9601953-4 EPOS IPO S

REPLACED SHEETS SG
☐ Description : paged ..... to paged .....
☐ Claim(s) : paged ..... to paged .....
☑ Drawing(s) : paged 1/3 to paged 3/3
☑ Abstract : paged 15 to paged —
DATE OF RECEIPT .....

A data carrier having an integrated circuit

The present invention relates to a data carrier having an integrated circuit according to the preamble of claim 1, and to a method for producing such a data carrier.

Data carriers having integrated circuits are used, for example, as identity cards, credit cards, booking cards or the like. One possibility of producing such cards is to glue a so-called module or carrier element into a matching recess in the card body. The modules or carrier elements, which are preferably stamped out of an endless film, generally comprise a substrate on which one or more integrated circuits are connected with conductive paths. The conductive paths lead to contact surfaces located on the substrate which permit communication with appropriate devices. The IC module and the conductive paths leading from the IC module to the contact surfaces are preferably surrounded by a casting compound. Many methods are already known for connecting the module with the card body.

For example, EP-A 0 299 530 discloses connecting the carrier element with the card body in a matching recess in the card with the aid of a thermally activated adhesive layer. In the known solution the heat-sealing layer has a double function. It serves not only to connect the carrier element with the card but also to form a limiting frame for the casting compound. For this purpose, an adhesive layer having a recess in the area of the IC module is applied to the substrate prepared with the IC module, the conductive

paths and the contact surfaces. The area formed by the recess is then filled with a casting compound, the dosage of the compound being adjusted in such a way that the IC module is completely enclosed but the adhesive layer limiting the casting compound remains completely free.

The use of a thermally activated adhesive layer for connecting a carrier element with a card body is also known from EP-A 0 334 733. In this known solution a two-step recess is provided in the card body. A first recess serves to take up the substrate, while a second, deeper recess disposed within the first is provided to take up the integrated circuit. The carrier element is bonded to the card body on the shoulder area of the deeper recess. A heat-sealing film stamped in a ring shape is inserted for bonding in the recess in advance. After the carrier element is inserted it is connected with the card body under the action of heat and pressure.

Since the adhesive ring is stamped independently of the carrier element and inserted into the recess in the card in advance, all tolerances in the dimensions of the recess, the adhesive ring and the carrier element have an influence on the position of the carrier element and adhesive ring in the recess. This means that the available adhesive surface is generally not totally utilized, which necessarily reduces the strength of the bond between the carrier element and the card.

When the carrier element is bonded to the card body under the action of heat and pressure, an epoxy resin drop located on the bottom of the blind hole in the recess also bonds with the IC module. The hardened resin is intended to improve the mechanical resistance of the bottom area of the

recess. However, this measure seems to have the disadvantage that the IC module is subjected to a strong mechanical lumped load in the bottom area of the blind hole when the card is bent accordingly due to the stiffening of the hardened epoxy resin. Furthermore, the bond produced by the heat-sealing layer between the carrier element and the card body is loaded considerably in case of bending stresses due to the stiffening in the bottom area of the blind hole. This can cause the adhesive layer to be detached from the carrier element or the card.

The present invention is based on the problem of obtaining a very good and lasting connection when bonding a carrier element to a data carrier with the aid of a thermally activated heat-sealing layer, while simultaneously protecting the integrated circuit well from mechanical loads.

This problem is solved by the features stated in the characterizing part of the main claim.

The invention starts out from an endless film on which integrated circuits are mounted and provided with a casting compound. This endless film is brought together with a thermally activated adhesive film. The adhesive film has openings which are dimensioned and positioned relative to the carrier film in such a way that the adhesive layer at least partly covers not only the carrier film but also the casting compound in the edge areas. The carrier elements are stamped out of the endless material jointly with the adhesive layer. The carrier element provided in this way with an adhesive layer is connected with the card material in a two-step recess in a data carrier under the action of heat and pressure.

The inventive solution makes it possible to utilize the entire available adhesive surface in the recess independently of tolerances in every case. One thus achieves a uniform, large-surface and lasting bond between the carrier element and the card body. Due to the recess in the adhesive layer a cavity remains between the casting compound of the carrier element, on the one hand, and the bottom area of the blind hole in the recess, on the other hand. This cavity gives the IC module and the casting compound a certain freedom of movement when there are bending stresses on the card body, thereby relieving the IC module. Pressure stresses in the area of the carrier elements are not transmitted directly to the IC module. Since there is no bond between the cast body and the generally very thin bottom area of the recess, the thermal load of the card material in the bottom area is very low during incorporation of the carrier element. It has been shown that the back card surface opposite the carrier element therefore shows no distortions or deformations in the area of the bottom. This is particularly important when the back of the card is to be printed, for example, in which case a particularly flat surface is desirable.

