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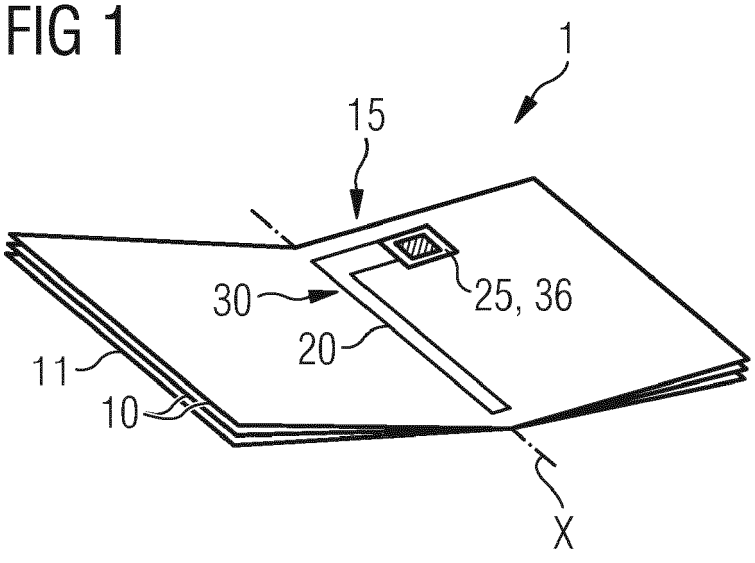
(54) **CONDUCTIVE THREAD TO BIND A PASSPORT BOOKLET**

(57) An identification document (1) such as a passport booklet, comprising a cover foldable at a folding line (X), an end sheet (11) being foldable at the folding line (X) and attached to the cover, at least one sheet (10) being foldable at the folding line (X), and a closed circuit. The closed circuit comprises an electrical device (25) such as an integrated circuit (35) or a LED light (36) and a conductive thread (20) attaching the at least one sheet (10) to the end sheet (11). The device (25) malfunctions when the closed circuit is interrupted by means of manipulation of the conductive thread (20).

FIG 1



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Description

Technical Field

[0001] The present disclosure generally relates to an identification document and particularly to an identification document such as a passport booklet comprising a conductive thread.

Background

[0002] The use of identification documents is pervasive. Identification documents are used for example to prove identity or to verify age. An example of an identification document is a passport booklet. A passport booklet is an official governmental document that certifies the personal identity of its holder.

[0003] Passport booklets are provided with indicia of identification (identification features) of the document holder such as the full name, the photograph, the date of birth and the signature of the document holder.

[0004] Further, passport booklets are provided with security features such as laser engraving/personalization, holograms or security printing. Security features are directed to verifying the authenticity of the passport booklet. For example, an RFID chip module which allows the identification information stored on the RFID chip to be read following authentication, may be considered as a security feature. Such an RFID chip module and the associated chip readers may be integrated with high security mechanisms in order to prevent any forceful skimming of data it contains. Thus, the RFID chip module is part of the authentication process of the passport booklet.

[0005] Usually, passport booklets comprise a rigid cover and an end sheet (end paper) attached to the rigid cover. Further, the passport booklet usually comprises multiple data sheets. Data sheets are arranged inside the end sheet in folded state. One of the multiple data sheets may form two pages of the passport booklet by being foldable around a folding line such that it forms one page on each side of the folding line. In the region of the folding line, this one sheet is connected to the end sheet. Alternatively, one data sheet of the passport booklet may form one page of the passport booklet including a hinge, the hinge being connected to the end sheet in the region of the folding line. In the sense of this disclosure, the term sheet refers to both, a sheet forming two pages on each side of the folding line and a sheet forming a page including a hinge.

[0006] At least one of the multiple data sheets of the passport booklet usually comprises an identification feature and/or a security feature.

[0007] Usually, the multiple data sheets are attached to the end sheet by being stitched with a thread. The end sheet may then be glued to the cover. Typically, threads made, for example, of polymer or nylon are used to stitch the multiple data sheets to the end sheet.

[0008] Known stitch arrangements to attach the multiple data sheets to the end sheet are two threads in chain stitch or programmable stitch formation.

[0009] One of the main challenges when using identification documents such as a passport booklet is to provide a high security level to prevent fraud, tampering, and counterfeiting. In particular, preventing efforts made by counterfeiters to tamper with the passport booklet and manipulate the information of the personal identity of the passport holder.

[0010] The attachment of the multiple data sheets to the end sheet is an important factor of the security level of the passport booklet. If the attachment is easy to disconnect, counterfeiters may try to detach the multiple data sheets from the end sheet and for example may try to insert an additional fake data sheet to the rest of the passport booklet or may try to modify an existing data sheet to manipulate the passport booklet.

[0011] The present disclosure is directed to provide a secure connection of the multiple sheets of an identification document such as a passport booklet.

