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"A PORTABLE IDENTIFYING ELEMENT"

The invention relates to a portable identifying element comprising an encapsulation which contains at least one integrated solid state electronic circuit for digital data processing and which has a data port for external accessing. A portable element of this kind has been described in French Patent Specification 2266222. Such elements are capable of recording, storing and transmitting all sorts of personal or financial information possibly protected by secret codes. Such elements may, therefore, comprise one or more memories (PROM, EPROM), and/or one or more processing units (e.g. microprocessors), and possibly further circuits, which arrangement may communicate and cooperate with an externally-powered machine or terminal device. The portable element may be powered internally (e.g. by batteries) or otherwise the external machine would provide both power and data (galvanic or contactless). While the prior art deals extensively with the various electronic functions which are realized with such portable elements, the technological realization thereof has received little attention. Moreover, the electronic devices described in the prior art are no longer used because they are bulky and have only limited capacity for storing and processing digital data.

It is a general object of the present invention to provide a portable identifying element of the kind recited hereabove which may be manufactured as a card comprising a lamination of plastic sheets of not more than a few millimetres in thickness. The study of such a card has revealed that the operation of loading the electronic circuit with data may cause an extensive dissipation of electric energy. In certain cases the temperature rise in the element may cause permanent damage. More specifically, it is an object of the present invention to improve the removal of heat from the electronic circuit by simple means that may be easily manufactured

so that the portable element or "card" may satisfy a number of requirements or standards. The object of the invention is realized in that said encapsulation is formed by laminated sheets comprising a front sheet of polyvinylchloride, a central sheet provided with a cavity for at least partly accommodating said electronic circuit(s), a rear sheet of polyvinylchloride, and a further sheet of metal interposed between said front sheet and said rear sheet and juxtaposed with said at least one electronic circuit for dissipating heat generated in said electronic circuit(s) during operation thereof. Juxtaposed means that a projection of the electronic circuit transverse to the laminated layers would at least partially coincide with the metal sheet. The thin metal sheet may have a plurality of openings to improve its adhesion to the central sheet which may also be of polyvinylchloride.

The thin metal sheet may be made of copper having a thickness of some tens of microns. Copper on the one hand is a metal which is an excellent heat conductor, whilst on the other hand it is not magnetic.

The realization of the invention will be better understood on the basis of the following description of an embodiment thereof given by way of example with reference to the accompanying diagrammatic drawing, of which

Figure 1 is a sectional view portion of a card in accordance with the invention,

Figure 2a is a front view of the card,

Figure 2b is a rear view of the card,

Figure 3a is a plan view of the thin metal sheet, and

Figure 3b is a sectional profile of the thin metal sheet.

Figure 1 shows a sectional view of part of a portable identifying element according to the invention, realized as a lamination of sheets. Such identifying element could be used, for example, as a credit card. Credit cards currently issued to the general public are passive information carriers which perform only two functions; namely (i) deferred payment by mechanical transfer of a number, carried on the card, by embossing

onto a payment sheet which is signed by the debtor in order to settle his debt, and (ii) the dispensing of banknotes by special machines, upon manual generation of a secret code which is linked to the information embodied in the magnetic tracks on the card.

A card of this kind has numerous inconveniences. The card may be lost or stolen and, because the identification number is visible, it may be easily used for illegal payment. Regarding the dispensing of banknotes, the magnetic inscription of the secret code may be erased by a strong magnetic field or by heat, or it may be read by means of a special reader device for magnetic patterns.

Portable elements comprising one or more active electronic circuits offer, on the one hand, capabilities of realizing an enhanced security level, and on the other hand, means whereby additional functions may become feasible, such as output of information, updating of a bank account, management of a data file, identification of a bearer (such as by voice comparison) etc. The portable identifying element shown in Fig. 1 comprises a central sheet 1 of polyvinylchloride, having a customary thickness of 0.5 mm, in which there is provided a cavity 2 which serves at least partially to accommodate the electric devices 3 which may be formed by one or several semiconductor elements which are interconnected and which are supported by a thin sheet 4 of polyimide. Taken in isolation, the realization of a thin and flexible carrier of polyimide that is pierced and metallized on both surfaces has been described in an earlier French Patent Application No. 7524882. The use of such a carrier for realizing a relative fixation and interconnection of electronic circuits has been described in an earlier French Patent Application No. 7705769.

The conductor networks on the thin sheet 4 of polyimide can thus be situated on both surfaces thereof with metallized holes to provide the connection through said sheet. Furthermore, metallized contacts 5, 5' have been provided on the extremities of the network. These could be used as data terminal points,

or power terminals.

Two thin sheets 6 and 6' polyvinyl-chloride, each with a thickness of less than 0.1 mm, are provided on either side of the card, thus enclosing the assembly. At the positions of metallized contacts 5 and 5' opening are provided in front sheet 6 so that these contacts remain accessible from outside. These sheets may be initially transparent and become opaque during lamination. The thickness of the ultimate card does not exceed 0.7 mm, which is the standardized value for credit cards.

