserted.

In the alternative embodiment of the cover illustrated in Figure 25, apart from the presence of the two card brakes 210, 211, the rear part of the upper plate, which extends longitudinally
30 beyond the slot 61', is apertured in a uniform pattern, here in diamonds 212.

This design makes it easier to solder the components borne by the printed circuit board and located beneath this apertured rear part of the cover 54, and it allows the soldered

joints to be visually inspected. The mass of the cover is reduced, as is therefore the total mass of the connector, something which is a desirable feature especially when the apparatus is a so-called portable telephone, the reduced weight of which constitutes an important feature.

The stiffness of the cover and its screening properties are barely modified, while the guiding of the cover is not affected.

If it is desired to have a connector raised with respect to the printed circuit board which bears it, the insulating support may have lower feet which extend from its lower face 57.

As illustrated in Figures 27 to 29, the face 57 may also have vertical studs 214, 215 for positioning the connector on the printed circuit board. In this case, the connection tabs 104 of the blades 102 and the solder tabs 132, 134, 136 and 138 are, of course, at a greater height in order to be soldered to the upper face of the printed circuit board.

Figures 31 to 46, which relate to the superposition of two connectors according to the invention, will now be described.

It may in fact be necessary, in the same equipment or apparatus, to connect at least two smart cards corresponding, for example, to two telecommunications networks or else to two bank networks, or else two cards making it possible to increase the storage capacity provided by the apparatus, or, finally, for specifying each card according to one particular type of data that it stores.

It is then necessary to have as many connectors as there are cards to be connected, and to do this in a minimum amount of space.

In the description which follows, the elements or components of the first, lower, connector will be denoted by the same reference numbers as previously but with the letter "A" as suffix and those of the second connector will have the letter "B" as suffix. Likewise, in the description of Figures 47 to 54, the

elements or components of the third, upper, connector will have the letter "C" as suffix.

In the stack shown in Figure 31, the lower connector 50A is identical overall to the connector 50 described above, except for
5 modifications allowing a second connector 50B to be superposed and especially allowing it to be positioned and held in the superposed position on the first connector 50A.

As may be seen especially in Figures 35 to 39, it is firstly the front end part of the insulating support 52A which is modified.

10 Apart from the step 216A already described above, the insulating support 52A is extended beyond its front transverse face 86A by two vertical bearing mounts 220A, 222A, the upper face of which is coplanar with the upper face 56A of the support 52A and in which a vertical hole 224A, 226A emerges, the said
15 hole being intended to house a vertical positioning stud 228B, 230B belonging to the connector 50B.

As may be seen especially in Figures 38 and 39, the increase in the length of the insulating support 52A towards the front, resulting from the presence of the two mounts 220A, 222A
20 of axial orientation, which are placed symmetrically transversely on either side of the step 216A - and therefore in the total length of the connector 50A - is very small compared with the first embodiment and the insulating 52A can therefore constitute the insulation common to the entire range of connectors intended to
25 be placed by their lower face on a printed circuit board, or raised with respect to the latter, whether or not these connectors are intended to house a second, superposed connector 50B.

The other modifications relate only to the metal cover 54A.

In fact, as may be seen especially in the details in Figures
30 35 to 37, each lateral rim 120A' and 122A' has, near its rear free end, a loop 234A, 236A in the form of a ring which extends transversely outwards in an approximately horizontal mid-plane of the corresponding lateral rim 120A', 122A'. Each loop 234A, 236A is produced as one piece by cutting and folding the sheet of the

cover and the corresponding cut or opening is of very small size and does not affect the screening nor the guiding of the card.

Each loop is open vertically, especially upwards, so as to allow a corresponding prong 262B, 264B, belonging to the cover
5 54B of the second connector 50B, to be inserted vertically downwards.

The annular upper face 235A, 237A of each loop 234A, 236A is plane and horizontal and constitutes a bearing and stop face in order to define the vertical position of the rear part of the
10 second connector 50B with respect to the first 50A, as will be described below.

The position and the size of the right loop 234A are such that it does not interfere with the ejection pusher 144A, which is in all aspects identical to the pusher 144 described above.

15 The transverse dimension of each loop is such that they do not increase the total transverse width of the cover 54A, given the rear end chamfers of the rims 120A' and 122A' and that, as a consequence, the same cover 54A can be used as a cover common to the entire range of connectors intended to be placed
20 via their lower face on a printed circuit board, or raised with respect to the latter, whether or not these connectors are intended to house a superposed second connector 50B.