In the inventive procedure the carrier element is always connected with the card body via the adhesive layer in the edge area of the cast body as well, which further improves the overall adhesion between the carrier element and the card body.

Further advantages and developments of the invention can be found in the subclaims and in the embodiment examples described in the following with reference to the figures, in which

Fig. 1 shows an identity card with an incorporated carrier element from the front,

Fig. 2 shows a carrier film with IC modules disposed thereon and with a heat sealing film in cross section,

Fig. 3 shows an identity card with an incorporated carrier element as in Fig. 1 in cross section,

Figs. 4a to 4c show a method for producing an identity card as in Fig. 3, and

Fig. 5 shows a heat-sealing layer.

Fig. 1 shows, as an exemplary embodiment of a data carrier, an identity card 1 with an incorporated carrier element 11 having contact surfaces 9 located on its surface. Identity card 1 can be constructed of a single layer or of several layers.

Fig. 2 shows a sectional view of part of a heat-sealing band 17 connected with carrier film 8. Carrier film 8 serves to take up IC modules 5 in a regular arrangement. In the embodiment example shown, IC module 5 is directly connected with a conductive layer 15 in a recess 13 in carrier film 8, for example with the aid of an adhesive. The desired contact design with contact surfaces 9 can be etched out of conductive layer 15. Recesses 12 in carrier film 8 permit access to contact surfaces 9. It is thus easy to establish an electric connection between the terminals of IC module 5 and corresponding contact surfaces 9. In the embodiment example shown, the so-called wire bonding technique was used whereby fine gold wires or aluminum wires establish the electric connection (conductive paths 14). To provide protection from

mechanical loads a casting compound 10 is applied to the side of carrier film 8 opposite contact surfaces 9. Casting compound 10 has a size so as to enclose IC module 5, conductive paths 14 and the connection points, located in recesses 12, between conductive paths 14 and contact surfaces 9. Casting compound 10 may be a hardening resin. Heat-sealing band 17 disposed on the second side of carrier film 8 comprises a carrier band 16 with a heat-sealing layer 7 located thereon and is firmly connected by means thereof with carrier film 8. Heat-sealing band 17 is provided at regular intervals with openings 19. The size of openings 19 in heat-sealing band 17 is such that this band 17 at least partly covers, in the edge area, casting compound 10 located on carrier film 8. Carrier band 16 is removed before carrier element 11 is incorporated into an identity card.

Fig. 3 shows finished identity card 1 in cross section according to the line A-A shown in Fig. 1. Two-step recess 3 in card 1 formed suitably for incorporating carrier element 11 has in its center area a blind hole 2 for taking up IC module 10 sealed with a casting resin. Two-step recess 3 can be cut with corresponding deeper blind hole 2, for example, in a card body consisting of a plastic plate. If card 1 consists of several layers, for example a core layer and upper and lower cover layers, the upper cover layer and the core layer are provided with corresponding openings to permit the carrier element to be embedded in an accurate fit. Carrier element 11 shown in Figs. 1 and 3 was connected permanently with the body of card 1 under the action of heat and pressure with the aid of heat-sealing layer 7. This layer 7 completely covers substrate 8a, which was stamped out of carrier film 8 shown in Fig. 2, and at least partly covers casting compound 10. Since heat-sealing layer 7 is stamped jointly with carrier film 8, and adhesive layer 7

overlaps casting compound 10 in the edge areas, the total available adhesive surface is always utilized for attaching carrier element 11 with card body 1 independently of tolerances in the production of recess 3. This results in an accordingly strong and lasting bond between carrier element 11 and card 1. The overlapping of casting compound 10 by adhesive layer 7 also causes step edge 6 in recess 3 to be covered by heat-sealing layer 7. This virtually prevents edge 6 from being embossed through onto back 4 of the card under the necessary action of heat and pressure when carrier element 11 is being incorporated into card 1. This buffer or protective function is also performed by adhesive layer 7 with respect to edges 6 under corresponding mechanical loads during the daily use of card 1. Finally, this overlap also causes casting compound 10 to be connected with card body 1 via adhesive layer 7, which further improves the overall bond of carrier element 11 with card body 1.

Opening 19 in adhesive layer 7 in the area of blind hole 2 prevents carrier element 11 from being connected with the bottom of blind hole 2 in the area of casting compound 10, and causes less heat to be transmitted to relatively thin back walling 4 of the card during incorporation of carrier element 11. This avoids distortions or deformations of thin back wall 4 of card 1. Opening 19 in adhesive layer 7 also causes a cavity to remain in the area of blind hole 2 below casting compound 10, which gives carrier element 11 a certain freedom of movement. This has a relieving effect on IC module 5 during bending stresses on card 1. This cavity also permits a certain range of tolerance to be allowed with respect to the thickness of casting compound 10.