Summary of the Disclosure

[0012] According to a first aspect, the present disclosure relates to an identification document such as, for example, a passport booklet, comprising a cover and an end sheet. The cover is foldable at a folding line. The end sheet is foldable at the folding line and attached to the cover. The identification document further comprises at least one sheet being foldable at the folding line and a closed circuit comprising an electrical device and a conductive thread. The conductive thread attaches the at least one sheet to the end sheet. The device malfunctions when the closed circuit is interrupted by means of manipulation of the conductive thread.

[0013] According to second aspect, the present disclosure relates to an identification document such as, for example, a passport booklet, comprising a cover, at least one sheet and a closed circuit. The cover is foldable at a folding line. The at least one sheet is foldable at the folding line. The closed circuit comprises an electrical device and a conductive thread. The conductive thread attaches the at least one sheet to the cover. The device malfunctions when the closed circuit is interrupted by means of manipulation of the conductive thread.

[0014] The present disclosure is based at least in part on the realization that a thread may not only be used as a connecting means for sheets of a passport booklet but may also be a component of a closed circuit. The closed circuit may, for example, be a security feature such as an RFID chip module which is directed to verifying the authenticity of the identification document such as a passport booklet. Due to the double functionality of the thread, it becomes more difficult to tamper with the passport booklet.

[0015] The closed circuit comprises the conductive thread and an electrical device. When the closed circuit of the identification document is interrupted, the conduc-

tive path to power the electrical device is broken and the electrical device malfunctions. The interruption of the closed circuit may be caused by manipulation of the conductive thread. The conductive thread made at least partly of conductive material acts as a bridge to complete the closed circuit for a successful powering of the electrical device of the closed circuit. When the closed circuit is interrupted by means of manipulation of the conductive thread, the electrical circuit (electrical loop) is incomplete and the electrical device malfunctions.

[0016] Manipulation of the conductive thread includes a complete or partial removal of the conductive thread, and a cutting or breaking of the conductive thread. Manipulation of the conductive thread in the sense of this disclosure include all actions which result in an interruption (a break) of the closed circuit. Thus, deliberate manipulation such as a removal of the conductive thread will be more evident and reusing of the conductive thread or recreating of the broken connection will be very difficult without being detected. As the electrical device malfunctions, it becomes obvious to when the passport booklet is inspected that the conductive thread has been manipulated.

[0017] The electrical device provided in the closed circuit may, for example, be an integrated circuit or a LED lamp. The electrical device may be any device which requires a closed circuit to be successfully powered.

[0018] In known passport booklets, in which the thread is, for example, made of polymer or nylon and in which the thread stitches together the passport sheets, the stitching is susceptible to tampering via manipulation such as a removal and reuse of the thread with little indication that tampering has occurred. Having a conductive thread provided in the closed circuit of the identification document, the electrical device will cease functioning when the conductive thread is manipulated. The conductive thread and the electrical device are components of the same circuit such that the electrical device does not fulfill its assigned function when the conductive thread is manipulated.

[0019] The conductive thread attaches the at least one sheet to the end sheet or the at least one sheet to the cover. Attaches in the sense of this disclosure includes a partly attachment as well. For example, further attachment means may be used in addition to the conductive thread to attach the at least one sheet to the end sheet respectively the cover.

[0020] Usually, identification documents such as a passport include an end sheet which is attached to the cover. The present disclosure is directed to an identification document in which the at least one sheet is attached to an end sheet. The present disclosure is also directed to an identification document which does not comprise an end sheet and in which the at least one sheet is directly attached to the cover.

[0021] The conductive thread allows the flow of electrical current within the closed circuit. According to an exemplary embodiment, the conductive thread is made of metallic material such as silver or copper or copper alloys. The conductive thread may comprise only metallic material or the conductive thread may comprise other materials such as polyester besides the metallic material as well. The conductive thread may be metalized. Metallization in the context of this disclosure refers to the application of a metal coating to another metallic or non-metallic surface. The conductive thread may also comprise multiple (thin) threads which are twisted together to form a single (thick) thread. The multiple (thin) threads may comprise a (thin) thread comprising conductive material and a (thin) thread not comprising conductive material such as for example a thread made of polymer. The conductive thread may be combined with other threads. The conductive thread may also be incorporated into another thread.

[0022] According to an exemplary embodiment, the closed circuit of the identification document comprises an antenna and the conductive thread forms at least a part of the antenna.

[0023] The antenna is at least partly formed by the conductive thread. The antenna may be formed by multiple antenna elements, one of which is the conductive thread. Alternatively, the antenna may be completely formed by the conductive thread. In this case, the conductive thread is connected to the electrical device. If the conductive thread is manipulated (for example removed), the closed circuit is not closed anymore, and the electrical device will malfunction or will stop functioning. The antenna may for example be used to power the device connected to the antenna via wireless technologies such as RFID/Bluetooth/NFC. By means of manipulation, the closed circuit is broken and the device cease functioning.

[0024] According to an exemplary embodiment, the electrical device comprises an integrated circuit and/or a LED light.