The modifications made to the connector 50 described above, so that it can form a second connector 50B of a
25 superposable stack on a first connector 50A, will now be described.

As may be seen especially in Figures 40 to 46, the first modifications relate to the insulating support 52B and the contact blades 100B with their output or connection tabs 104B.

30 In fact, the insulating support 52B is extended beyond its transverse front end face 86B by an overall plate-shaped front extension 242B which extends to the same level as the bottom 62B of the housing 58B and the outputs are oriented forwards, that is to say they terminate approximately in line with the front

transverse face 244B of the plate 242B, each end 104B here being designed in the form of a tab to be soldered to the surface of the upper face of the printed circuit board.

The design of each contact blade 100B is overall identical
5 to that of the blades 100 or 100A, except for the total height of the output tabs 104B, which is increased so as to allow them to be soldered to the printed circuit board, in the same way as in the case of the raised connector in Figures 27 to 29.

The lateral edges of the plate 242B each have a thicker
10 part 246B, 248B, the upper faces 247B, 249B of which are coplanar with the bottom 150B of the cavity 148B which houses the ejection lever 146B. In its upper face 247B, 249B (which is coplanar with the upper face 56B of the insulating support 52B), each thicker part 246B, 248B has a vertical hole 250B, 252B
15 whose function will be explained below.

The lower face 57B of the insulating support 52B has, approximately in line with the front transverse face 86B, the two vertical studs 228B and 230B which are intended to be housed vertically in the holes 224A, 226A in the mounts 220A, 222A of
20 the first connector 50A.

As may be seen in Figures 41, 44 and 46, the mounts are of cylindrical overall shape and each have two raised flats so that their insertion into the holes 224A, 226A takes place with a slight interference.

25 The lower face 57B also has, approximately in line with the front end face 244B of the plate 242B, another pair of vertical studs 254B, 256B which extend vertically downwards and are symmetrically separated transversely by a distance corresponding to the transverse separation of the two holes 250B and 252B.

30 Each stud 254B, 256B is shouldered so as to define two lower shoulders 258B, 260B.

With regard to the cover 54B, and as may be seen especially in Figures 32 to 34, 41 and 42, each horizontal rim 120B', 122B' has a loop 234B, 236B identical to the loops 234A,

236A of the cover 54A of the lower connector 50A and has, in line with each loop 234B, 236B, a superposition prong 262B, 264B which is made as one piece by cutting and folding and which extends vertically downwards in a longitudinal plane slightly offset transversely outwards with respect to the lateral face of the corresponding rim 120B', 122B' so as to be vertically received, upwards in a corresponding loop 234A, 236A of the first, lower connector 50A during superposition of the connector 50B on the latter, this being done at the same time as the studs 228B, 230B are received in the holes 224A, 226A.

Each prong 262B, 264B has a lower free end 266B, 268B having a smaller dimension than its width so as to be able to be housed in its associated loop 234A, 236A and to define a lower shoulder 270B, 272B which bears vertically on the annular upper face 235A, 237A of the associated loop 234A, 236A in order to define the vertical position of the rear part of the cover 54B with respect to the rear part of the cover 54A.

Each free end 266B, 268B has a raised boss or "spot" 267B, 269B which, after mounting in the associated loop by elastic deformation, constitutes a stop for the vertical positional retention of the prong, which in particular prevents inopportune vibrations or movements of the cover 54B with respect to the cover 54A. The prongs are thus "snap-fastened" in the loops.

Apart from positioning the connector 50B in three directions with respect to the lower connector 50A, the prongs and loops also provide electrical earth continuity between the two covers 54A and 54B, the assembly of which constitutes screening cages which surround and enclose the MMC cards, together with the earth plane of the printed circuit board for the card housed in the lower connector.

At the front of the connector 50B, the vertical position of the latter with respect to the lower connector 50A is defined indirectly by the output tabs 104B bearing vertically on, and then

being soldered to, the upper face of the printed circuit board which also supports the first, lower connector 50A.

Thus, it is possible to ensure good coplanarity of the outputs 104A and outputs 104B with the printed circuit board, for the purpose of soldering, without any vertical geometrical offset
5 resulting from the superposition of the two connectors.