With reference to Figs. 4a to 4c a method for producing the inventive data carrier shall now be explained. Fig. 4a

shows carrier film 8 unreeled from a roll 20 in an endless form with IC modules mounted thereon and then sealed with a casting resin 10. Heat-sealing band 17 comprising carrier band 16 with heat-sealing layer 7 located thereon is likewise present in an endless form and is likewise unreeled from roll 21. Openings 19 are stamped out of heat-sealing band 17 at regular intervals with a corresponding stamping die 22. Heat-sealing band 17 provided with openings 19 is brought together with carrier film 8 in an accurate fit for further processing by means of corresponding guide rolls 23, whereby stamped openings 19 in heat-sealing band 17 can be utilized for phased transport. Casting compounds 10 provided on carrier film 8 in accordance with the arrangement of the IC modules are at least partly covered by heat-sealing band 17. After positioning, heat-sealing band 17 can be connected with carrier film 8 under the action of heat and pressure with the aid of a heat-sealing die 24. Several heat-sealing dies 24 can also be used for this purpose, working in parallel operation in the same phase. The laminate comprising carrier film 8 and heat-sealing band 17 can be wound onto a roll (not shown) for stock keeping. However, the laminate can also be supplied directly to the following method steps.

Fig. 4b shows a stamping die 26 for stamping carrier elements 11 out of the laminate together with heat-sealing layer 7 out of carrier film 8 or heat-sealing band 17. Carrier band 16 is removed before the stamping process and wound onto roll 25. Carrier element 11 underlaid with heat-sealing layer 7 can also be held by stamping die 26 and incorporated into card body 1 provided with a two-step recess 3. The grid remaining after carrier elements 11 and heat-sealing layers 7 are stamped out is wound onto roll 27.

Fig. 4c shows die 28 for connecting carrier element 11 with card 1 by means of heat-sealing layer 7. The back of card 1 can be cooled with the aid of an appropriate cooling die 29. This has the advantage that the bonding can take place at relatively high temperatures which guarantee a fast and good bond, without back 4 of the card being subjected to a high temperature particularly in the thin bottom area of the blind hole.

To further improve the flatness of data carrier 1 in the area of carrier element 11 and the surface quality in the thin bottom area of blind hole 2, it has proven advantageous for data carrier 1 to be cooled under pressure in a last unit with the aid of suitable cooling dies 30.

In the embodiments described up to now, the opening in the heat-sealing band is stamped in a circular shape. Other contours are possible in accordance with the selection of the stamping die.

Fig. 5 shows a heat-sealing band 17 from which elements 31 are stamped along the broken lines as described above. In each element 31 a circular opening 33 is stamped with a channel 32 leading from opening 33 to the stamped edge of element 31 indicated by broken lines. Channel 32 avoids a hermetic seal of the cavity remaining in blind hole 2 in card 1. This channel 32 compensates an overpressure possibly coming about in this cavity under the action of heat, which could be a load for the card and module. Channel 32 can be dimensioned in accordance with the thickness of the adhesive film in such a way that an opening still exists in the finished card to connect the cavity with the environment of the card.

In the case of cards with thin walls in the bottom area which can be subjected to relatively high or low temperatures due to their field of application, a deformation of the card material in the area of the cavity is avoided if a pressure compensation can come about via channel 32. This function promoting the lasting stability of the card can be obtained by a slightly modified stamping as in Fig. 5.

Claims

1. A data carrier comprising a card body with a recess in which a carrier element is disposed which comprises a substrate having a first side with a plurality of contact surfaces and a second side opposite the first with an IC module whose terminals are connected with the contact surfaces via electric conductors, whereby at least the IC module is surrounded by a casting compound, and the second side of the carrier element is connected with the card body with the aid of a thermally activated adhesive layer, characterized in that the thermally activated adhesive layer is provided with an opening which is dimensioned and positioned relative to the carrier element in such a way that it partly covers the casting compound at least in the edge areas.

2. The data carrier of claim 1, characterized in that the casting compound has the form of a drop, and the opening in the adhesive layer is positioned centrally with respect to the geometry of the drop.

3. The data carrier of claim 1, characterized in that the thickness of the carrier element in the area of the casting compound is smaller than the depth of the recess so that a cavity remains between the casting compound and the bottom of the recess.

