(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 November 2018 (15.11.2018)

WIPO | PCT

(10) International Publication Number
WO 2018/208762 A1

(51) International Patent Classification:
G02C 1/00 (2006.01) *G02C 11/00* (2006.01)
G02C 5/00 (2006.01) *G06K 19/07* (2006.01)
G02C 7/00 (2006.01) *H01Q 1/20* (2006.01)
G02C 7/02 (2006.01)

(21) International Application Number:
PCT/US2018/031577

(22) International Filing Date:
08 May 2018 (08.05.2018)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
62/503,004 08 May 2017 (08.05.2017) US

(71) Applicant: **SATO HOLDINGS KABUSHIKI KAISHA** [JP/JP]; 7-1, Shimomeguro 1-chome, Meguro-ku, Tokyo 153-0064 (JP).

(72) Inventor; and

(71) Applicant *(for SC only)*: **MERCIER, Mike** [US/US]; 6594 NW 1st Street, Margate, Florida 33063 (US).

(72) Inventors: **NIELAND, David**; 4787 Bethel Church Rd., Hickory, North Carolina 28602 (US). **JONES, Chris**; 11623 S Laramie Ave., Alsip, Illinois 60803 (US). **COTE, Andre**; 1140 Windham Parkway, Margate, Florida 33063 (US).

(74) Agent: **CRITCHLEY, Adele** et al.; Westerman, Hattori, Daniels & Adrian, LLP, 8500 Leesburg Pike, Suite 7500, Tysons, Virginia 22182 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,

WO 2018/208762 A1

(54) Title: LENS WITH RFID

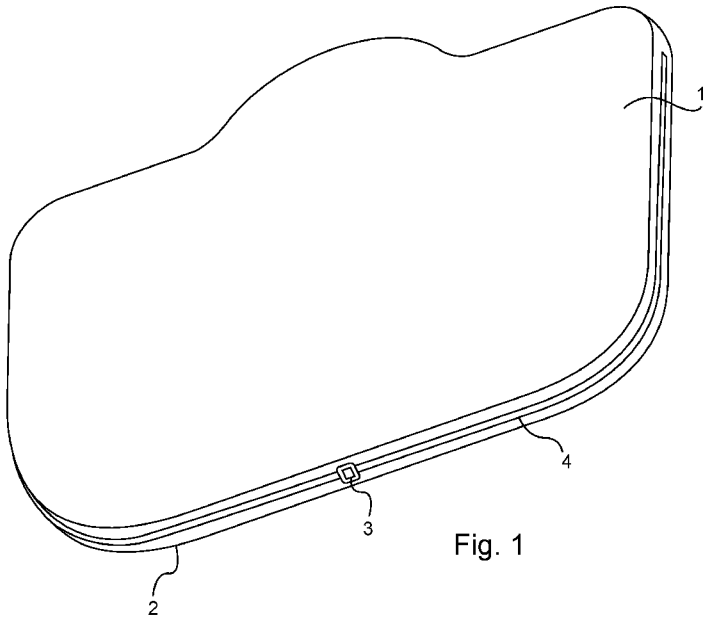

Fig. 1

(57) Abstract: A custom application solution developed for the tracking and tracing of eyewear, such as augmented and virtual reality eyewear, by the inclusion of an RFID system affixed to the outer circumference edge of a lens rim is disclosed. The RFID system including an RFID chip and an antenna, with the antenna positioned along the rim portion so as to conform to the shape of the edge. The conductive antennae and/or the RFID chip should be incorporated in such a manner that its attempted removal would destroy the aesthetic value and/or the usability of the lens.

[Continued on next page]

OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

— *with international search report (Art. 21(3))*

LENS WITH RFID

CROSS-REFERENCES TO RELATED APPLICATIONS

[0001] The present application claims priority to US Provisional Application No. 62/503,004 filed May 8, 2017, the disclosures of which are incorporated herein by reference in their entireties.

TECHNICAL FIELD

[0002] The present disclosure broadly relates generally to eyewear, such an Augmented and Virtual Reality eyewear, wherein a lens has been integrated with RFID components.

BACKGROUND

[0003] For many people, eyewear is indispensable, from those who wear prescription eyewear on a daily basis, to those who enjoy being out in the sun where a pair of sunglasses is necessary. Eyewear itself can be very expensive, especially when coupled with a designer brand. As a result, the eyewear has a high value to both the manufacturers and the consumers.

[0004] In more recent times, wearable computing devices have gained attractiveness. Evolving technologies coupled with a desire for convenience has fueled a rise in the popularity of eyewear as wearable computing devices. Such eyewear may incorporate photonic elements and similar components to allow information to be projected to a wearer's eye. As a result, the lenses constituting the eyewear have a high value and owners thereof will desire both security and individual identification with the lenses.