The only purpose of the slight interference of the studs 228B, 230B which are housed in the holes 224A, 226A is to preposition the upper connector with respect to the lower
10 connector during a first assembly phase and to allow, during the final assembly of the combination formed by the two preassembled connectors, a relative movement of the two insulations 52A and 52B in order to adjust the coplanarity of the output tabs 104A and 104B. Thus, all the superposed connectors
15 delivered to the customer have coplanar outputs which guarantee the reliability of the soldering to the printed circuit board.

As in the case of the lower connector 50A, the ejection pusher 144B of the second connector 50B is in all aspects identical to the pusher 144 according to the invention described
20 above.

As shown in Figures 47 to 52, it is possible to superpose more than two connectors, for example here three connectors 50A, 50B, 50C, using, right from the third "stage" of the stack, a connector overall identical to the second connector 50B with
25 regard to its stacking and positioning means with respect to the connector which is immediately below it.

This is because, as may be seen in the figures, the studs 254C, 256C of the third insulating support 52C are housed in facing holes 250B, 252B of the connector 50B with each lower
30 shoulder 258C, 260C bearing vertically against the facing upper face 247B, 249B of the thicker part 246B, 248B.

To the rear of the connector, the prongs 262C, 264C are received and retained vertically in the loops 234B, 236B of the second connector 50B.

According to one possibility, described in the document MultiMediaCard System Specification Version 2.11 Official Release @ June 1999 MMCA, an architecture exists which requires all the conducting pads of the same row or in the same position on several MMC cards to be connected together and requires data to be exchanged individually with each of the cards in a "BUS" arrangement controlled by a BUS master circuit for MMC cards.

Thus, it is then no longer necessary for each connector to allow connection of the pads on the MMC card that it bears with a corresponding and individualized set of conducting tracks on the printed circuit board.

The same set of conducting tracks, for example a set of seven transversely adjacent tracks, may then serve for simultaneously connecting the cards, which here are supported by the connectors of the upper two levels, with the processing circuits of the apparatus or equipment allowing BUS data exchange, each MMC-type card having specific circuits for producing the interrogation bus and for identifying each card.

For this purpose, the vertical output tabs 104B of the second connector 50B each have, near its right-angled upper end, a ring-shaped loop 247B which extends transversely forwards in a horizontal plane approximately coplanar with that of the plate 242B. Each loop 274B is made as one piece with the output tab 104B by cutting and folding. Each loop is open vertically, especially upwards, so as to allow insertion, vertically downwards, of the lower free end 105C of the corresponding output tab 104C of the third connector which is shaped "in the form of a tip" for this purpose, with a reduced width allowing it to be inserted vertically upwards into the loop 274B.

From one stage to the other, the elasticity of each output tab 104C, 105C makes it possible to absorb the offset equal to the thickness of the output tabs which thus do not need to be offset during manufacture.

The open annular lower face 275B of each loop 274B is plane and horizontal and constitutes a stop face for a protruding boss 276C formed on the front face of the lower end 105C of the corresponding output tab 104C of the third connector 50C.

5 Each output tab 104C is thus in electrical contact with the corresponding tab 104B of the connector 50B, which tab is itself connected to the printed circuit board.

Beyond the second stage, all the following connectors are identical to the third connector 50C, that is to say the lower ends
10 105n of a connector 50n are housed in the loops 274n-1 of the output tabs 104n-1 of the lower connector 50n-1.

According to another alternative embodiment, not shown, it is possible to design the first, lower connector also with its output tabs oriented forwards with loops for the output tabs of the
15 second connector so as to connect all the cards via a BUS and to produce a printed circuit board with only one set of conducting tracks for soldering the output tabs of the first connector.

If it is not possible to connect the cards via an interrogation bus, especially when the cards are not of the MMC
20 type, it is of course possible to superpose several connectors but the output tabs are respectively longer and longer towards the front and higher and higher towards the bottom so as to allow connection of each series of output tabs with a corresponding series of conducting tracks on the upper face of the printed circuit
25 board.

Such a configuration of the stack is illustrated in Figures 56 to 58 in which it may be seen that, apart from the conformation of the output tabs of the third connector 50C, all the other elements and components are identical to those described with
30 reference to Figures 47 to 52.

