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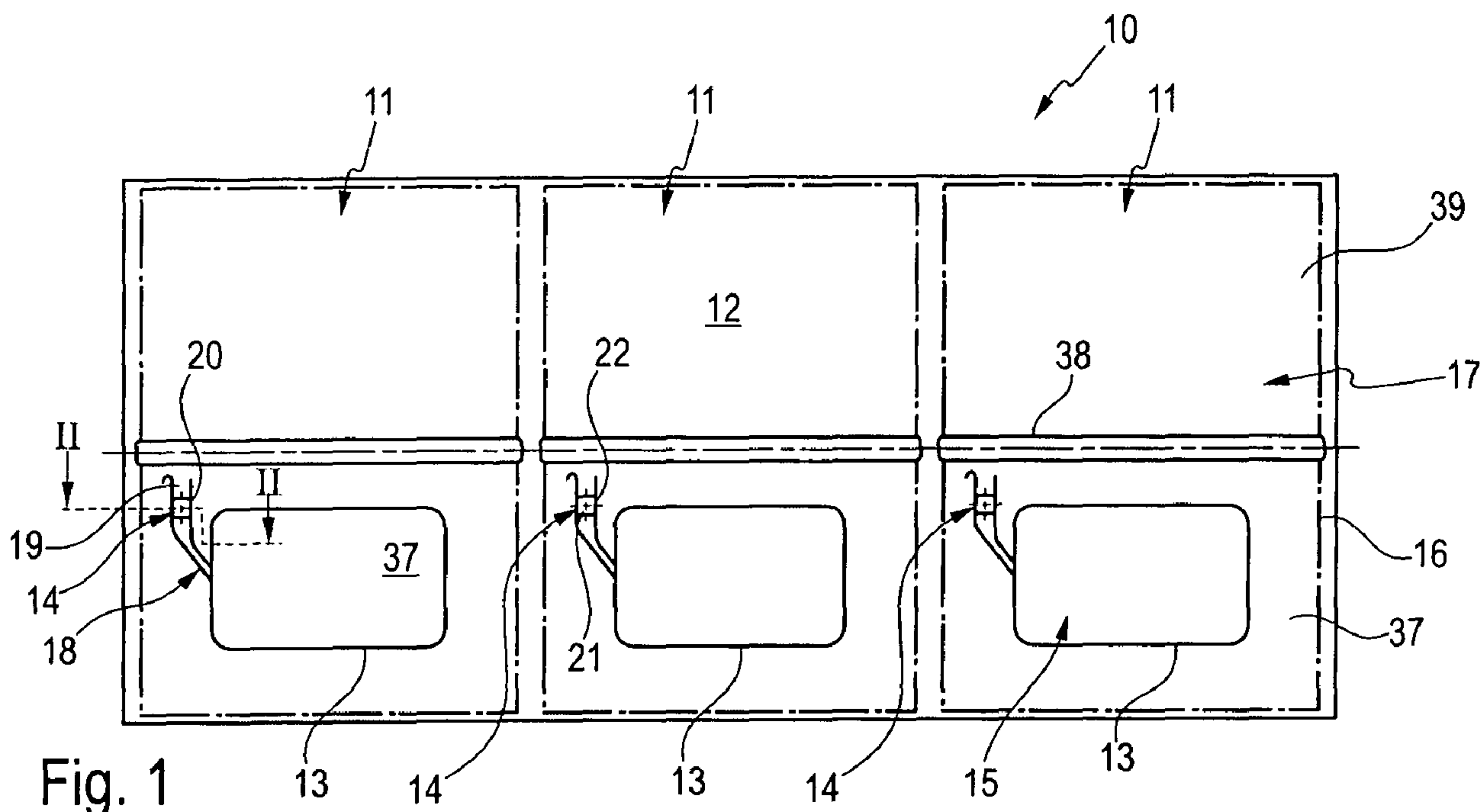
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(54) Titre : INSERT POUR TRANSPONDEUR POUR UN DOCUMENT PERSONNEL, ET SON PROCEDE DE FABRICATION

(54) Title: TRANSPONDER INLAY FOR A PERSONAL DOCUMENT AND METHOD FOR THE PRODUCTION THEREOF



(57) Abrégé/Abstract:

The invention relates to a transponder inlay (11) for the production of a layer structure (40) for a personal document having a substrate layer (12) for disposing a transponder unit (15) comprising an antenna coil (13) and a chip module (14), said transponder unit being located on a contact surface (17) of the substrate layer, wherein the chip module (14) is accommodated in a window opening (30) formed in the substrate layer (12) such that a chip carrier (23) of the chip module rests on a compressed edge section

(57) **Abrégé(suite)/Abstract(continued):**

(24) of the window opening (30). The invention further relates to a method for producing the transponder inlays. The invention additionally relates to a layer structure for a personal document provided with such a transponder inlay and a passport document comprising such a layer structure.

