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The present invention relates to IC card readers. IC cards are cards including at least one electronic component with which electrical connections are to be established in a reader integrated in an apparatus which is operated by this type of card (e.g. a bank terminal or a pay phone).

In general, IC card readers comprise means for guiding or positioning the card, means for verifying that a card is present in the reader, and is present in an appropriate position, and also contact elements for providing electrical connection with conducting pads on the IC card via which circuits are established to the apparatus including the IC card reader.

One such IC card reader is described in French patent number 2 534 713. The guide means therein are surfaces associated with the structure of the reader. The presence of a card is verified by means of an end-of-stroke microswitch and the contact elements are resilient metal blades mounted in a frame of insulating material.

There are thus three independent parts and assembly thereof is not described in detail. Unfortunately, given the dimensions of the parts coming into contact, in particular, such a structure requires the various parts to be assembled accurately every time, and not only is it expensive, but given the accumulated assembly tolerances on the various parts, this may also lead to it being impossible, in practice, to satisfy the requirements of the user. In addition, the actual assembly is left to the manufacturer of the apparatus, whereas such a manufacturer would find it appreciably easier to use a unit component which did not require any special precautions.

Further, a microswitch is a relatively expensive component for such an application even if use of a microswitch is justified by difficult environmental conditions (card dust, humidity, ...).

European patent application number 0 231 409 describes an IC card reader comprising a self-contained assembly made of a plurality of assembled pieces in accordance with the above description such that the same observations apply thereto.

5 The object of the present invention is thus to provide a contact frame for an IC card reader in which the end-of-stroke contact is integrated in a unitary structure together, at least, with the contact elements for making connections with the IC card, while nevertheless satisfying requirements
10 due to environmental conditions.

 The contact frame of the invention is characterized by the fact that in addition to the contact elements for making connections to the IC card, it includes two electric contact blades carried by said frame and constituting an end-of-stroke
15 contact, with one of said blades, a "fixed" blade, being coupled to the frame in such a manner that its stationary position relative to the frame is defined, while the other blade, a moving blade, is urged by a resilient force in a direction opposite to the direction in which a card is inserted
20 into the reader, and is disposed in such a manner that a card being inserted comes into abutment thereagainst and imparts actuating motion thereto against its resilient force. This end-of-stroke contact is of the self-cleaning type. To this end, the "fixed" blade preferably includes a retaining finger,
25 and two abutments are formed in the substance of the frame. The abutments are advantageously constituted by two opposite edges of a slot made in the frame and in which the retaining finger is engaged.

 The various objects and characteristics of the present
30 invention are now described in greater detail in the following description which is made by way of non-limiting example and with reference to the accompanying drawings, in which:

 Figure 1 is a perspective view of a contact frame in accordance with the present invention;

35 Figure 2 is a plan view of the Figure 1 frame;

Figure 3 is an end view of the Figure 1 frame, with a lid constituting the card-guiding slideways;

Figure 4 is a plan view of the "fixed" blade of the end-of-stroke contact 5 shown in Figures 1 and 2; and

5 Figure 5 is a plan view of the moving contact blade of the end-of-stroke contact 5 shown in Figures 1 and 2.

Figure 1 is a perspective view of a contact frame 1 designed in accordance with the present invention and showing an IC card 2 in position to be inserted. For the purposes of
10 this description, these two parts are shown upsidedown relative to the normal position thereof in which the card is presented with its contact zone on top and in which the contact frame 1 should therefore be disposed above the card and facing the card. The frame essentially comprises a part 3 made of molded
15 insulating material and acting simultaneously: as a support for contact elements 4 used for making connections with the integrated circuit (IC) on the card 2; as a support for an end-of-stroke contact 5 for indicating that a card is present in the reader and is properly positioned for the purposes of being
20 read; and as a support at least for slideways 6 for guiding the card and intended to lead it to the above-mentioned correct position.