[0005] With the rise of online shopping, there is further desire to be able to efficiently track eyewear location.

[0006] Conventionally, serial numbers and the like, are often engraved on the body of eyewear, but this can become unreadable over time and, amongst other problems, is not a deterrent for pirated products since the engravings are usually easily reproducible. During manufacture and sales, RFID tags are usually attached as a separate component to the eyewear to monitor location and inventory management. The RFID tags are then removed at the time of sale. After-market enhancements and/or modifications to eyewear are not always readily available. Thus, it can be impossible to confirm the authenticity of a produce by consumers at a later stage, for instance on resale.

[0007] However, there is a need for a balance of security with aesthetics. For instance, the separate RFID tags commonly used during manufacture and sales would not be suitable for the end component as they would be unsightly. They would also be easily removable, and so not a deterrent to theft.

SUMMARY

TECHNICAL PROBLEM

[0008] Thus, there is a continued need to provide a system for tracking the eyewear, checking the authenticity of a product and deterring theft. Users require that the eyewear remain aesthetically pleasing. Therefore, the system has to be well integrated to the product to ensure virtual invisibility to the consumer. The system also has to be sufficiently integrated so that

removal would result in significant damage to the integral parts of the eyewear in order to deter theft.

SOLUTION TO PROBLEM

[0009] In accordance with a first aspect disclosed herein, there is provided a custom application solution developed for the tracking and tracing of eyewear, such as Augmented and Virtual Reality eyewear.

[0010] In accordance with a second aspect disclosed herein, there is provided a lens tagged with an RFID (radio frequency identification device) with extended range due to inclusion of an antenna without impacting the aesthetic value of the lens. The antenna is positioned along the edge portion of the lens so as to conform to the shape of the lens' rim.

[0011] These and other aspects and features of non-limiting embodiments will now become apparent to those skilled in the art upon review of the following description of specific non-limiting embodiments in conjunction with the accompanying drawings.

ADVANTAGOUS EFFECTS

[0012] In some non-limiting embodiments an RFID system assists with anti-counterfeiting, authentication, supply chain logistics, and interconnectivity with software, providing real time information about the lens and any associated information regarding its pedigree.

[0013] The placement allows it to be virtually invisible to the wearer appearing to be part of the perimeter of the lens which can also be hidden within an eyewear frame. This allows for unique

identification of an individual lens without materially affecting the aesthetic value of the eyewear.

[0014] In some non-limiting embodiments an RFID system may be affixed to the lens in such a manner that any attempted removal results in damage and/or destruction to the lens and/or components within the lens.

BRIEF DESCRIPTION OF THE FIGURES

[0015] The non-limiting embodiments will be more fully appreciated by reference to the accompanying drawings, in which:

[0016] Fig. 1 depicts an example of a lens according to a non-limiting embodiment wherein along a single perimeter of a lens edge a RFID chip with a conductive antenna is placed directly thereon.

[0017] Fig. 2 depicts an example of a lens according to a non-limiting embodiment wherein around a circumferential lens edge of the lower rim and partial side rims of the lens is a RFID chip with a conductive antenna placed directly thereon.

[0018] Fig. 3a depicts a top view of an example of a lens according to a non-limiting embodiment wherein an RFID chip is embedded into a glass lens edge. Fig. 3b is a side of the non-limiting embodiment according to Fig. 3a. Fig. 3c is a bottom view of an RFID chip.

[0019] The drawings are not necessarily to scale and may be illustrated by phantom lines, diagrammatic representations and fragmentary views. In certain instances, details that are not

necessary for an understanding of the embodiments or that render other details difficult to perceive may have been omitted.

DESCRIPTION OF NON-LIMITING EMBODIMENTS

[0020] Reference will now be made in detail to various non-limiting embodiment(s) of an identification bracelet and a monitoring system including an identification bracelet. It should be understood that other non-limiting embodiment(s), modifications and equivalents will be evident to one of ordinary skill in the art in view of the non-limiting embodiment(s) disclosed herein and that these variants should be considered to be within scope of the appended claims.

[0021] Furthermore, it will be recognized by one of ordinary skill in the art that certain structural and operational details of the non-limiting embodiment(s) discussed hereafter may be modified or omitted (i.e. non-essential) altogether. In other instances, well known methods, procedures, and components have not been described in detail.

[0022] Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. The use of "including," "comprising," or "having" and variations thereof herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items.

[0023] The disclosure provides lens articles secured with RFID components and methods of making the same.