In this configuration, the shoulders 258C and 260C do not necessarily bear vertically against the faces 247B and 249B in so far as it is the coplanarity of the outputs 104B and 104C which

determines the relative vertical position of the two insulating supports 52B and 52C.

In the embodiment shown in Figures 59 to 72, it is possible to provide each connector 50 with a function of positively locking or retaining the card C in the inserted contact position in the connector, and to do so again without modifying the insulating support but only the cover 54 and its pusher 144.

For this purpose, a stop or retention lip 282, which engages with the rear edge 68 of the card C, is formed at the rear free end of a flexible blade 276 which is made as one piece by cutting in the pusher 144 near its rear end.

The flexible blade 276 preferably lies in the extension of the upper flange 188 from which it is separated by a longitudinal slot 278 so as to increase its length and to increase its capability of bending elastically about a horizontal transverse pivot axis formed by the fold 280 marked at the front longitudinal end of the tab.

The stop lip 282 consists of a downwardly bent-over part of the rear free end of the flexible blade 276.

Near its rear end, above its part facing the upper plate 60 of the cover 54, the rear part of the flexible blade has a boss 284 which projects below its lower face and which is capable, depending on whether the pusher is in one or other of its two extreme longitudinal positions, of being housed in one or other of two indexation holes, namely the rear indexation hole 286 and the front indexation hole 288, which are formed in the plate 60. The rear hole 286 consists, in the example illustrated in the figures, of a cut-out in the rear edge 110 of the plate 60.

The boss 284, when it "leaves" the rear hole 286, causes, by a cam or ramp effect, the stop lip 282 to be raised and moved aside and thus allows the card C to be ejected under the action of the lever 146.

The second front hole, which is optional, as may be seen in Figures 67 to 72, allows the pusher 144 to be indexed in the

pushed-in front position, thereby preventing, in the absence of a return spring, inopportune longitudinal movements of the pusher 144 due, for example, to the vibrations of the equipment or the apparatus.

5 Only the insertion again of a card then allows the pusher 144 to resume its rear position and the stop lip 282 is thus, in this case, always retracted and does not impede the insertion of the card.

10 As may be seen especially in Figures 60 and 62, the stop lip 282 is shaped with its rear lower face 290 inclined in the manner of an insertion chamfer and forming a cam for retracting the stop lip. Thus, if the pusher is in the set-back rear position before insertion of a card, it is nevertheless possible to insert the card which raises the lip 282 which is then moved aside, by
15 moving with the pusher, the card of which causes the forward travel.

 The arrangement of these stop means is, of course, applicable in the case of superposed connectors.

20 In the absence of a card in the connector, it may be desirable to "seal" the connector, that is to say to provide means which prevent the penetration of foreign bodies into the connector via the rear longitudinal end face forming the slot for inserting the card into the connector.

25 For this purpose, it is possible to adopt sealing means of the type described and shown in document WO-A-97/39418, and especially of the type shown in Figure 13 of that document.

 An example of such sealing means suitable for a connector according to the invention is shown in Figures 73 to 75.

30 For this purpose, the insulating support 52 of the connector 50 is modified in its rear part in order to have two opposed longitudinal slots 300 and 302, consisting of longitudinally and vertically offset lugs formed on the facing internal faces of the rear extensions 88 and 90 of the insulating support, in order to mount a closure device 304 in a fixed position.

The device 304 shown in Figure 74 essentially consists of a closure lip 306 of hollow semi-cylindrical curved overall outline, the convex upper face 308 of which is oriented upwards (see Figure 75) so as to lie within the cover 54 when there is no card in the connector.

For this purpose, as may be seen in Figure 73, the cheeks 140 and 142 are recessed in line with the tabs 136 and 138.

The closure lip 306 is joined to two longitudinal and opposed parallel arms 310 and 312, each of which is longitudinally inserted, via its front free end 314, 316, into the corresponding slot 300, 302 of the insulating support.

The closure device 304 is, for example, made by cutting and drawing a thin metal sheet.

As may be seen in Figure 74, the arms 310 and 312 which carry the closure lip 306 allow, by their flexing vertically, movements in a substantially vertical plane of the lip 306 between its position normally moved aside downwards when the card C is in place in the connector 50 and a normal rest position illustrated in Figure 75.

The closure lip 306 retracts automatically during insertion of the card C in so far as the front transverse edge 64 of the card C engages with the rounded upper face of the lip, which acts as a cam in order to elastically deform the arms 310, 312, the lip 306 then bearing against the facing portion of the lower face 76 of the card C.

