

The present invention concerns an electrical connector for electronic memory cards, of the type having on one of its main faces a plurality of electrical contact areas aligned parallel to the direction of insertion of the card in a read-write device and a front transverse edge perpendicular to the direction of insertion of the card, the connector having a support frame with first and second parallel flat faces and a plurality of electrical conductors in the form of elastically deformable blades extending parallel to the direction of insertion of the card, each contact blade comprising a curved end portion normally projecting beyond the first flat face on which the card slides so as to be in contact with one of the areas on the card when the latter is in the read position, each contact blade extending parallel to the direction of insertion of the card.

An electrical connector of this type is for example described in French patent application No 88 13988 of 26 October 1988.

When the card is inserted into the connector, the curved end portions of the contact blades cooperate firstly with the front edge of the card, which causes the elastic deflection thereof from their normal projecting position beyond the sliding stage of the card. The remainder of the insertion travel of the card until it reaches its final read position results in a prolonged rubbing of the curved convex areas of the end portions of the contact blades on the opposite face of the card.

These repeated impacts and rubbings, when a card is inserted and extracted each time, very rapidly cause wear to the curved end portion of the contact blades, the quality of the connection established between the card and the read-write device being rapidly affected thereby, notably because of the very rapid disappearance of the gold plating which is generally provided on these end portions.

In order to remedy this drawback, a chip card reader which comprises card guiding and positioning means, and contact elements which provide the electrical connection with conductive areas on the chip card and through which circuits relating to the appliance incorporating the chip card reader are established, is known through EP-A-0 376 087.

It also comprises notably a carriage which can move in translation with respect to a contact frame, having an idle position which it occupies in the absence of any card in the reader, under the effect of a return means, and an actuating position into which it is pushed by a card inserted into the reader, the said carriage being arranged so as to cooperate with the contact elements so that, when it is in the idle position, the carriage ensures that the contact elements are kept in an idle position in which they are outside the insertion path of a card and that, when it is in the actuating position, the carriage ensures that the contact elements come to bear on the contact positions of the card.

In addition, through EP-A-0 274 684, an integrated-circuit card reader is known which includes a contact support element mounted pivotally on a sliding element which is in abutment on a part of the integrated-circuit card which is to be inserted and which is moved by the integrated-circuit card. When the sliding element moves, the contact support element also moves and is tilted in the direction of the integrated-circuit card by fixed cams. Thus the contact elements of the support elements come into contact with the contacts of the printed circuit board.

The invention aims to improve still further the arrangements of the type described above.

Its object is therefore an electrical connector for electronic memory cards, of the type having on one of its main faces a plurality of electrical contact areas aligned parallel to the

direction of insertion of the card in a read-write device and a front transverse edge perpendicular to the said direction of insertion, the connector having a support frame with a first flat face on which the card slides and a second flat face parallel to the first and a plurality of electrical connectors in the form of elastically deformable blades extending parallel to the direction of insertion of the card, each contact blade comprising a curved end portion intended to be in contact with one of the areas on the card when the latter is in the read position, each contact blade extending parallel to the direction of insertion of the card, the said connector including a device for controlling the position of the said curved end portions of the contact blades which is mounted so as to be able to move with respect to the frame between a first idle position in which the curved end portions are retracted below the said first flat face and a second read position in which the curved end portions project beyond the plane of the first face, and means for controlling the movements of the control device according to the position of the card with respect to the frame, in accordance with EP-A-0 376 087, characterised in that the control device is a control bar connected to a control lever mounted so as to pivot on the support frame about an axis perpendicular to the direction of insertion of the card and parallel to the faces of the frame, a control cam being provided on the lever in order to cooperate with the transverse edge of the card when the latter reaches the end of its insertion travel in the read-write device and to cause the lever to pivot in the direction corresponding to the movement of the control bar to its read position.