[0025] By means of a LED light, a visual signal may be used to confirm the passports holder's identity. The integrated circuit and/or a LED light are for example connected to an antenna and may be powered by means of wireless technologies such as RFID/Bluetooth/NFC. Breaking the antenna and therefore breaking the closed loop for electrical current to the LED light or to the integrated circuit, the LED light will stop lighting or the integrated circuit will be rendered unreadable since the RFID chip module will be unable to communicate with a reader. Alternatively, the LED light may be configured to change color to indicate tampering.

[0026] According to an exemplary embodiment, the conductive thread attaches the at least one sheet to the end sheet respectively the at least one sheet to the cover by means of a stitching connection.

[0027] Known arrangements such as two threads in chain stitch or programmable stitch formation may be used to attach the sheets to the cover.

[0028] The passport booklet may comprise multiple conductive threads attaching the at least one sheet to the end sheet respectively the cover. The multiple con-

ductive threads may for example be arranged in chain stitch formation. The multiple conductive threads may for example be twisted with each other or run beside each other.

Connection of conductive thread

[0029] The identification document comprises a closed circuit. The closed circuit comprises an electrical device and a conductive thread.

[0030] The closed circuit may further comprise an antenna and the conductive thread forms at least part of the antenna. The conductive thread may form the complete antenna of the identification document. In that case, the conductive thread may be directly connected to the electrical device of the identification document. The connection between the conductive thread and the electrical device may for example be realized by thermocompression bonding. Alternatively, the conductive thread may form only a part of the antenna which is connected to the remaining part of the antenna.

[0031] According to an exemplary embodiment, the passport booklet comprises a metalized printed section which is electrically connected to the conductive thread. Such metalized printed section may serve as a bridge between the conductive thread and a remaining part of the antenna which is electrically connected to the metalized printed section as well.

[0032] The metalized printed section comprises conductive material. The metalized printed section may for example be made of conductive silver, silver ink or copper. The conductive thread may comprise an insulation. In order to make a connection with the metalized printed section, an uninsulated end of the conductive thread may for example exit the region of the folding line (the region of the hinge) and overlap the metalized printed section. The uninsulated end of the conductive thread may be connected to the metalized printed section by means of, for example, thermal coupling, thermal compression bonding or ultrasonic bonding. Alternatively, the uninsulated ends of the conductive thread may be connected to the metalized printed section by being stitched through the metalized printed section.

[0033] The metalized printed section may be located on any one of the at least one sheet or the end sheet of the passport booklet and will overlap with the region where the uninsulated ends of the conductive thread are located.

[0034] By means of the metalized printed section it is possible to electrically connect the conductive thread to a remaining part of the antenna. Thus, the metalized printed section may be used to serve as a bridge between two parts of an antenna, one part of the antenna being the conductive thread.

[0035] Two uninsulated ends of the remaining part of the antenna may be placed on the metalized printed section. This forms the connection between the remaining part of the antenna and the metalized printed section. The connection between the remaining part of the antenna and the metalized printed section may, for example, be realized by a thermal coupling connection, a thermal compression connection or an ultrasonic connection. By means of a metalized printed section, a secure and flexible connection between the conductive thread and the remaining part of the antenna may be provided.

[0036] According to a further exemplary embodiment, the passport booklet comprises at least one copper pad which is electrically coupled to the conductive thread.

[0037] The copper pad may be connected to an uninsulated end of the conductive thread and may serve as connecting member between the conductive thread and a remaining part of the antenna.

[0038] The copper pad may allow for a connection such as a thermocompression bond between the conductive thread and the remaining part of the antenna.

[0039] According to a further exemplary embodiment, the conductive thread may be connected to a remaining part of the antenna by means of a solder connection.

Brief Description of the Drawings

[0040]

Fig. 1 shows an exemplary first embodiment of a passport booklet 1 in a perspective view.

Fig. 2 shows a top view of the passport booklet 1 shown in Fig. 1.

Fig. 3 shows a part of a first conductive thread and a part of a second conductive thread according to an exemplary second embodiment of the passport booklet.

Fig. 4 shows an exemplary third embodiment of the passport booklet 1 in a top view.

Fig. 5 shows an exemplary fourth embodiment of the passport booklet 1 in a top view.

Fig. 6 shows an exemplary fifth embodiment of the passport booklet 1 in a top view.

Fig. 7 shows an exemplary sixth embodiment of the passport booklet 1 in a perspective view.

Detailed Description

[0041] The following is a detailed description of exemplary embodiments of the present disclosure. The exemplary embodiments described herein are intended to teach the principles of the present disclosure, enabling those of ordinary skill in the art to implement and use the present disclosure in many different environments and for many different applications. Therefore, the exemplary embodiments are not intended to be, and should not be considered as, a limiting description of the scope of protection. Rather, the scope of protection shall be defined by the appended claims.