[0024] Each individual lens of eyewear can be individually secured with RFID components. Examples of eyewear include, but are not limited to, wearable computer eyewear, (*e.g.*,

augmented and virtual reality eyewear and smartglasses), 3D eyewear, protection eyewear, prescription eyewear, sunglasses, bioptics (*e.g.*, magnification eyewear), anti-glare protection glasses, gaming/computer glasses (*e.g.*, yellow tinted gaming/computer glasses), monocles and fashion eyewear.

[0025] The RFID system described herein allows for a lens to be tagged with an RFID (radio frequency identification device) with extended range due to inclusion of an antenna without impacting the aesthetic value of the lens. Examples of RFID systems include, but are not limited to, RFID inlay product LXMSANAA10-139 (Manufactured by Murata Manufacturing Co., Ltd under the name MAGICSTRIP®), and product IPJ-W1700-K00 (Manufactured by INPINJ® under the name MONZA® R6). These examples are non-limiting examples.

[0026] The RFID chip is not particularly limited as long as the chip is sufficiently small enough to be virtually invisible when integrated into the lens. An example of an RFID chip sufficient small would be a wafer type RFID thinned to ≤109μm. It is desirable that the RFID chip should have sufficient memory, for example tag memory designed to ensure 100,000 write cycles or retain data for 50 years. It is desirable that the RFID chip maintain performance and function over a wide range of temperature stresses, for example an RFID chip that maintains performance and function over a range of temperature from about -40°C to about 125°C.

[0027] In some non-limiting embodiments there is provided a lens tagged with an RFID with extended range due to inclusion of an antenna. The antenna is not particularly limited as long as the antenna can electrically connect to the RFID chip, conforms to the shape of the lens and is sufficiently small enough to be virtually invisible when integrated into the lens. An example of

an antenna for use in some non-limiting embodiments is a conductive ink, wherein such inks can be applied to the lens edge via printing. For instance, an electrically conductive silver flake ink that is formulated for screen printing. The example is a non-limiting example and any type of conductive material including but not limited to steel, iron and aluminum can be used as the antenna.

[0028] With reference to the figures, a non-limiting embodiment will be described. Lens (1) of Fig. 1 is provided an RFID chip (3) with a conductive antenna (4) placed directly onto the lens edge (2) using an adhesive or a direct application method. The conductive antenna (4) is positioned along the edge portion so as to conform to the shape of the rim. The conductive antenna (4) is generally formed in the shape of a strip or band, but one skilled in the art will appreciate that the shape of the antenna is not limited so long as it fits the rim of the lens, and is capable of conforming to the shape thereof without being visible to the user. The lens edge (2) may or may not include a pre-cut groove to accommodate the RFID chip (3) and/or antenna (4).

[0029] The side of the lens constituting to the lens edge (2) for the purpose of some non-limiting embodiments is along the outer circumferential rim of the lens but is not limited to any one side, and may include at least one of the upper edge, lower edge or either side edges of the outer circumferential rim of the lens. The lens edge (2) for the purpose of some non-limiting embodiments may include at least two of the upper edge, lower edge and either side edges of the outer circumferential rim of the lens. The lens edge (2) for the purpose of some non-limiting embodiments may include at least three of the upper edge, lower edge and either side edges of the outer circumferential rim of the lens. The lens edge (2) for the purpose of some non-limiting

embodiments may include all sides of the outer circumferential rim of the lens. It is also understood that the RFID chip (3) and conductive antennae (4) may cover a whole of a side or portion of a side of the outer circumferential rim of the lens.

[0030] One skilled in the art will understand that the shape of the lens is not limited to those illustrated in the figures. Lens shape may include, but are not limited to, rectangle, round, flat-top, heart, aviator, butterfly, cat-eye, pillowed rectangle, squares, wayfarer, diamond and oval.

[0031] In one non-limiting embodiment, the conductive antennae (4) and RFID chip (3) are directly placed on an edge of the lens rim (2) using an adhesive. Adhesives of some non-limiting embodiments are capable of maintaining sufficient adhesive strength between the RFID chip (3) and antenna (4) to the lens edge (2). The adhesive of some non-limiting embodiments has a peel strength characterized by having relatively high ultimate adhesion, so that the RIFD chip (3) and antenna (4) cannot be removed intact or requires a great deal of force to be removed. Thus, the conductive antennae and/or the RFID chip should be incorporated in such a manner that its attempted removal would destroy the aesthetic value and/or the usability of the lens.