According to other characteristics of the invention:

- the control bar extends perpendicularly to the direction of the contact blades and cooperates with the free ends, in the form of a tip, of each blade which extend the curved end portions;

- the control bar is pushed elastically towards its normal idle position and the control means act against the elastic restoring force of the control bar;
- the control lever is a lever pivoting about a central axis, the control bar and control cam each being arranged respectively in the vicinity of one of the two ends of the lever;
- the lever has two parallel side members connected together by the control bar and which extend on each side of a group of parallel contact blades;
- the central pivot axis includes two pivots which extend laterally outwards from the side member and which are received respectively in two corresponding housings in the frame forming pivot bearings;
- the elastic return means include at least one compression spring received in a housing in the frame and which acts on the free end of the lever in the vicinity of which the control cam is arranged;
- the lever acts on an electrical switch for detecting the end of insertion travel of the card by means of a transverse lug, one face of which cooperates with a component for triggering the electrical switch and which is disposed substantially at the end of the lever in the vicinity of which the control cam is arranged.

Other characteristics and advantages of the invention will emerge from a reading of the following detailed description, for an understanding of which reference will be made to the accompanying drawings in which:

- Figure 1 is a plan view of an electrical connector produced in accordance with the disclosure of the invention and which

is shown without its cover;

- Figure 2 is a view in section along the line 2-2 in Figure 1, the connector being shown with a card inserted in the read position;
- Figure 3 is a partial view similar to the one in Figure 2, showing the connector without a card; and
- Figure 4 is a detailed view in section along the line 4-4 in Figure 1.

The overall design of the electrical connector, the main components of which are shown in the figures, corresponds to the design of the one described and shown in French patent application No 88 13988, to the contents of which reference may be made for a detailed description of its design, structure and production method.

The electrical connector comprises a support frame 10, rectangular in shape overall, which comprises a substantially rectangular opening 12 in which are arranged electrical conductors in the form of deformable elastic blades 14 which extend parallel to the direction of insertion I of an electronic memory card C, the silhouette of which has been shown in dot-and-dash lines in Figure 1.

A slot F for inserting the card C is defined partially in the top face 20 of the support frame 10.

The slot F is defined laterally by two guide portions 22 and is supplemented by a closing cover 18 shown in Figures 2 to 4.

Each contact blade 14 has a main part 24 which connects a first end portion 26 to a second free end 28 which enables electrical connection to be made to a processing circuit (not shown).

The second free end 28 is connected to the main part 24 by a connecting portion 30 onto which the plastic constituting the support frame 10 is moulded when the connector is manufactured.

In the absence of cards and if a control bar were not provided in accordance with the disclosure of the invention, the curved end 26 of each blade 14 would occupy the position 26' shown in dotted lines in Figure 2, in which it projects vertically beyond the flat top face 20 of the support frame 10.

The elastic blades 14 are designed so as to be able to exert an elastic contact force, in a direction substantially perpendicular to the plane of the face 20, which is particularly high and may for example attain 0.5 newtons per contact point on the memory card C when the latter is in its read position.

According to the invention, the connector has a bar 32 for controlling the position of the curved end contact portions 26 of the blades 14.

The bar 32 is a transverse bar with a T-shaped cross section (see Figures 2 and 3) which extends in a direction perpendicular to the direction of insertion I of the card.

Each of the opposite arms 34 of the T-shaped bar is able to cooperate through its bottom face with an end in the form of a tip 36 which extends the curved end portion 26 of each contact blade 14 in a direction substantially merged with that of the main portions 24.

The control bar 32 connects together two parallel longitudinal side members 38 so as to form a lever 40 for controlling the movements of the control bar 32.

Each of the side members 38 has a pivot 42 which extends laterally outwards and which is received in a corresponding housing 44 in the support frame 10 in which it fits elastically and which forms a pivot bearing for defining the pivot axis X-X of the control lever 40.