[0042] Fig. 1 shows an exemplary first embodiment of a passport booklet 1 in a perspective view. The passport booklet 1 comprises an end sheet 11 and two data sheets

10. The end sheet 11 and the two data sheets 10 are foldable at a folding line X. The two data sheets 10 and the end sheet 11 are stitched together by means of a conductive thread 20. The end sheet 11 is attached to the cover of the passport booklet (cover not shown in Fig. 1). The in folded state innermost data sheet 10 of the passport booklet 1 comprises a LED light 36 (electrical device 25). The LED light 36 is electrically connected to an antenna 30. The LED light 36 and the antenna 30 form a closed circuit 15. The conductive thread 20 completely forms the antenna 30 and is attached to the LED light by means of a thermocompression bond for example.

[0043] Fig. 2 shows a top view of the passport booklet 1 shown in Fig. 1. The passport booklet 1 comprises the LED light 36. The LED light 36 is electrically connected to the antenna 30. The antenna 30 is formed by the conductive thread 20. The conductive thread 20 attaches the data sheets 10 and the end sheet 11 to the cover of the booklet (only the innermost sheet 10 in folded state of the passport booklet 1 is shown).

[0044] Fig. 3 shows a part of a first conductive thread 21 and a part of a second conductive thread 22 according to an exemplary second embodiment of the passport booklet. This embodiment does not only comprise one but two conductive threads. Fig. 3 only shows the conductive threads 21, 22, but does not show the end sheet 11 or the at least one sheets 10 of the passport booklet 1. The first conductive thread 21 and the second conductive thread 22 stitches together the at least one sheets 10. The first conductive thread 21 and the second conductive thread 22 are stitched along a folding line X of the passport booklet in chain stitch formation.

[0045] Fig. 4 shows an exemplary third embodiment of the passport booklet 1 in a top view. The passport booklet 1 comprises an integrated circuit 35 on data sheet 10. The integrated circuit 35 is the electrical device 25 of the passport booklet 1. The integrated circuit 35 is electrically connected to an antenna 30. The connection may for example be realized by a thermocompression bonding. The antenna 30 comprises a first antenna element 50 and a second antenna element 60 which are connected by means of a solder connection 70. The second antenna element 60 corresponds to the conductive thread 20. The conductive thread 20 is positioned to a large extend in the region of a hinge 80 of the data sheet 10 of the passport booklet 1. Two ends of the conductive thread 20 exit the region of the hinge 80. The two ends of the conductive thread 20 are each connected to a first end respectively a second end of the first antenna element 50 by means of a solder connection. Due to the solder connection, the first antenna element 50 and the second antenna element 60 form a closed electrical loop connected to the integrated circuit 35. The conductive thread 20 attaches the data sheet 10 to the end page 11.

[0046] Fig. 5 shows an exemplary fourth embodiment of the passport booklet 1 in a top view. The data sheet 10 comprises an integrated circuit 35. The integrated circuit 35 is electrically connected to an antenna 30. The antenna 30 comprises a first antenna element 50 and a second antenna element 60 which are connected by means of two copper pads 90 to which respective ends of the first antenna element 50 and the second antenna element 60 are connected. The respective ends of the first antenna element 50 and the second antenna element 60, which are connected by the copper pad, are uninsulated. connected The connection of the first antenna element 50 and the second antenna element 60 to the copper pad 90 may for example be realized by a thermocompression bonding. The second antenna element 60 corresponds to the conductive thread 20. The conductive thread 20 is positioned to a large extend in the region of the hinge 80 of the data sheet 10. Two ends of the conductive thread 20 exit the region of the hinge 80 and are connected to a first end and a second end of the first antenna element 50, respectively. Due to the connection by means of copper pads, the first antenna element 50 and the second antenna element 60 form a closed electrical loop connected to the integrated circuit 35. The conductive thread 20 attaches the data sheet 10 to the end page 11.

[0047] Fig. 6 shows an exemplary fifth embodiment of the passport booklet 1 in a top view. The sheet 10 comprises an integrated circuit 35. The integrated circuit 35 is electrically connected to an antenna 30. The antenna 30 comprises a first antenna element 50 and a second antenna element 60 which are connected by means of metalized printed sections 40.

[0048] The first antenna element 50 corresponds to the conductive thread 20 and is arranged along the folding line X. The conductive thread 20 comprises a uninsulated first conductive thread end 26 and an uninsulated second conductive thread end 27.

[0049] The second antenna element 60 is connected to the integrated circuit 35 and comprises an uninsulated first wire end 31 and an uninsulated second wire end 32, both ends 31, 32 arranged close to the folding line X. The uninsulated first wire end 31 is electrically connected to the uninsulated first conductive thread end 26 by means of the metalized printed section 40. The uninsulated second wire end 32 is electrically connected to the uninsulated second conductive thread end 27 by means of the metalized printed section 40. Thus, the metalized printed sections 40 serve as a bridge between the first antenna element (the conductive thread) and the second antenna element. Due to the connection by means of the metalized printed section, the first antenna element 50 and the second antenna element 60 form a closed electrical loop connected to the integrated circuit 35.