To this end, the contact frame 1 comprises an inner frame 7 constituted by portions of the frame 1 delimiting connection
25 windows 8, 9, 10, and 11. The contact elements 4 extend into these windows from bars 13 and 12 in which they are overmolded. It can thus be understood that the positions of the contact elements 4 are determined by the positions of a portion of the mold used for forming the frame 1. The contact elements 4 are
30 shaped and they project above the plane 14 of the surface of the frame 1. They are intended to come into contact with contact pads in the connection zone 15 of the card 2 when the card is properly inserted in the IC card reader. With reference to Figure 2 which is a plan view of the Figure 1 contact
35 frame, it can be seen that the windows 8 to 11 include inden-

tations 16 which protect the ends of the contact elements 4.

The inner frame 7, as shown in Figures 1 and 2, is extended by two extensions 17 and 18 which terminate at their ends furthest from the inner frame 7 in slideway supports 6.

5 These supports 6 are mere flat surfaces, each provided with at least one centering peg 19 or 20. Other slideway positioning means could be provided instead of or in addition to those mentioned above. Further, the centering pegs such as those

10 shown in Figures 1 and 2 may also serve as fixing means (e.g. by rivets) for the slideways. Reference is made to Figure 3 which is an end view of the frame 1 as shown in Figures 1 and 2, shown the usual way up, this time. It can be seen that

slideways 21 and 22 are both formed in a piece of molded insulating material 23 constituting a lid and mounted on the support 6 of the frame 1. This piece 23 is accurately positioned relative to the frame 1 by the centering pegs 19 and

15 20. It guides the card 2 by engaging its edges. If the same portion of the mold as that which defines the positions of the contact elements 4 also serves for defining the surfaces 6 and the centering pegs 19 and 20, then the positioning of the card

20 1 relative to the contact elements 4 is obtained with a degree of accuracy which is now related solely to the care with which the mold is made for forming the frame 1 and to the assembly tolerances between the frame 1 and the lid part 23, which

25 assembly is performed in the factory, i.e. with narrow tolerances.

As can be seen in Figures 1 and 2, the extensions 18 and 19 are perforated with relatively large holes 24 in order to save material.

30 The contact frame also carries the end-of-stroke contact 5 and an end-of-stroke abutment 25. The end-of-stroke contact 5 is a normally closed contact which is opened by the card shortly before it comes into abutment against the end-of-stroke abutment 25 by pressing against the end 27 of a moving

35 blade 26, thereby separating the blade from the fixed contact

blade 28. The two blades are force-fitted in slots 29 and 30 provided in the frame 1, thereby ensuring that they are accurately positioned. Further, the abutment 25 ensures that the card is properly positioned in the IC card reader.

5 Naturally, the end-of-stroke contact could be a normally open contact which closes instead of opening.

Finally, Figures 1 and 2 show a pusher 31 which is integrally molded with the frame 1 and which is a resilient blade for pressing the IC card 2 against the piece 23, thereby
10 defining the distance of the card from the contact elements 4.

As can be seen in Figure 3, this pusher may alternatively be integrally formed with the piece 23, extending from the end thereof which is not reached by the card, and being cantilevered back from that end towards the
15 center of the frame 1. Its end 34 is shaped so as to be cammed away by the leading edge of the card 2, after which it exerts pressure on the card by means of a surface which is rounded so as to avoid damaging the card.

It may also be observed that the opening via which the IC
20 card is inserted is chamfered at 32 in conventional manner.

The end-of-stroke contact 5 is a self-cleaning contact. It comprises two contact blades 26 and 28 which are inserted in two slots 29 and 30 in the frame 1, made in a contact support
25 33 which constitutes a kind of block projecting proud from the surface 14 of the frame 1 and from which the blades extend sideways at such a height that the end 27 of the moving blade lies in the path of a card 2 reaching the end of its stroke in the reader. It may be assumed that the two blades are hinged where they leave the block 33. Their respective hinge points
30 are relatively far apart by virtue of the block 33 being suitably shaped. The fixed blade 28 which is shown in plan view in Figure 4 thus comprises a blade end 35 which is inserted in the frame 1 with only a connection pin 45 projecting beyond the other side of the frame 1. The arm 36 of
35 the blade is cantilevered out parallel to the surface 14 of the