[0032] One measure is that the force required to remove the adhesive is greater than the tensile strength of the RFID chip (3) and antenna (4), or the tear strength of the product surface. For example, a system, which is firmly attached to a lens surface, but which can be removed from it, intact, may be considered to be non-permanent for that application; however, that same system may destroy the surface of a lens by ripping up fibers or breaking the item, *i.e.* the force to destroy or remove the system is greater than that which can be borne by the lens.

[0033] The adhesive is not particularly limited as long as it sufficiently adheres the RFID components to the lens material in a manner that if removed damage occurs to the lens, RFID components or both. The adhesive may exhibit a 180° peel adhesion force at a peel rate of 300 mm/min of 0.1 N/20 mm or greater, 1 N/20mm or greater, 2 N/20mm or greater, 3 N/20mm or greater, 4 N/20mm or greater, 5 N/20mm or greater, 6 N/20mm or greater , 7 N/20mm or greater, 8 N/20mm or greater, 9 N/20mm or greater, 10 N/20mm or greater, 11 N/20mm or greater, 12 N/20mm or greater, 13 N/20mm or greater, 14 N/20mm or greater, 15 N/20mm or greater, 16 N/20mm or greater, 17 N/20mm or greater, 18 N/20mm or greater, 19 N/20mm or greater, 20 N/20mm or greater, 21 N/20mm or greater, 22 N/20mm or greater, 23 N/20mm or greater, 24 N/20mm or greater, 25 N/20mm or greater and 30N/20mm or greater, when measured based on JIS Z 0237 (2009).

[0034] These are only examples of what is specifically intended, and all possible combinations of numerical values between and including the lowest value and the highest value enumerated are to be considered to be expressly stated in this application. The peel strength of the adhesive is not particularly limited other than the force is specified so that cracking, breakage and/or distortion of the rigid members (i.e., lens, RFID components *etc.*) occurs if the RFID chip (3) and/or antenna (4) are removed.

[0035] Suitable adhesives may include, but are not limited to, acrylic adhesives, adhesive films, anaerobic adhesives, adhesive tapes, epoxies, heat activated adhesives, hot melt adhesives, hydrocolloids/hydrogel adhesives, moisture cured adhesives, polyester adhesives, pressure sensitive adhesives, silicone adhesives, urethane adhesives, light cured adhesives, and UV

cured adhesives. Any suitable type of adhesive can be used that is compatible with the lens and RFID component and antenna being bonded.

[0036] The RFID chip (3) and conductive antennae (4) can adhere directly onto the surface of the lens edge or can be adhered into a pre-cut groove on the lens edge. The dimensions of the pre-cut groove are not limited and would be based upon the dimensions of the RFID chip (3) and conductive antennae (4), while ensuring that the RFID chip (3) and conductive antennae (4) would not be visible. For example, for a RFID inlay (RFID chip and antenna) having the dimensions 60.0 x 2.2 x 0.7 mm, the pre-cut groove would be just big enough to tightly secure the RFID inlay without movement.

[0037] In another non-limiting embodiment, the conductive antennae (4) and RFID chip (3) are directly placed on the lens edge (2) using a direct application method. Such methods include welding, silver paste, printing, antenna pins, recessed into a pre-cut groove, embedded directly, or by using similar application around the circumference of the lens. The methods can include more than one method, for instance, the RFID chip may be adhered to the surface using an adhesive and the ink conductive antenna printed on to the surface.

[0038] The RFID components can be covered with a protective layer. For example, as illustrated in Fig. 3a, a protective layer in the form of a dome can be used to cover the RFID chip. The material of the protective layer is not particularly limited as long as the material is capable of sufficiently protecting the RFID components. High sheer and peel strength resins are preferable. Non-limiting examples include epoxies, acrylic adhesives, silicone resins and urethane resins.

[0039] Fig. 3a and Fig. 3b depict a non-limiting method of embedding an RFID device into a glass lens (11). The RFID chip (13) is embedded into a pre-cut groove (15) and secured using an adhesive (16). A protective layer (17) is applied over the RFID chip (13). Antennae (14) is printed directly on to the lens edge (12) and is bonded to the RFID chip (13).

[0040] A method of attaching the RFID components to the lens edge (2) using welding, may comprise the steps of having a housing encapsulate at least a portion of the RFID chip (3) and/or conductive antennae (4), placing the RFID component with housing in place on the lens edge and applying, for example, an ultrasonic welding process to melt a portion of the housing thereby ensuring the RFID component is fixed in place without damaging the RFID components upon manufacture. Attempted removal of the RFID component should result in serious damage to the RFID component and lens. The conductive antennae and/or the RFID chip should be incorporated in such a manner that its attempted removal would destroy the aesthetic value and/or the usability of the lens. A non-limiting example of the housing is a resin housing, including epoxies, acrylic adhesives, silicone resins and urethane resins.