[0050] Fig. 7 shows an exemplary sixth embodiment of the passport booklet 1 in a perspective view. Fig. 7 shows an end sheet 11 being partly folded. The cover to which the end sheet 11 is attached is not shown in Fig. 7. A data sheet 10 comprises a page and a hinge 80. The data sheet 10 is attached to the end sheet 11 in the area of the hinge 80 by means of a conductive thread 20. The conductive thread 20 is stitched through the end

sheet 11 and the hinge 80 of the passport booklet 1. The passport booklet 1 may be provided with further sheets (not shown in Fig. 7) which are arranged inside the data sheet 10 (in folded state) and are attached by the conductive thread 20 as well. The passport booklet 1 further comprises two metalized printed sections 40.

[0051] The conductive thread 20 corresponds to a first antenna element 50. The conductive thread 20 is stitched through the two metalized printed sections 40. Thus, a connection (an electrical path) is created between the conductive thread 20 and the metalized printed sections 40. The area in which the conductive thread 20 is connected to the metalized printed section 40 is marked with the dotted rectangles 46 in Fig. 7. In the area in which the conductive thread 20 is connected to the metalized printed section 40, the conductive thread is uninsulated.

[0052] The passport booklet 1 further comprises an integrated circuit 35 which is electrically connected to a second antenna element 60. The second antenna element 60 comprises two uninsulated wire ends which exit the back of the hinge 80. The area in which the uninsulated wire ends are connected to the metalized printed sections 40 is marked with the dotted rectangles 48 in Fig. 7. The connection between the second antenna element 60 and the metalized printed sections 40 may, for example, be realized by a thermal coupling connection, a thermal compression connection or an ultrasonic connection.

[0053] Due to the connection by means of the metalized printed section, the first antenna element 50 and the second antenna element 60 form a closed electrical loop connected to the integrated circuit 35. With arrows the flow of current in the antenna is indicated.

Industrial applicability

[0054] Crucial for identification documents such as a passport booklet is their level of security to ensure that the identity of the passport holder is correctly authenticated.

[0055] With current thread technology, there is only little indication of tampering when the thread is manipulated such as removed.

[0056] The present disclosure for the first time describes an identification document such as a passport booklet with a conductive thread which serves as an attachment means on the one hand and as part of a closed circuit on the other hand. The closed circuit comprises an electrical device. Having a thread which is a component of the closed circuit means when it is manipulated, the closed circuit will be interrupted and the electrical device will cease functioning. Due to this double functionality of the conductive thread it becomes more difficult to tamper with the passport booklet as attempts to manipulate (for example remove) the conductive thread may be detected. Thus, the level of security is significantly increased. A passport booklet according to the present disclosure therefore is of high interest for authorities.

[0057] It is explicitly stated that all features disclosed in the description and/or the claims are intended to be disclosed separately and independently from each other for the purpose of original disclosure as well as for the purpose of restricting the claimed invention independent of the composition of the features in the embodiments and/or the claims. It is explicitly stated that all value ranges or indications of groups of entities disclose every possible intermediate value or intermediate entity for the purpose of original disclosure as well as for the purpose of restricting the claimed invention, in particular as limits of value ranges.

List of reference signs

[0058]

1	passport booklet
10	data sheet
11	end sheet
15	closed circuit
20	conductive thread
21	first conductive thread
22	second conductive thread
25	electrical device
26	uninsulated first conductive thread end
27	uninsulated second conductive thread end
30	antenna
31	uninsulated first wire end
32	uninsulated second wire end
35	integrated circuit
36	LED light
40	metalized printed section
46	connection between conductive thread and metalized printed section
48	connection between first antenna element and metalized printed section
50	first antenna element
60	second antenna element
70	solder connection
80	hinge
90	copper pad
X	folding line

Claims

1. An identification document (1) such as a passport booklet, comprising:

- a cover foldable at a folding line (X),
- an end sheet (11) being foldable at the folding line (X) and attached to the cover,
- at least one sheet (10) being foldable at the folding line (X), and
- a closed circuit comprising:

a) an electrical device (25) such as an inte-

grated circuit (35) or a LED light (36,) and
b) a conductive thread (20) attaching the at least one sheet (10) to the end sheet (11),

wherein the device (25) malfunctions when the closed circuit is interrupted by means of manipulation of the conductive thread (20).

2. The identification document (1) according to claim 1, wherein

- the closed circuit further comprises an antenna (30), and
- the conductive thread (20) forms at least a part of the antenna (30).

3. The identification document (1) according any one of the preceding claims, wherein the closed circuit is at least part of a security feature such as an RFID chip module directed to verifying the authenticity of the identification document (1).

4. The identification document (1) according to any one of the preceding claims, wherein the conductive thread (20) attaches the at least one sheet (10) to the end sheet (11) by means of a stitching connection.

5. The identification document (1) according to any one of the preceding claims comprising multiple conductive threads (21, 22).

6. The identification document (1) according to any one of the preceding claims, further comprising at least one metalized printed section (40) electrically coupled to the conductive thread (20).