Abstract

The invention relates to a transponder inlay (11) for manufacturing a layered structure (40) for a personal document with a substrate layer (12) for arranging a transponder unit (15) that includes an antenna coil (13) and a chip module (14) and which is situated on a contact surface (17) of the substrate layer, wherein the chip module (14) is accommodated in a window opening (30) formed in the substrate layer (12) in such a way that a chip carrier (23) of the chip module rests with its circumferential edge on a compressed peripheral shoulder (24) of the window opening (30); the invention also relates to a method for manufacturing the transponder inlay. In addition, the present invention relates to a layered structure for a personal document, which is provided with such a transponder inlay, and an identification document having such a layered structure.

(Fig. 1)

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Transponder inlay for a personal document and method for the production thereof

The present invention relates to a transponder inlay for manufacturing a layered structure for a personal document with a substrate layer for arranging a transponder unit comprising an antenna coil and a chip
5 module, said transponder unit being situated on a contact surface of the substrate layer, and a method for manufacturing the transponder inlay. In addition, the present invention relates to a layered structure for a personal document provided with such a transponder inlay as well as an identification document having such a layered structure.

10 Current trends in the field of personal documents are in the direction of supplementing the documents that are conventionally used for personal identification with transponders which permit automated contactless reading of the data stored on a chip in the transponder. Such transponders include, in addition to the chip, an antenna coil that allows
15 contactless data access.

Integration or implementation of such transponders in conventional personal documents that contain a plurality of pages of paper accommodated in a document volume makes special demands of the design of the transponder units and/or the so-called transponder inlays,
20 which have the transponder unit on a substrate layer. It is obvious that it is regarded as desirable to interfere with the known format of the identification documents as little as possible through implementation of such a transponder inlay in an identification document. Furthermore, handling of the identification documents, e.g., the pages in such
25 documents, should be influenced as little as possible. On the other hand, the transponder inlays and/or the transponder units arranged on the substrate layers of the transponder inlays are of course subject to special mechanical stresses which naturally derive from the handling of these identification documents.

For the reasons given above, it is therefore assumed that it is especially important to design the transponder inlays intended for implementation in identification documents to be as thin as possible. A reduction in the thickness of the substrate layers used for the transponder inlays is
5 limited already by the thickness of the chip modules if it is assumed that the chip modules are to be accommodated so they are essentially flush with the surface in the transponder inlays.

Designing suitable recesses or window openings in the substrate layers is therefore associated with a significant expense and complexity.

10 The object of the present invention is therefore to propose a transponder inlay and a method of manufacturing same so that the manufacturing allows transponder inlays to be designed to be as thin as possible at a comparatively low cost.

This object is achieved by a transponder inlay having the features of
15 Claim 1.

With the inventive transponder inlay, the chip module is accommodated in a window opening formed in the substrate layer in such a way that a chip carrier of the chip module sits on a compressed peripheral shoulder of the window opening with its peripheral edge resting on the
20 compressed peripheral shoulder.

The peripheral shoulder of the window opening, which allows the chip carrier to be accommodated in such a way that it is flush with the surface, is implemented by compressing the material of the substrate layer in the area of the window opening, in contrast with the design
25 known from the state of the art, in which, depending on the choice of material for the substrate layer, either only one chip housing of the chip module arranged on the chip carrier is accommodated in the window opening, and the chip carrier protruding laterally beyond the chip housing rests on the surface of the substrate layer, or the chip carrier

rests on a peripheral shoulder of a window formed by a milling operation in the substrate layer to accommodate the entire chip module including the chip carrier.

An optimum with regard to completely accommodating the chip module in the substrate layer in such a way as to protect the chip module from mechanical stresses and with regard to the thinnest possible design of the substrate layer is possible if the chip module is accommodated in the window opening in such a way that the chip carrier is arranged to be essentially flush with the contact surface of the substrate layer, and a chip housing of a chip unit arranged on the chip carrier is situated to be essentially flush with the underside of the substrate layer opposite the contact surface.

An arrangement of the antenna coil on the contact surface of the substrate layer so that it is also flush with the surface is made possible if the antenna coil is formed from a wire conductor which is provided in a coil on the contact surface and is arranged to be essentially flush with the contact surface by embedding it in the contact surface.