Also shown partially in Figure 75 is the front wall 318 of the equipment which houses the connector 50 and which has a slot 320 into which the rear longitudinal end section of the cover 54 is housed.

The sealing means, which close off the entrance of the connector, are, of course, applied in the case of superposed connectors, especially in so far as they do not increase the overall height or the transverse width of the connector.

CLAIMS

1. Electrical connector (50) for a contact-type memory smart card (C) of rectangular overall shape, of the type comprising a support (52) made of insulating material which defines a housing (58) open in its upper face (56), bounded laterally by two parallel longitudinal edges (80, 82) and transversely by at least one front bottom edge (78) and which receives at least one front portion of a card (C) which is inserted longitudinally (I) from the rear forwards into the housing (58) in a direction parallel to the general plane of the card and having on its lower main face (76) conducting pads which are provided near a front transverse edge (66) of the card and which interact with contact ends (102) of electrical contact elements (100) provided in a bottom (62) of the housing of the support (52) when the card is in its contact position in which its front transverse edge (64, 66) butts against the front transverse bottom edge (78) of the housing, in which type the electrical contact elements are borne by the support, and of the type comprising actuated means (144, 146) for ejecting the card out of the housing, having a card ejection lever (146) which is mounted so as to pivot on the insulating support (52) near a bottom corner (98) of the housing (58), bounded by a longitudinal edge and by the transverse bottom edge (78), so that the lever (146) acts on a corresponding corner (64, 66) of the card due to the action of a pusher (144) mounted so as to slide longitudinally with respect to the insulating support (52), characterized in that it includes a metal cover (54) for holding the card (C) in the housing (58) which extends above the upper face (74) of the card and which is mounted on the insulating support, and in that the pusher for actuating the ejection lever is mounted so as to slide along the metal cover.

2. Connector according to the preceding claim, characterized in that the cover (54) is made in the form of an upper plate (60) which extends above the upper face (74) of the

card (C) and parallel lateral edges of which are extended by two lateral turned-down rims (120, 122) which are extended horizontally under the insulating support (52) by lower horizontal arms (124, 126) which are bent inwards so as to form slideways for mounting the cover (54) on the insulating support (52).

3. Connector according to the preceding claim, characterized in that the pusher (144) has a vertical lateral plate, adjacent to the lateral rim (120) of the cover (54) close to the said corner of the housing, which belongs to a yoke of cross section in the form of a U lying horizontally and which straddles the corresponding slideway of the cover.

4. Connector according to the preceding claim, characterized in that the yoke has two parallel flanges, an upper flange (188) and a lower flange (190), which are joined together by the vertical lateral plate (176) forming the pusher, and in that the upper flange (188) is adjacent to the upper plate (60) of the cover.

5. Connector according to the preceding claim, characterized in that means for guiding and transversely retaining the yoke on the cover (54) are provided between the yoke and the cover.

6. Connector according to the preceding claim, characterized in that the upper flange (188), or alternatively a facing part of the upper plate of the cover, has at least one longitudinal slot (194) for guiding and transversely retaining the yoke on the metal cover (54, 60) which slidably accommodates a vertical finger (196) formed so as to project from the facing part of the cover (54), or alternatively under the upper flange of the yoke.

7. Connector according to any one of Claims 2 to 6, characterized in that the upper plate (60) of the cover extends longitudinally rearwards so as to cover approximately the entire card (C) when the latter is in the contact position.

8. Connector according to the preceding claim, characterized in that each lateral edge (120-120', 122-122') of the cover extends approximately over the entire length of the cover (54).

5 9. Connector according to any one of the preceding claims, characterized in that the main portion of the body of the card (C) extends in a cantilever fashion rearwards beyond a rear transverse face (84) of the insulating support (52) and in that an upper face of a printed circuit board, which bears the connector
10 and which extends below that main portion of the body of the card (C) which is provided in a cantilever fashion out of the connector (50, 52), may bear other electronic components.

10 10. Connector according to the preceding claim taken in combination with Claim 8, characterized in that, beyond the said rear transverse face (84) of the insulating support (52), each lateral edge (120', 122') of the cover is extended horizontally under the upper plate (60) by a lower horizontal cheek (140, 142) bent inwards so as to form a channel (141, 143) for
20 accommodating the corresponding longitudinal edge of the card (C).