frame 1 and is terminated by a shaped contact surface 37 having a retaining finger 38 extending down therefrom. The retaining finger penetrates into a slot 39 made in the frame 1, which slot may be square in shape having two bearing surfaces 40 and 41 constituting abutments for the retaining finger 38. In the stationary position, the fixed blade 28 is prestressed in such a way as to be subjected to a resilient force urging it in the card insertion direction. The moving blade 26 which is shown in plan view in Figure 5 comprises a blade end 42, a cantilevered arm 43, a contact surface 44, and a moving end 27 which is folded to act as an actuating cam (see Figures 1 and 2). This blade is prestressed in such a manner as to exert a resilient force towards the fixed blade 28. The force exerted by the moving blade 26 is greater than the force exerted by the fixed blade 28 such that in the stationary position both blades are pressed together against the abutment 40 of the slot 39.

When a card is inserted so as to press against the moving end 27 of the blade 26, the blade 26 moves in the card insertion direction and the blade 28 follows it by virtue of its own prestress. Since the hinge points of the two blades are at a distance apart from each other, the two contact surfaces rub against each other along the axial direction of the arms 36 and 43, thereby producing a self-cleaning effect on the contact. When the retaining finger 38 of the fixed blade encounters the abutment 41, contact between the two blades is interrupted. This indicates that the card is fully inserted. The card is thus about to reach the abutment 24 which will prevent it from moving any further. It may be observed, given the friction forces and in particular the friction force produced by the pusher 31, that the card 2 may be left fully inserted in the card reader in spite of the return force due to the moving blade 26.

If the end-of-stroke contact 5 were designed as a normally open switch, which possibility has already been mentioned above, then the moving blade 26 would be in front of the fixed

blade 28, but the remainder of the structure would be unaltered except for specific dimensions, with the axial positions of the items being such that the contact 5 closes when the card is in exactly the same position that causes the contact to open as described above.

In either event, the advantages are the same. The end-of-stroke contact is included in a unit component which also includes the connection contact elements, thereby simplifying assembly of the card reader and solving assembly tolerance problems. It is of the self-cleaning type, thereby ensuring that good quality contact is retained over time. The "fixed" blade is free to move between two abutments, thereby providing the necessary accompanying stroke for contact-cleaning purposes while still accurately defining the position where contact is broken, or more precisely where the closed-to-open changeover occurs. This changeover point corresponds to a position of the IC card in which reading becomes possible (normally closed contact) or in which reading becomes no longer possible (normally opened contact).

Naturally, the above description is given by way of non-limiting example and numerous variants may be envisaged without going beyond the scope of the invention.



CLAIMS

1/ A contact frame for an IC card reader including contact elements for making connections with the IC card, characterized in that it further includes two

5 electric contact blades (26, 28) carried by said frame and constituting an end-of-stroke contact (5), with one of said blades, a "fixed" blade (28), being coupled to the frame in such a manner that its stationary position relative to the frame is defined, while the other blade, a moving blade (26),
10 is urged by a resilient force in a direction opposite to the direction in which a card is inserted into the reader, and is disposed in such a manner that a card being inserted comes into abutment thereagainst and imparts actuating motion thereto against its resilient force.

15 2/ A contact frame according to claim 1, characterized in that the coupling between the "fixed" blade (28) and the frame is such as to leave it free between two abutments (40, 41), with the "fixed" blade (28) being resiliently maintained against one
20 of the abutments in the stationary position and accompanying the moving blade (26) during its actuating motion while passing from one of the abutments to the other.

3/ A contact frame according to claim 2, characterized in that
25 the "fixed" contact blade (28) includes a retaining finger (38) and in that said two abutments (40, 41) are formed in the material of the frame (1), with the retaining finger co-operating with said two abutments in order to limit the accompanying motion of the "fixed" blade.

30 4/ A contact frame according to claim 3, characterized in that said abutments are two opposite sides of a slot (39) made through the material of the frame, with said retaining finger (38) extending into said slot.

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5/ A contact frame according to any preceding claim,
characterized in that the end-of-stroke contact (5) is of the
normally closed type.