4. A data carrier comprising a card body with a recess in which a carrier element is disposed which comprises a substrate having a first side with a plurality of contact surfaces and a second side opposite the first with an IC module whose terminals are connected with the contact surfaces via electric conductors, whereby at least the IC module is surrounded by a casting compound, and the second side

* C L M S *

of the carrier element is connected with the card body with the aid of a thermally activated adhesive layer, characterized in that a cavity is present between the casting compound and the bottom of the recess, and the thermally activated adhesive layer has, alongside an opening in the area of the casting compound, at least one channel leading from the opening, and thus from the cavity, to the edge of the carrier element.

5. A carrier element for an IC module comprising a substrate with a first side with a plurality of contact surfaces and a second side opposite the first with an IC module whose terminals are connected with the contact surfaces via electric conductors, whereby at least the IC module is surrounded by a casting compound, and the second side of the carrier element has a thermally activated adhesive layer, characterized in that the adhesive layer has exactly the dimensions of the substrate and is provided with an opening which is dimensioned and positioned relative to the casting compound in such a way that it partly covers the latter at least in the edge areas.

6. A carrier element for an IC module comprising a substrate with a first side with a plurality of contact surfaces and a second side opposite the first with an IC module whose terminals are connected with the contact surfaces via electric conductors, whereby at least the IC module is surrounded by a casting compound, and the second side of the carrier element has a thermally activated adhesive layer, characterized in that the adhesive layer has, alongside an opening in the area of the casting compound, at least one channel extending from the opening to the edge of the substrate.

7. A method for producing a data carrier having an integrated circuit which is located on a carrier element connected with the card body in a recess in the data carrier by means of a thermally activated adhesive layer, characterized by the following method steps:

- supplying a heat-sealing band in the form of endless material comprising an adhesive layer and at least one carrier layer,

- supplying a carrier film with integrated circuits in the form of endless material, whereby at least the circuits are each surrounded by a casting compound,

- stamping openings in the heat-sealing band,

- bringing together the heat-sealing band and carrier film with proper positioning in such a way that the adhesive layer covers the casting compound at least in the edge areas,

- connecting the adhesive layer with the carrier film,

- removing the carrier layer from the heat-sealing band,

- stamping a carrier element out of the compound consisting of the carrier film/adhesive layer and inserting it into a recess in the data carrier,

- connecting the carrier element with the card body in the recess under the action of heat and pressure.

* C L M S *

8. The method of claim 7, characterized in that the stamped openings in the adhesive band are utilized for bringing together the heat-sealing band and carrier film with proper positioning.

9. The method of claim 7, characterized in that the back of the card opposite the carrier element is cooled during the thermal activation of the heat-sealing layer.

10. The method of claim 7, characterized in that the data carrier, after incorporation of the carrier element, is guided into a further unit in which the card is cooled under pressure at least in the area of the carrier element.

11. A method for producing a carrier film with integrated circuits in connection with a thermally activated adhesive layer, characterized by the following method steps:

- supplying a heat-sealing band in the form of endless material comprising an adhesive layer and at least one carrier layer,

- supplying a carrier film with integrated circuits in the form of endless material, whereby at least the circuits are surrounded by a casting compound,

- stamping openings in the heat-sealing band,

- bringing together the heat-sealing band and carrier film with proper positioning in such a way that the adhesive layer covers the casting compound at least in the edge areas.

Abstract

The present invention relates to a data carrier having an integrated circuit, and describes a method for producing data carriers. The data carrier has the form of a card in which an accordingly formed two-step recess is provided for incorporation of the carrier element. The carrier element comprises a substrate on which the integrated circuit is disposed. To be protected from mechanical loads at least the integrated circuit is surrounded by a casting compound, for example a casting resin. The carrier element is connected with the card body by means of a thermally activated adhesive layer under the action of heat and pressure. The adhesive layer is provided with an opening dimensioned in such a way that the casting compound is at least partly covered in its edge area by the adhesive layer when the carrier element is bonded to the card body.

This Sheet Has Been Replaced.