It has proven especially advantageous if the substrate layer of the transponder inlay is made of a thermoelastic material, so that, on the one hand, a protective elastic sheathing is provided for the chip module, keeping mechanical stresses away from the chip because of its elasticity, and, on the other hand, a permanent compression is possible in the circumferential area of the window opening to form the peripheral shoulder through a temperature-supported pressure acting on the substrate material with a minimal expenditure of energy.

The inventive layered structure for a personal document according to Claim 5 has, in addition to the transponder inlay, a cover layer of a book binding material for personal documents arranged as an additional layer on the contact surface of the transponder inlay.

The inventive layered structure may thus consist of just two layers bonded together, supplemented by conventional intermediate pages in a simple manner to yield a personal document which is provided with a transponder unit despite giving the appearance of being a conventional personal document. The inventive layered structure thus allows the production of an identification document that essentially shows no difference from a conventional personal document from a purely external standpoint.

Depending on the choice of material and/or the composition of the material for the cover layer, the bond between the substrate layer and the cover layer may be created by arranging an adhesive intermediate layer or by direct lamination of the cover layer onto the substrate layer to produce the layered structure. The latter is the case, for example, when the cover layer is a textile fabric coated with thermally activatable adhesive or some other laminatable material.

It is especially advantageous if the layered structure is designed to be double-sided, with a substrate layer designed to be discontinuous, having the transponder unit on the transponder page and having a blank page that is divided from the transponder page by a fold recess and with a cover layer designed to be continuous, extending over the substrate layer. Such an embodiment of the layered structure in combination with the intermediate pages of a personal document makes it possible to produce a personal document that gives the user the impression of being a conventional personal document despite the implementation of the transponder unit in the front page or the back page of the binding.

The inventive personal document has the features of Claim 8.

The inventive method for producing a transponder inlay has the features of Claim 9. According to this invention, to form a window opening that holds the chip module, a through-opening is created in the substrate layer, and the peripheral edge of the through-opening is exposed to

pressure and temperature to achieve a compressed peripheral shoulder with a reduced thickness.

It is especially advantageous if the treatment with pressure and temperature is accomplished by means of an ultrasonically energized stamping tool. The temperature treatment may be accomplished by
5 external heating of the stamping tool or by a heating of the stamping tool and/or the substrate layer induced by mechanical friction as a result of the ultrasonic oscillations of the stamping tool, i.e., without external overheating.

10 In addition, it has also proven to be especially advantageous if the stamping tool is used at the same time to form the through-opening because this allows the creation of the window opening as well as the creation of the peripheral shoulder in one machining operation using one and the same tool.

15 A variant of the method that is optimized with regard to universal tool use is made possible if the stamping tool serves at the same time to embed a wire conductor, which is used to produce the antenna coil, in the contact surface of the substrate layer.

A preferred embodiment of the transponder inlay is illustrated in the
20 drawings and is described with reference thereto, including an explanation of the process steps associated with the production of the transponder inlay.

Fig. 1 shows a panel sheet arrangement with three transponder inlays designed contiguously;

25 **Fig. 2** shows a window opening of a substrate layer in an enlarged diagram according to sectional line II-II in **Fig. 1**;

Fig. 3 shows the window opening from **Fig. 2** in a view from above;

Fig. 4 shows a panel sheet arrangement with three bound pages designed contiguously for the production of a layered structure for an identification document;

Fig. 5 shows a partial sectional diagram of the layered structure shown in **Fig. 4** according to sectional line V-V in **Fig. 4**;

Fig. 6 shows a bound page folded over to form a bound back cover.

Fig. 1 shows three transponder inlays 11 that are designed to be joined together in a panel sheet arrangement 10, each transponder inlay having a substrate layer 12 with a transponder unit 15 arranged thereon, comprising an antenna coil 13 and a chip module 14. **Fig. 1** also shows dividing lines 16 along which the transponder inlays 11 can be separated from the panel sheet arrangement.

The diagram in **Fig. 1** shows the transponder inlays 11 in a view from above with a contact surface 17 that faces upward and has a wire conductor 18 arranged thereon in the form of a coil embedded in the contact surface 17, as is also illustrated in **Fig. 2**. As shown in **Fig. 5** in particular, free ends 19, 20 of the wire conductor are in contact with contact surfaces 21, 22 of a chip carrier 23 of the chip module 14 arranged in the contact surface 17 of the substrate layer 12.