11. Connector according to the preceding claim, characterized in that the lower flange (190) of the yoke extends opposite the corresponding lower cheek (140) of the cover.

25 12. Connector according to the preceding claim, taken in combination with Claim 5, characterized in that the lower flange (190), or alternatively the facing part of the lower flange of the yoke, has at least one longitudinal slot (198) for guiding and transversely retaining the yoke on the metal cover which slidably accommodates a vertical finger (200) formed so as to project from
30 the facing part of the lower cheek (140) of the cover, or alternatively from the lower flange of the yoke.

13. Connector according to any one of the preceding claims, characterized in that the insulating support (52) is extended longitudinally rearwards beyond the said rear transverse

face (84) by two opposed lateral extensions (88, 90) in which the rear parts of the parallel longitudinal edges (80, 82) of the housing (58) for guiding the card (C, 70, 72) laterally are formed.

14. Connector according to any one of the preceding claims, characterized in that the front transverse edge (66) of the card has a cut corner (64), cut at approximately 45° , intended to engage with a corresponding surface (98) inclined at 45° and formed at one of the ends of the front transverse bottom edge (78) of the housing (58) in order to constitute polarization means defining a correct position of the card (C) in the housing (58) of the connector (50) and in that the ejection lever (146, 154, 166) acts on the cut corner (64) of the card (C).

15. Connector according to the preceding claim, characterized in that the insulating support (52) has, in the said bottom corner of the housing, a recess (148, 150) formed in its upper face (56) which accomodates the ejection lever (146).

16. Connector according to any one of the preceding claims, characterized in that the pusher (144) is a part made of cut and folded sheet metal.

20 17. Connector according to any one of the preceding claims, characterized in that the metal cover (54) for holding the card (C) in the housing (58) has tabs (132, 134, 136, 138) for fastening it by soldering to the upper face (51) of a plate which bears the connector (50), especially to conducting tracks connected to the earth plane of a printed circuit board.

25 18. Connector (50A, 50B, 50C) according to any one of the preceding claims, characterized in that it includes means for superposing another connector (50B, 50C) immediately above it and produced according to any one of the preceding claims.

30 19. Connector according to the preceding claim, characterized in that the said means have holes (224A, 226A, 250B, 252B, 250C, 252C) and complementary studs (228B, 230B, 254B, 256B, 254C, 256C) of the front part of the insulating support of the connector.

20. Connector according to Claim 18, characterized in that the said means include loops (234A, 236A, 234B, 236B, 234C, 236C) and complementary prongs (262B, 264B, 262C, 264C) of the rear part of the metal cover (54A, 54B, 54C).

5 21. Connector according to any one of Claims 18 to 20, characterized in that the connector has output tabs (104B, 104C) which extend vertically downwards beyond the front transverse face (244B, 244C) of its insulating support (52B-242B, 52C-242C).

10 22. Connector according to the preceding claim, characterized in that the output tabs (104C-105C) of the upper connector (50C) are electrically connected to the output tabs (104B-274B) of the connector (50B) which is immediately below it.

15 23. Connector according to any one of the preceding claims, characterized in that the cover (54) and the ejection pusher (144) include retractable means (282) for retaining the card (C) in the inserted contact position in the connector (50, 52).

20 24. Connector according to any one of the preceding claims, characterized in that closure means (304) are provided for at least partially closing off the slot for inserting the card into the connector.

25 25. Connector according to the preceding claim, characterized in that the closure means are elastically deformable means which, at rest, extend opposite the insertion slot and which are capable of automatically moving aside during insertion of the card (C).

ABSTRACT

The invention provides an electrical connector (50) for a chip or smart card (C), of the type comprising a support (52) made of insulating material which defines a housing (58) which receives a card (C), and of the type comprising actuated means (144, 146) for ejecting the card out of the housing, having a card ejection lever (146) which is mounted so as to pivot on the insulating support (52) so that the lever (146) acts on a corresponding corner (64, 66) of the card due to the action of a pusher (144) mounted so as to slide longitudinally with respect to the insulating support (52), characterized in that it includes a metal cover (54) for holding the card (C) in the housing (58) which extends above the upper face (74) of the card and which is mounted on the insulating support, and in that the pusher for actuating the ejection lever is mounted so as to slide along the metal cover.

Figure 1.