Between central sheet 1 and rear sheet 6' of the card there is provided, in direct contact with the central sheet 1, a thin metal sheet 7, which serves to remove the heat developed by the electronic device during operation. This sheet 7 thus serves as a thermal conductor and radiator, so that the temperature in the region of the devices 3 can be maintained with acceptable limits.

In experiments performed by Applicant during loading of the memory of the electronic device with data, the heat dissipation approached 1 W over a period of 50 ms. Without the metal radiator sheet 7, the temperature increased to approximately 180°C and the card was damaged, whilst after the provision of the radiator sheet the temperature did not increase beyond 60°C. Furthermore, the thin metal sheet 7 is provided with a plurality of openings. During the final stage of manufacture of the card a lamination operation is performed at a temperature above 100°C and under a high pressure. The two polyvinyl-chloride sheets 1, 6' are partially extruded into the openings and come into contact and solidify, thus very efficiently anchoring the sheet 7 between sheets 1 and 6'. Similarly, the thin polyimide sheet 4 may be pierced with a plurality of openings which have the same anchoring function in order to ensure fixation of this sheet in a comparatively flexible manner. This flexibility diminishes the internal stresses caused by flexing the card during the use thereof.

The thin metal sheet 7 may be made of copper and its thickness may lie between 10 and 100 microns. Shown within cavity 2 is an amount of encapsulating resin 10. In this way the holding together of the assembly is improved and the heat transfer from electronic circuits 3 to sheet 7 is enhanced. Flexing tests on the whole assembly performed by Applicant in accordance with the relevant DIN standard (flexation of 21 mm and 20,000 tests) have demonstrated the adequate holding together of the assembly. It should be noted that for the purposes of clarity, the several sheets and further elements of the assembly have been drawn somewhat apart in the direction represented by arrowed line e.

Figure 2a is a front view of a possible card arrangement. The contact points 5, 5' are only visible though the apertures which are provided for this purpose in the front PVC sheet 6. Eight contacts are shown, but the number is not restricted thereto.

Figure 2b is a rear view of the card which illustrates the advantage of making the position of the metal sheet 7 visible with respect to the magnetic tracks which exist on non-electronic cards available up to now. In this example of the positioning, the metal sheet 7 has the form of a comparatively long rectangle (length/width ratio greater than 3) which is situated between the two lower magnetic tracks 12 and 13. Its small thickness, amounting to a few tens of microns, enables this sheet to be integrated in the central sheet after the lamination operation, without substantially increasing the thickness thereof.

Figure 3a is a plan view of this sheet portion 7 in the form of a rectangle in which a plurality of openings are provided in order to ensure its fixation.

Figure 3b is a sectional view in profile of the same sheet portion with an additional protective ring 14, for example of teflon, which is positioned in line with cavity 2 in the central sheet. This ring limits plastic flow into and/or out of this cavity during the lamination operation.

A portable element as described above may be used for various purposes, such as electronic payment card, passport, or carrier of confidential information. The sheet 7 may have various thickness values and/or shapes.

CLAIMS

1. A portable identifying element comprising an encapsulation which contains at least one integrated solid state electronic circuit for digital data processing and which has a data port for external accessing, characterized in that said encapsulation is formed by laminated sheets, comprising a front sheet of polyvinylchloride, a central sheet provided with a cavity for at least partly accommodating said electronic circuit(s), a rear sheet of polyvinylchloride, and a further sheet of metal interposed between said front sheet and said rear sheet and juxtaposed with said electronic circuit(s) for dissipating heat generated in said electronic circuit(s) during operation.

2. A portable element as claimed in Claim 1, characterized in that the further sheet is provided with a plurality of openings for accommodating protrusions emanating from said central sheet which is made of polyvinyl.

3. A portable element as claimed in Claim 1 or 2, characterized in that said electronic circuit(s) is (are) arranged on a fifth sheet, of polyimide, which has metallization on both sides, and in that the fifth sheet is provided with a plurality of openings for accommodating protrusions emanating from said central sheet that is made of polyvinyl.

4. A portable element as claimed in Claim 1, 2 or 3, characterized in that said further sheet is made of copper and has a thickness between 10 and 100 microns.

5. A portable element as claimed in any of Claims 1 to 4, characterized in that said cavity has a filling of resin.

6. A portable element as claimed in any of Claims 1 to 5, characterized in that said further sheet has a length/width ratio larger than 3 and is interposed between said central sheet and said rear sheet.

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7. A portable element as claimed in any of the Claims 1 to 6, characterized in that said cavity is provided with a blocking ring as a flow-limiter for said central sheet.

8. A portable element as claimed in any of Claims 1 to 7 when used as an electronic payment card.

9. A portable element substantially as herein described with reference to the accompanying drawing.