The chip module 14 sits in a window opening 30, as illustrated in **Figs. 2** and **3**. For reasons of a simple diagram of the window opening 30, **Figs. 2** and **3**, in deviation from the diagram in **Fig. 1**, omit the chip module 14, which is inserted into the window opening 30. The window opening 30 is designed with a step gradation and has a peripheral shoulder 24 facing the contact surface 17 to accommodate the chip carrier 23 (**Fig. 5**) and, as shown in **Fig. 3**, having an accommodating cross section 25, which is designed to be larger than the accommodating cross section 26 of a through-opening 28 that extends to an underside 27

of the substrate layer 12 and serves to accommodate a chip housing 29 of the chip module 14 (**Fig. 5**).

The through-opening 28 as well as the peripheral shoulder 24 are adapted to the particular chip module to be accommodated. The chip module 14, which is used in the present exemplary embodiment, is a chip module 14 having a chip carrier 23 that is designed to be larger than the chip housing 29 in only one dimension. Therefore, in the exemplary embodiment shown here, the peripheral shoulder 24 is designed so that the peripheral shoulder 24 forms supporting surfaces 51, 52 for the chip carrier 23 on only two opposing edge sections (**Fig. 3**).

To produce the window opening 30 shown in **Figs. 2 and 3**, a stamping tool 31, for example, having a stamp tip 33 bordered by a stamp collar 32 may be used. The stamp tip 33 has a cross section corresponding to the through-opening 28, and the stamp collar 32 has a cross section corresponding to the peripheral shoulder 24. In addition, the stamp tip 33 is provided with a cutting edge 35 formed peripherally on the border of its end face 34.

To produce the window opening 30 illustrated in **Figs. 2 and 3**, the stamping tool 31 may be advanced toward a contact surface 53 with an intermediate arrangement of the substrate layer 12, so that the through-opening 28 is produced by the action of the cutting edge 35 on the substrate layer 12, based essentially on a punching operation.

Simultaneously with a forward movement 36 of the stamping tool 31, this forward movement 36 may be exposed to ultrasonic vibrations in the direction of the forward movement or across that direction, so there is a relative heating of the substrate layer 12 due to the relative movement between the stamp collar 32 and the contact surface 17 of the substrate layer 12. As a result of this heating, the compression of the substrate layer 12 which occurs due to the forward movement 36 is irreversible, i.e., it is a more or less frozen-in compression. If the material chosen for the substrate layer 12 is a thermoelastic material, then a certain

elasticity is retained in the compressed area of the peripheral shoulder 24 despite the thermal stress on the material. Essentially, however, it is also possible to produce a window opening in a thermoplastic material in the manner depicted in **Figs. 2 and 3**.

5 In deviation from the embodiments described above, it is also possible to produce the peripheral shoulder 24 not in direct correlation with the design of the through-opening 28 but instead first producing the through-opening 28 in any desired manner in a first process step and then designing the peripheral shoulder 24 by means of an ultrasonically
10 energized stamping tool.

The transponder inlays 11 of the panel sheet arrangement 10 shown in **Fig. 1** are designed to be double-sided with a transponder page 37, on which there is a transponder unit 15, and with a blank page 39, which is separated from the transponder page 37 by a fold recess and has the same
15 area as the transponder page 37 of the substrate layer 12.

Figs. 4 and 5 show a layered structure 40 with bound pages 49 designed to be cohesive with one another in a panel sheet arrangement 41. The panel sheet arrangement 41 consists of the panel sheet arrangement 10 shown in **Fig. 1** with the transponder inlays 11 and a panel sheet
20 arrangement 54 arranged on the contact surface 17 and having cover layers 42 arranged in the laminate. In a partial sectional diagram, **Fig. 5** shows the layered structure 40 of the panel sheet arrangement 41 and/or a bound page 49 provided therein on an enlarged scale. It can be seen in particular that the chip module 14 is arranged in the window opening 30
25 of the substrate layer 12 in such a way that a contact side 43 of the chip carrier 23 is essentially flush with the contact surface 17 of the substrate layer 12. The chip housing 29 which encloses a chip unit (not shown here) and extends downward from the chip carrier 23 is accommodated completely in the through-opening 28 of the window opening 30. A
30 housing top side 45 is situated so that it is slightly offset toward the interior into the window opening 30 or is arranged essentially flush with

the bottom side 46 of the substrate layer 12. In the exemplary embodiment depicted in **Fig. 5**, the chip carrier 23 is adhesively bonded to the supporting surfaces 51, 52 of the peripheral shoulder 24.