7. The identification document (1) according to any one of the preceding claims, further comprising at least a copper pad (90) electrically coupled to the conductive thread (20).

8. An identification document such as a passport booklet (1), comprising:

- a cover foldable at a folding line (X),
- at least one sheet (10) being foldable at the folding line (X), and
- a closed circuit comprising

a) an electrical device (25) such as an integrated circuit (35) or a LED light (36) and
b) a conductive thread (20) attaching the at least one sheet (10) to the cover,

wherein the device (25) malfunctions when the closed circuit is interrupted by means of manipulation of the conductive thread (20).

9. The identification document (1) according to claim 8, wherein

- the closed circuit further comprises an antenna (30), and
- the conductive thread (20) forms at least a part of the antenna (30).

10. The identification document (1) according claim 8 or 9, wherein the closed circuit is at least part of a security feature such as an RFID chip module directed to verifying the authenticity of the identification document (1).

11. The identification document (1) according to any one of claims 8 to 10, wherein the conductive thread (20) attaches the at least one sheet (10) to the cover by means of a stitching connection.

12. The identification document (1) according to any one of claims 8 to 11 comprising multiple conductive threads (21, 22).

13. The identification document (1) according to any one of claims 8 to 12, further comprising at least one metalized printed section (40) electrically coupled to the conductive thread (20).

14. The passport booklet (1) according to any one of claims 8 to 13, further comprising at least a copper pad (90) electrically coupled to the conductive thread (20).