In accordance with the standards in force at the time of the invention, the total number of contacts on the card is less than or equal to sixteen and the frame shown in Figure 1 corresponds to this maximum number of 16.

The two side members 38 extend on each side of a group of contact blades 14 from the control bar 32 as far as an opposite complementary cross member, which completes the structure of the lever.

The lever 40 is designed so as to be situated entirely within the thickness of the support frame 10 delimited by its top face 20 and its opposite flat bottom face 48.

The lever 40 normally occupies its idle position shown in Figure 1 and 3, towards which it is pushed elastically by two helical return springs 50, which are received in complementary housings 52 in the support frame 10 and which cooperate with the opposite faces 54 of two lateral end lugs 56 which extend laterally from the side members 38 in the end area of the cross member 46.

As can be seen in Figure 3, the action of the springs 50 has the effect of causing the clockwise rotation, as seen in this figure, of the lever 40 about its axis X-X. This normal idle position is defined by a stop face 58 formed on the lever 50 which cooperates with the bottom face of the cover 18.

In this idle position, the control bar 32 occupies a bottom position in which the arms 34 bear against the tips 36 of the blades 14 so as to bring about the retraction of the curved

end portions 26 below the flat top face 20 of the support frame 10 on which a card C slides when it is inserted into the electrical connector.

On the top face of the cross member 46 in the vicinity of the left-hand free end of the lever 40, as seen in the figures, a projecting surface 60 is provided, forming a cam for controlling the pivoting movements of the lever 40 about its axis X-X and therefore of the control bar 32.

The cam surface 60 is inclined and is designed to cooperate with the front transverse edge 16 of the card when the latter is inserted into the slot F.

As can be seen in Figure 1, the lateral lug 56 of the control lever 40 is extended laterally beyond the area of the spring 50 so as to form a control lug 62 for triggering an electrical switch 64 for detecting the end of insertion travel of the card C.

The switch 64 can be of any known type and notably a sealed microswitch, in the shape of a right-angled parallelepiped, arranged flat in a complementary housing 66 formed in the support frame 10.

Control of the triggering device (not shown) for the switch 64 is provided by the control lug 62 on the bottom face of which a stud 68 can be provided, forming a triggering pusher.

The mode of functioning of the electrical connector will now be described with reference in particular to Figures 2 and 3.

When the electrical connector is empty, all its components occupy the position shown in Figure 3, in which it can be seen that it is possible to insert a card into the slot F without its front edge 16 or its bottom sliding face, which cooperates with the top face 20 of the support frame 10, coming up

against or rubbing on the curved end portions 26 of the contact blades 14. This is because these portions 26 are held in the retracted position below the face 20 by the control bar 32, as illustrated in Figure 3.

When a card C is inserted and the latter arrives close to its end of insertion travel, its front transverse edge 16 comes into contact with the control cam surface 60 so as to cause the tilting of the control lever 40 about its axis X-X in the anti-clockwise direction, as seen in Figure 3, against the elastic restoring force applied to it by the springs 50.

This tilting movement has the effect of causing the movement of the control bar 32 in a substantially vertical direction until it comes to occupy its top read position shown in Figure 2, in which its arms 34 no longer cooperate with the tips 36 of the blades 14.

During this pivoting, the blades 14 also move up in the direction of the card C under the effect of their inherent elasticity so that their curved end portions 26 come into contact with the corresponding bottom face of the card 16.

In the read position, as shown in Figure 2, the front end of the card 16 bears on the stop surface 58, the springs 50 having the effect of providing a slight gripping of the card between the surface 58 and the bottom face of the cover 18 in order to ensure firm holding thereof in the axial position.

The curved contact portions 26 therefore "land" on the contact areas of the card in practice only when the latter is in the read position, the length of the rubbing travel thus being particularly short, of the order of approximately 1 mm, this reduced travel assisting moreover a "self-cleaning" of the contacts.