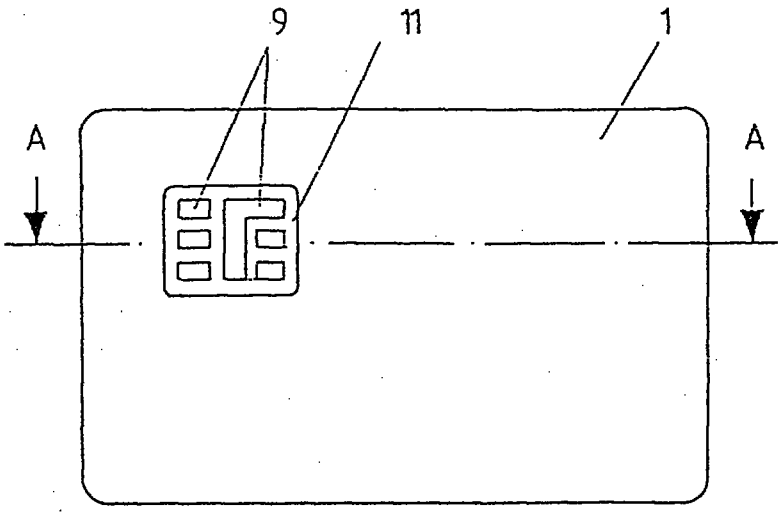

Fig. 1

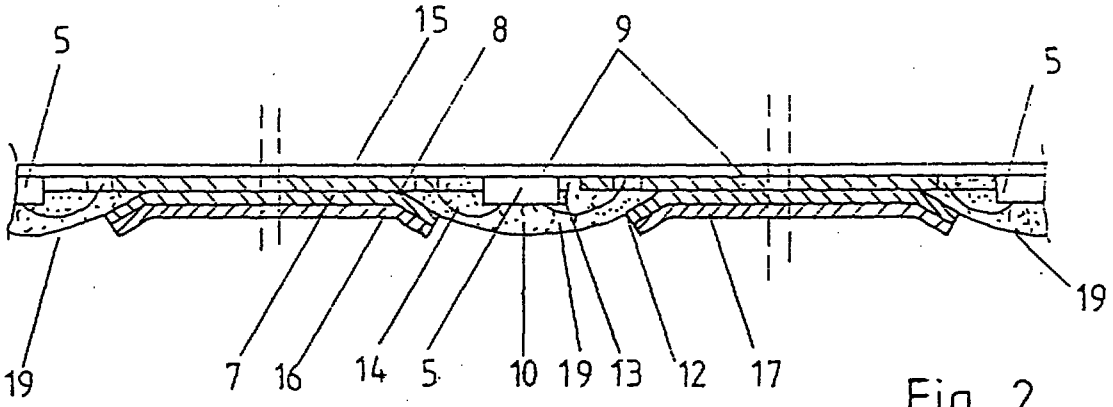

Fig. 2

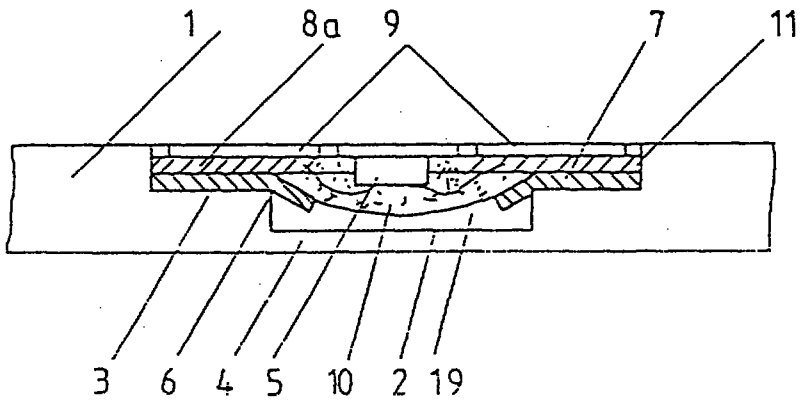

Fig. 3

This Sheet Has Been Replaced

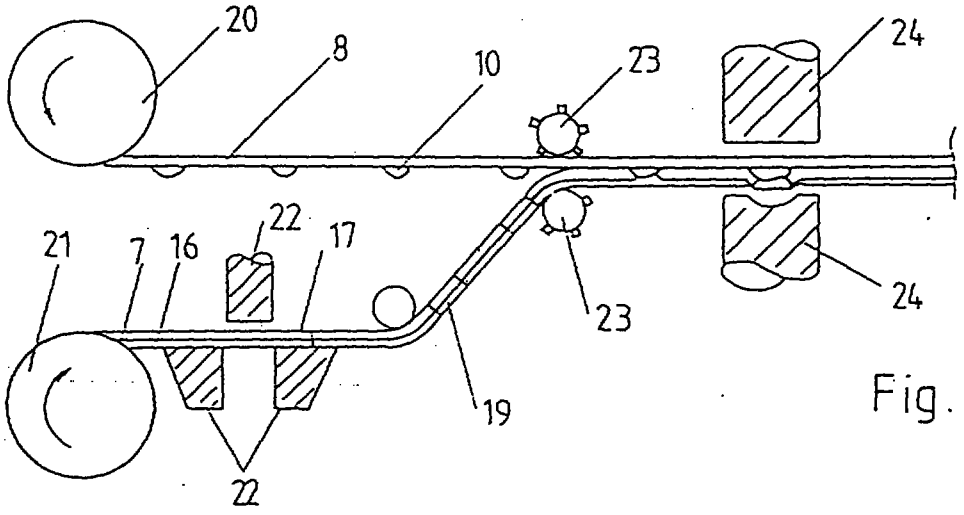

Fig. 4 a

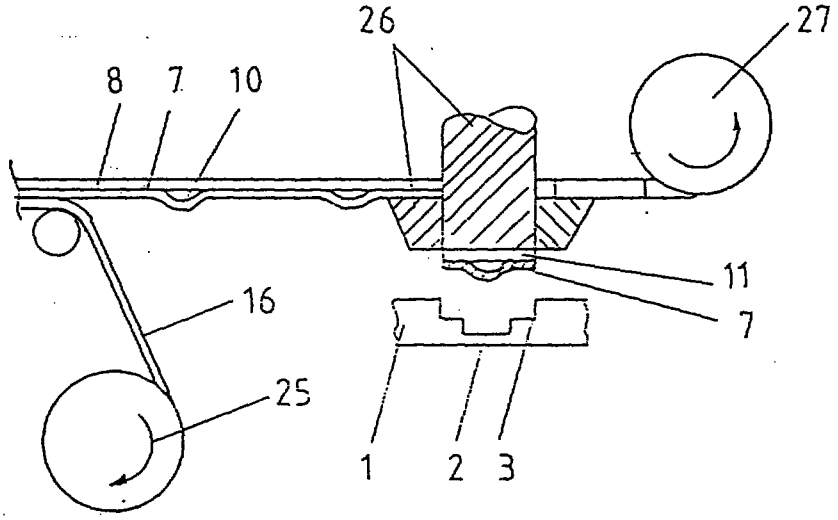

Fig. 4 b

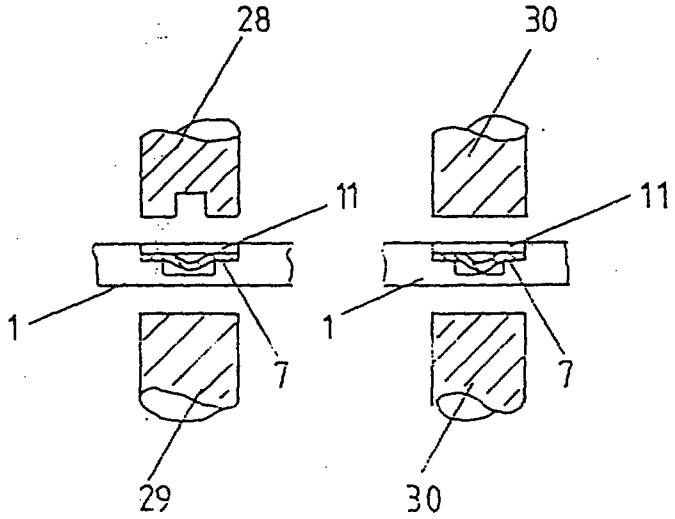

Fig. 4 c

This Sheet Has Been Replaced

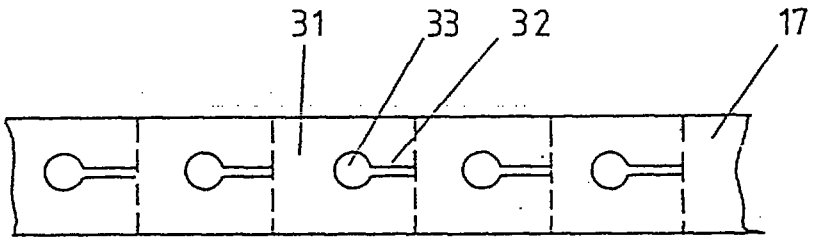

Fig. 5

This Sheet Has Been Replaced

Title: A Data Carrier Having An Integrated Circuit

Abstract

The present invention relates to a data carrier having an integrated circuit, and describes a method for producing data carriers. The data carrier has the form of a card in which an accordingly formed two-step recess is provided for incorporation of the carrier element. The carrier element comprises a substrate on which the integrated circuit is disposed. To be protected from mechanical loads at least the integrated circuit is surrounded by a casting compound, for example a casting resin. The carrier element is connected with the card body by means of a thermally activated adhesive layer under the action of heat and pressure. The adhesive layer is provided with an opening dimensioned in such a way that the casting compound is at least partly covered in its edge area by the adhesive layer when the carrier element is bonded to the card body.