Fig. 5 also shows that an adhesive intermediate layer 47 that bonds the
5 cover layer 42 and the transponder inlay 11 to form a fixed layered structure 40 is arranged between the cover layer 42 and the contact surface 17 of the substrate layer 12 and/or the transponder inlay 11. The wire conductor ends 19, 20 of the antenna coil 13 that are in contact with the contact surfaces 21, 22 of the chip carrier 23 are accommodated
10 essentially in the intermediate layer 47, so that with an inelastic design of the cover layer 42, no representation of the wire conductor ends 19, 20 in an outside or a visible side 48 of the cover layer 42 need be feared.

The bound pages 49 arranged in a cohesive laminate in the panel sheet arrangement 54 according to **Fig. 4** are formed by the layered structure
15 40 depicted in **Fig. 5** and can be separated by a punching operation along the dividing lines 16. Since the cover layers 42 extend continuously over the fold recess 38 in the substrate layer 12 and/or the transponder inlay 11, the bound pages 49 have a corresponding reduction in cross section in the area of the fold recesses 38, allowing the bound pages 49 to be
20 turned or folded about the bound back 50 defined by the fold recess 38, as is illustrated in **Fig. 6**. Then any intermediate pages containing personal information in a conventional manner can be inserted into an insertion space bordered by the blank page 39 and the transponder page 37 of the transponder inlay 11.

Claims

1. A transponder inlay (11) for manufacturing a layered structure (40) for a personal document, having a substrate layer (12) for
5 arranging a transponder unit (15) which comprises an antenna coil (13) and a chip module (14) and is situated on a contact surface (17) of the substrate layer, characterized in that
the chip module (14) is accommodated in a window opening (30)
10 formed in the substrate layer (12), such that a chip carrier (23) of the chip module rests with its peripheral edge on a compressed peripheral shoulder (24) of the window opening (30).
2. The transponder inlay according to Claim 1,
15 characterized in that
the chip module (14) is accommodated in the window opening (30) in such a way that the chip carrier (23) is essentially flush with the contact surface (17) of the substrate layer (12) and a chip housing (29) of a chip unit arranged on the chip carrier is essentially flush
20 with a bottom side (46) of the substrate layer opposite the contact surface.
3. The transponder inlay according to Claim 1 or 2,
characterized in that
25 the antenna coil (13) is formed from a wire conductor (18) arranged in a coil pattern on the contact surface (17), said wire conductor being arranged so that it is essentially flush with the contact surface by embedding it in the contact surface.
- 30 4. The transponder inlay according to any one of Claims 1 through 3, characterized in that

the substrate layer (12) is made of a thermoelastic material.

5. A layered structure for a personal document having a transponder inlay according to any one of the preceding claims, wherein a
5 cover layer (42) of a book binding material for personal documents is arranged on the contact surface (17) of the transponder inlay (11).
6. The layered structure according to Claim 5,
10 characterized in that the transponder inlay (11) and the cover layer (42) are joined together by an adhesive intermediate layer (47).
7. The layered structure according to Claim 5 or 6,
15 characterized in that the layered structure (40) is designed to be double-sided, having a substrate layer (12), which is designed to be discontinuous and has the transponder unit (15) on a transponder page (37) and has a blank page (39) separated from the transponder page by a fold
20 recess (38), as well as having a cover layer (42) that is designed to be continuous and extends over the substrate layer.
8. A personal document characterized by a layered structure (40) according to any one or more of Claims 5 through 7.
25
9. A method for manufacturing a transponder inlay (11) for a layered structure (40) of a personal document, wherein a substrate layer (12) is provided on a contact surface (17) with an antenna coil (13) and a chip module (14),
30 characterized in that to form a window opening (30) that accommodates the chip module (14) and has a compressed peripheral shoulder (24), a through-

opening (28) is produced in the substrate layer (12), and the circumferential edge of the through-opening is subjected to pressure and temperature to achieve a reduced thickness of the substrate layer in the area of the circumferential edge.

5

10. The method according to Claim 9,
characterized in that
the treatment with pressure and temperature is performed by means
of an ultrasonically energized stamping tool (31).

10

11. The method according to Claim 10,
characterized in that
the stamping tool (31) also serves at the same time to form the
through-opening (28).

15

12. The method according to Claim 10 or 11,
characterized in that
the stamping tool (31) serves at the same time to embed a wire
conductor (18) that is used to produce the antenna coil (13) in the
contact surface (17) of the substrate layer (12).

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