The geometry of the slope in the form of a cam 60 which controls the tilting of the lever 40 is designed so that the force required for inserting the card in the connector is substantially constant between the start of the stage in which the front edge of the card impinges on the cam 60 and the end of insertion of the card limited by a mechanical stop provided either on the support frame 10 or at the end of the side member 38.

By virtue of this design, it is possible to dispose the end-of-travel switch 64 in a horizontal position and thus to limit the thickness of the connector, whilst making the change of state of the switch 64 conform to the safety standards for the use of microcircuit cards.

As a variant (not shown), it is possible to incorporate, in the lever 40, a moulded-on metal insert in the form of a plate, portions of which could form the lugs 56 and 62. Likewise, the springs 50 could be replaced by elastic tongues forming part of the reinforcing insert.

CLAIMS

1. Electrical connector for electronic memory cards (C), of the type having on one of its main faces a plurality of electrical contact areas aligned parallel to the direction (I) of insertion of the card in a read-write device and a front transverse edge (16) perpendicular to the said direction of insertion, the connector having a support frame (10) with a first flat face (20) on which the card slides and a second flat face (48) parallel to the first and a plurality of electrical connectors in the form of elastically deformable blades (14) extending parallel to the direction of insertion of the card, each contact blade comprising a curved end portion (26) intended to be in contact with one of the areas on the card when the latter is in the read position, each contact blade (14) extending parallel to the direction of insertion of the card, the said connector including a device (32) for controlling the position of the said curved end portions (26) of the contact blades (14) which is mounted so as to be able to move with respect to the frame (10) between a first idle position in which the curved end portions (26) are retracted below the said first flat face (20) and a second read position in which the curved end portions (26) project beyond the plane of the first face, and means (40) for controlling the movements of the control device (32) according to the position of the card (C) with respect to the frame (10), characterised in that the control device is a control bar connected to a control lever (40) mounted so as to pivot on the support frame (10) about an axis (X-X) perpendicular to the direction of insertion of the card and parallel to the faces of the frame, a control cam (60) being provided on the lever in order to cooperate with the transverse edge of the card when the latter reaches the end of its insertion travel in the read-write device and to cause the lever (40) to pivot in the direction corresponding to the movement of the control bar (32) to its read position.



2. Connector according to Claim 1, characterised in that the bar (32) extends perpendicularly to the direction of the contact blades (14) and cooperates with the free ends, in the form of a tip (36), of each blade (14) which extend the said curved end portions (26).
3. Connector according to one of Claims 1 or 2, characterised in that the bar (32) is pushed elastically towards its normal idle position and in that the said control means (40) act against the elastic restoring force of the control bar (32).
4. Connector according to Claim 1, characterised in that the control lever (40) is a lever pivoting about a central axis (X-X), the control bar (32) and control cam (60) each being arranged respectively in the vicinity of one of the two ends of the lever.
5. Connector according to one of Claims 1 or 4, characterised in that the lever has two parallel side members (38) connected together by the control bar and which extend on each side of a group of parallel contact blades (14).
6. Connector according to Claim 5 taken in combination with Claim 4, characterised in that the central pivot axis includes two pivots (42) which extend laterally outwards from the said side members and which are received respectively in two corresponding housings (44) in the frame forming pivot bearings.
7. Connector according to any one of Claims 1 to 6, characterised in that the said elastic return means include at least one compression spring (50) received in a housing in the frame and which acts on the free end of the lever in the vicinity of which the control cam (60) is arranged.
8. Connector according to any one of the preceding claims, characterised in that the control lever acts on an electrical



switch (64) for detecting the end of insertion travel of the card.

9. Connector according to Claim 8, characterised in that the lever has a transverse lug (62), one face of which cooperates with a component for triggering the electrical end of travel switch (64).

10. Connector according to Claim 9 taken in combination with any one of Claims 4 to 6, characterised in that the said lug (62) is disposed substantially at the end of the lever (40) in the vicinity of which the control cam (60) is arranged.