Figure 3

REPLACEMENT SHEETS SG
☐ Description : paged ..... to paged .....
☐ Claim(s) : paged ..... to paged .....
☑ Drawing(s) : paged 1/3 to paged 3/3
☑ Abstract : paged 15 to paged .....
DATE OF RECEIPT 23/8/96

This is the replacement sheet
Date: 23 AUG 1996

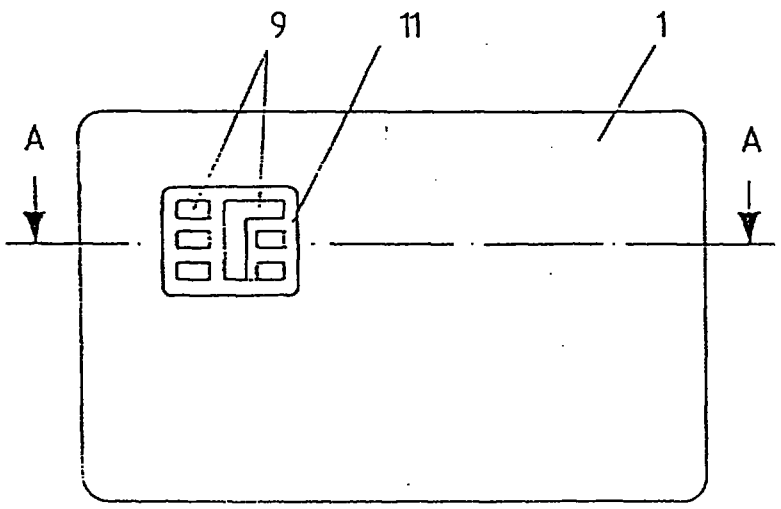

Fig. 1

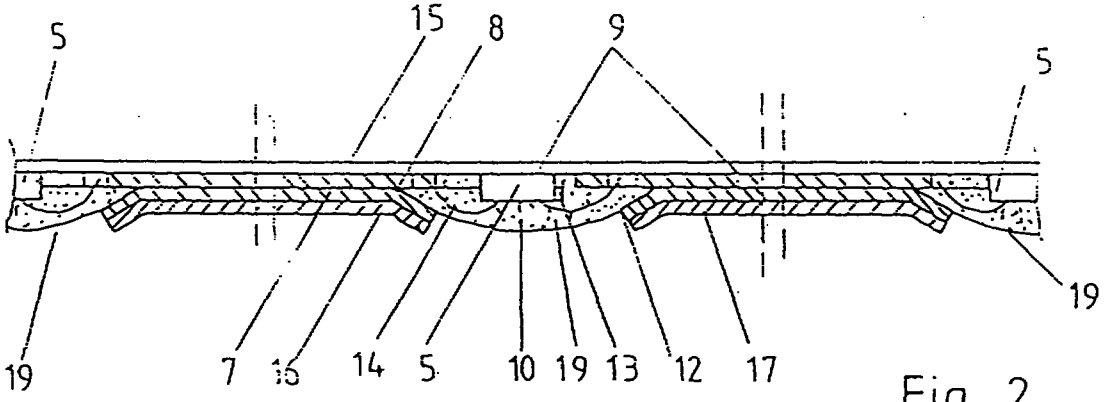

Fig. 2