FIG 1

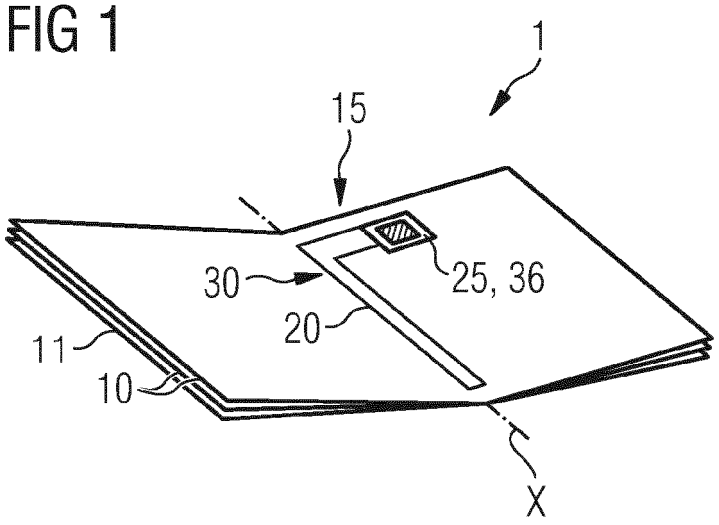


FIG 2

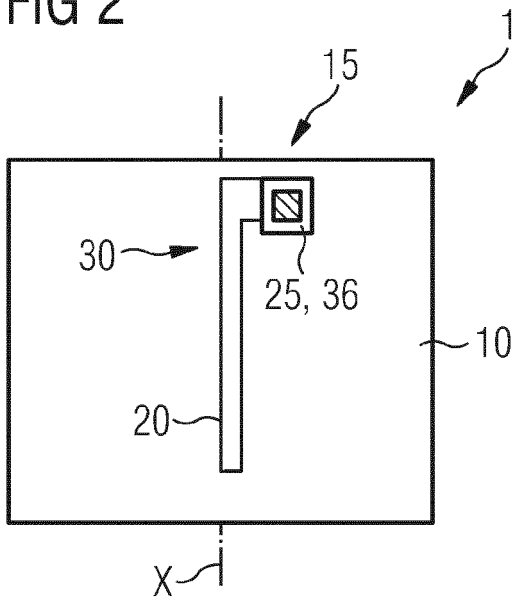


FIG 3

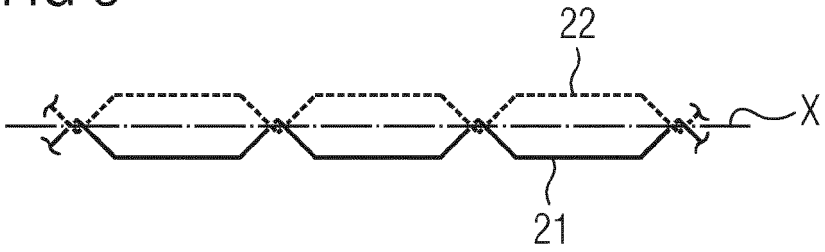


FIG 4

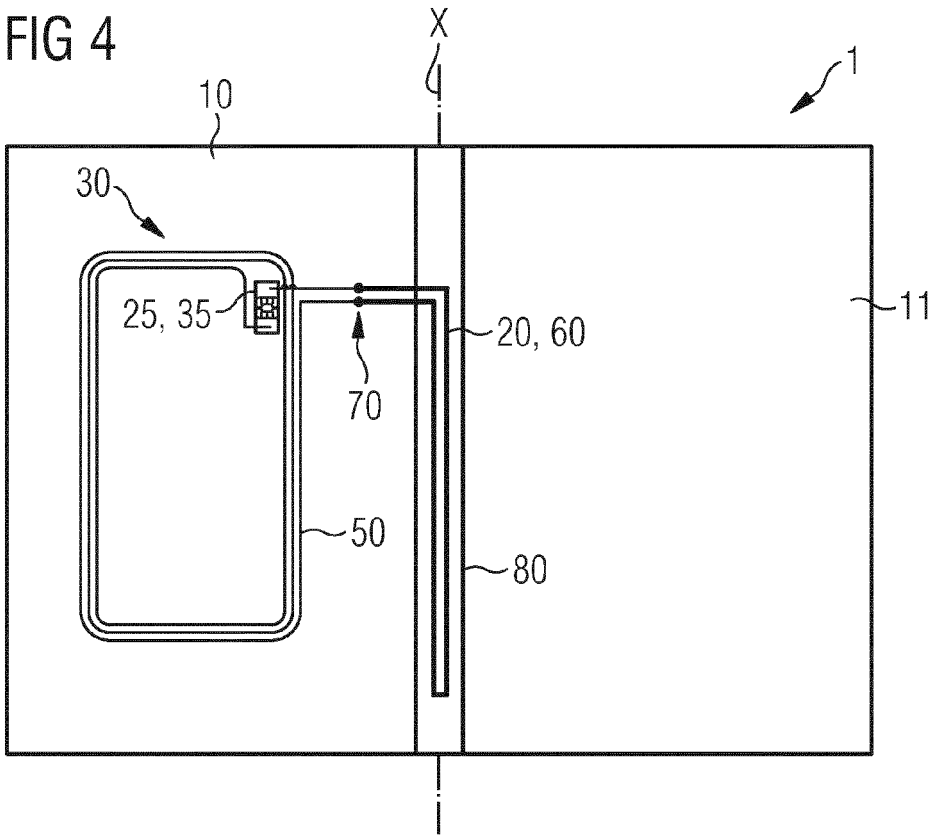


FIG 5

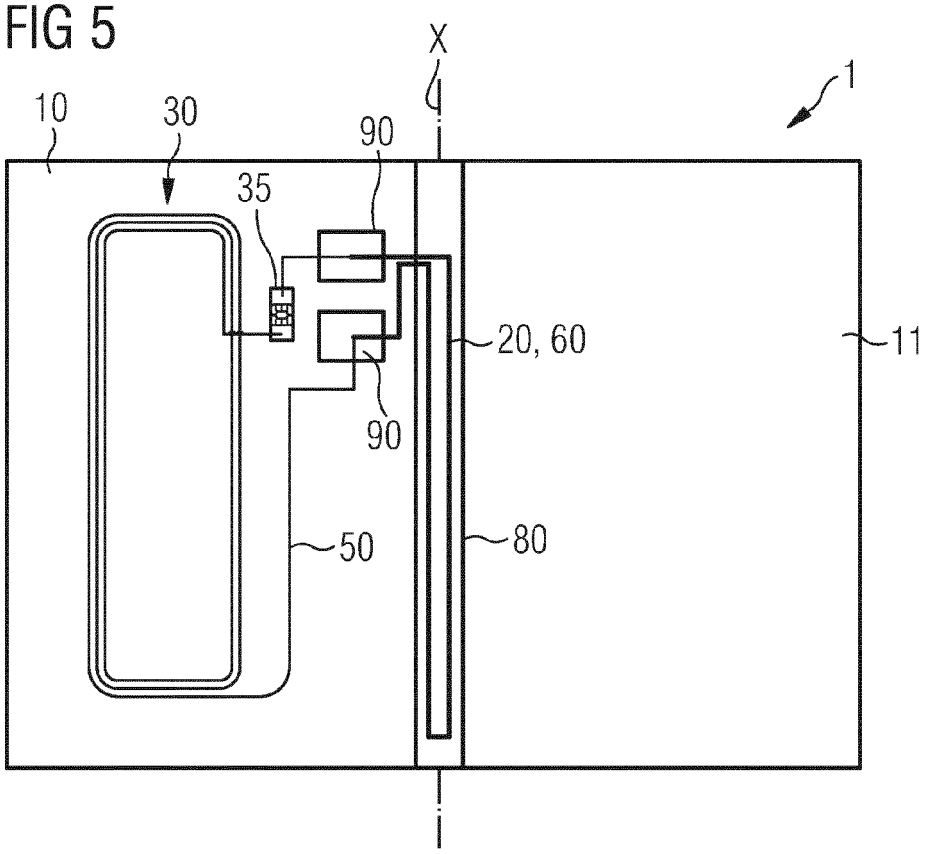


FIG 6

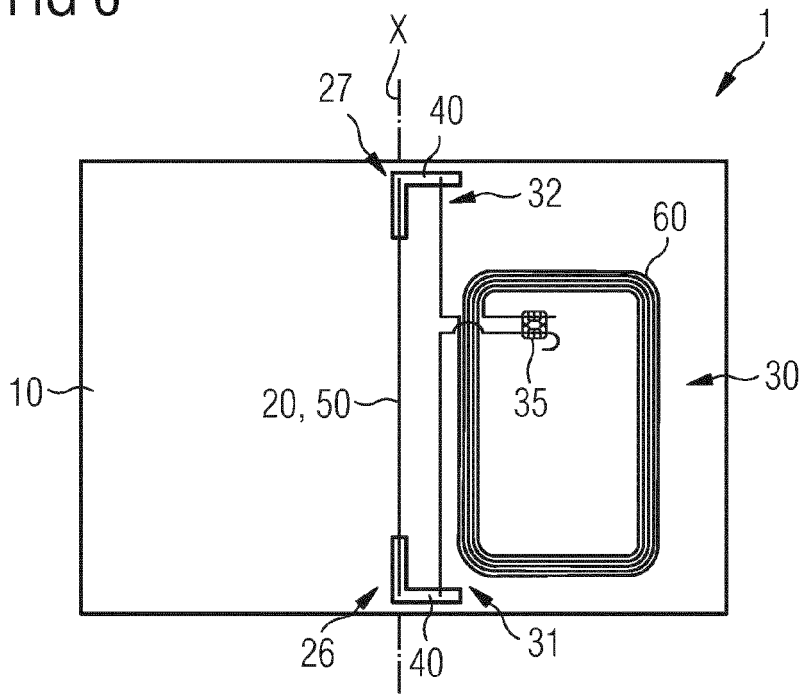
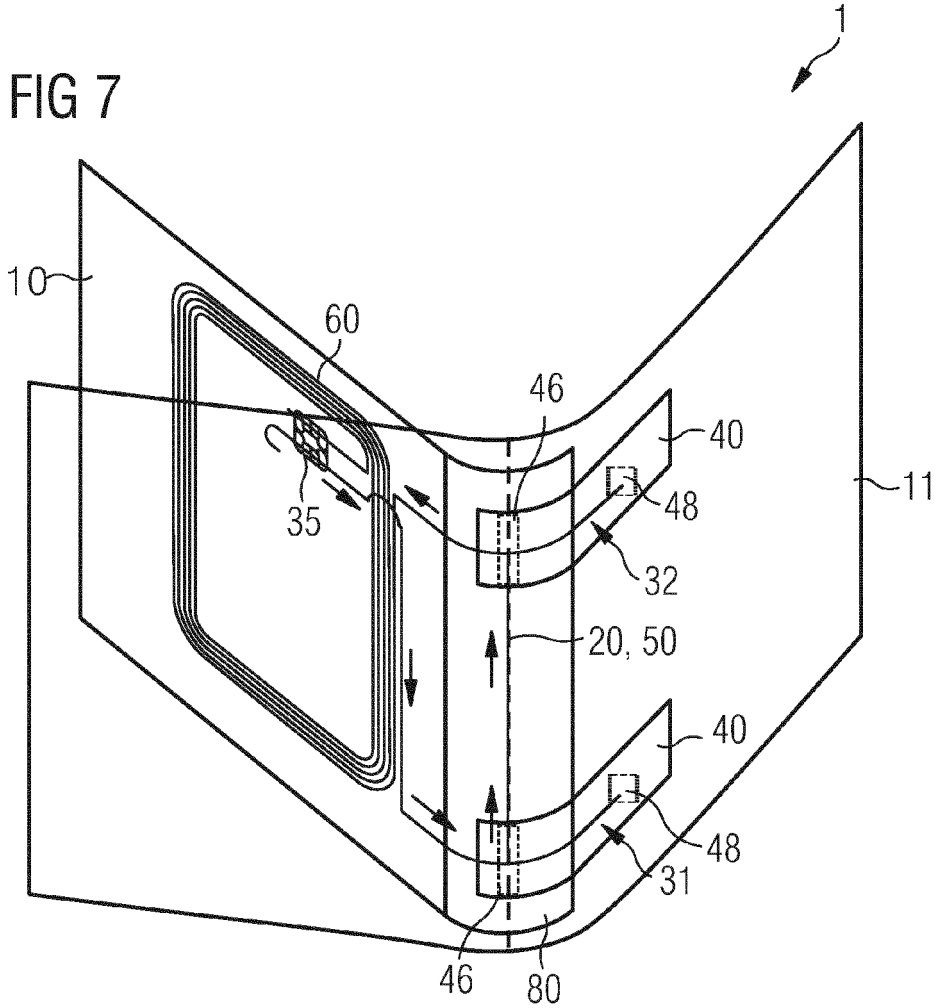

X
1
27
40
32
60
10
20, 50
35
30
26
40
31

FIG 7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EUROPEAN SEARCH REPORT

Application Number
EP 21 21 5053

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B42D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 May 2022	Achermann, Didier

CATEGORY OF CITED DOCUMENTS

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11-05-2022

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