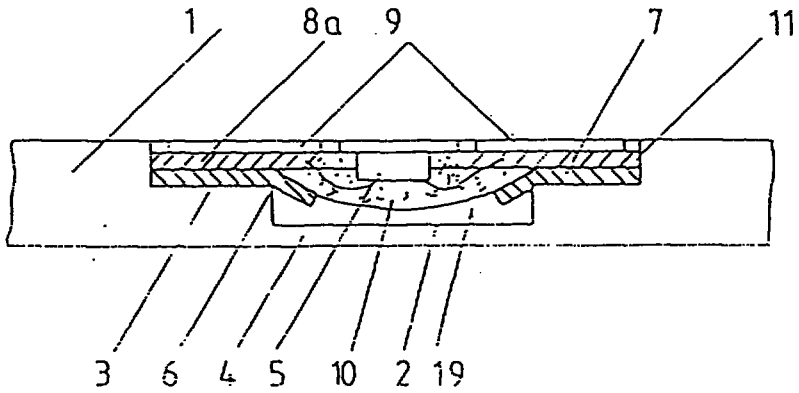

Fig. 3

This is the replacement sheet

Date: 23 AUG 1996

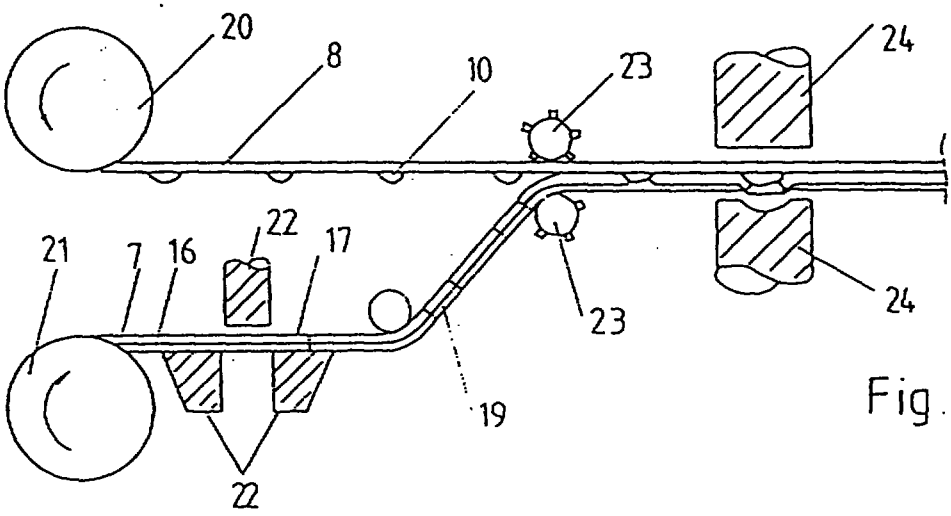

Fig. 4a

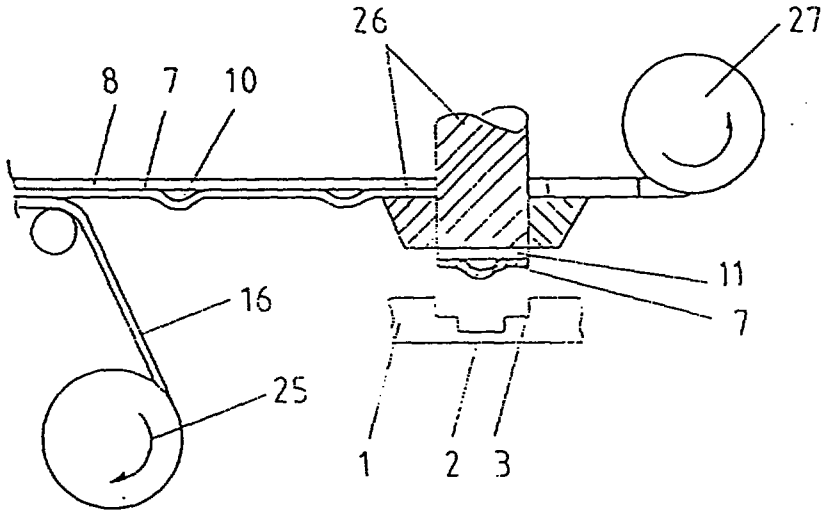

Fig. 4b

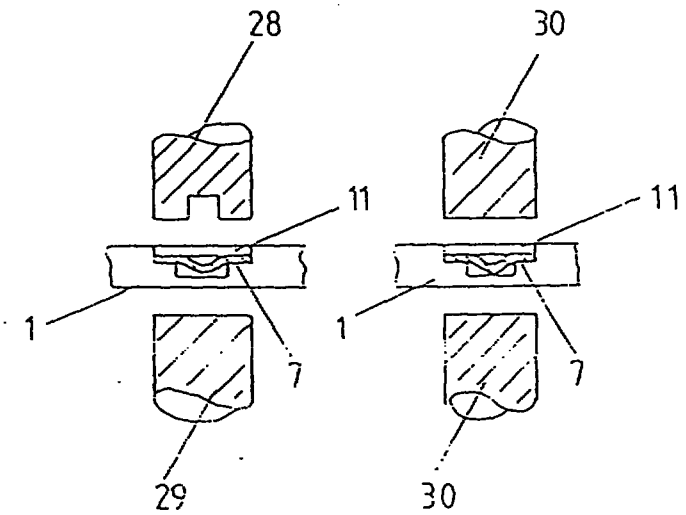

Fig. 4c

This is the replacement sheet

Date: 23 AUG 1996

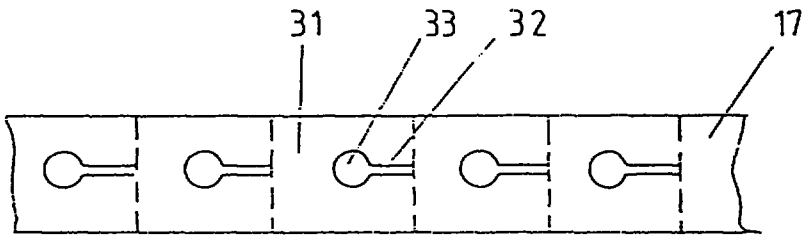

Fig. 5

This is the replacement sheet

Date: 23 AUG 1996