[0041] A method of attaching the RFID components to the lens edge (2) being recessed into a pre-cut groove, the dimensions of the pre-cut groove would be based upon the dimensions of the RFID chip (3) and conductive antennae (4), but understood that the RFID chip (3) and conductive antennae (4) would not be visible to the user when using the eyewear.

[0042] Any of the methods for attaching the RFID component to the lens edge, *i.e.*, welding, silver paste, printing, antenna pins can be either onto the outer surface of the lens edge or into a pre-cut groove on the lens edge.

[0043] The described placement of the RFID chip and antenna allow them to be virtually invisible to the wearer, as they appear to be part of the perimeter of the lens which can also be hidden within an eyewear frame, as oppose to on the eyewear frame. By incorporating the RFID component and antenna in each individual lens, the lenses can thereby bear a unique RFID number which can be associated with the pedigree of the lens. The location of the RFID system around the circumference of the lens provides the ability to mask the location of the system within eyewear frames.

[0044] This allows for unique identification of an individual lens including product authentication, an ability to automatically scan during the manufacturing and supply chain process as well as trigger alerts if in contact with an RFID sensor (*i.e.* security portal) without materially affecting the aesthetic value of the lens.

[0045] The RFID system may be affixed to the lens in such a manner that any attempted removal results in damage and/or destruction to the lens and/or components within the lens, such as a photonic chip or similar embedded within the lens. Thus, acting as a theft deterrent.

[0046] The above described system includes an RFID component and antenna of variable length and conductive antenna material which can be affixed around the circumference of the lens. The RFID chip (3) may operate at different operating frequencies according to the length and design of the conductive antenna (4).

[0047] The RFID component affixed and/or embedded in or around the lens has a unique identifier which can be read using RFID hardware such as RFID antennae, RFID tunnels or portals, or handheld RFID scanning devices, which when paired with supply chain, asset

management, or comparable software, can identify the unique attributes and pedigree of the lens. Thereby, the RFID system assists with anti-counterfeiting, authentication, supply chain logistics and interconnectivity with software providing real time information about the lens and any associated information regarding its pedigree. Pedigree could include such examples as ownership information, production and manufacture date, optical strength, service and repair dates, warranty, last read location information, and other supplier captured information.

EXAMPLES

[0048] The following is a prophetic example illustrating the preparation of a lens with integrated RFID edgeband according to one non-limiting embodiment.

EXAMPLE 1

[0049] An RFID device embedded into the low edge surface of a glass lens as illustrated in Fig. 3a and Fig 3b can be formed by drilling a small hole into a center portion of a lower edge of a glass lens. Metalon® HPS-030LV Conductive silver screen ink – aqueous dispersion (a water-based Ag flake ink, available from NOVACENTRIC®) can be used as the antenna and printed onto the outer circumferential surface of the lower edge of a glass lens, having a length of ~8.2cm, wherein the small drill hole will be positioned at the center of the antenna. A IMPINJ® MONZA® r6 UHF RFID Tag chip can be adhered in the drill hole via an epoxy adhesive (3M™ Scotch-Weld™ Expoxy Adhesive DP1000 Plus Clear). A protective dome can then be formed

over the RFID chip using the same epoxy adhesive (3M™ Scotch-Weld™ Expoxy Adhesive DP1000 Plus Clear).

[0050] It can be understood that the RFID components are sufficiently embedded into the glass lens so as to be invisible to the user, and affixed to the lens in such a manner that any attempted removal results in damage and/or destruction to the lens.

[0051] It is noted that the foregoing has outlined some of the more pertinent non-limiting embodiments. It will be clear to those skilled in the art that modifications to the disclosed non-embodiment(s) can be effected without departing from the spirit and scope thereof. As such, the described non-limiting embodiment(s) ought to be considered to be merely illustrative of some of the more prominent features and applications. Other beneficial results can be realized by applying the non-limiting embodiments in a different manner or modifying them in ways known to those familiar with the art. This includes the mixing and matching of features, elements and/or functions between various non-limiting embodiment(s) is expressly contemplated herein so that one of ordinary skill in the art would appreciate from this disclosure that features, elements and/or functions of one embodiment may be incorporated into another embodiment as skill in the art would appreciate from this disclosure that features, elements and/or functions of one embodiment may be incorporated into another embodiment as appropriate, unless described otherwise, above. Although the description is made for particular arrangements and methods, the intent and concept thereof may be suitable and applicable to other arrangements and applications.

INDUSTRIAL APPLICATION

[0052] A custom application solution developed for the tracking and tracing of eyewear, such as augmented and virtual reality eyewear, by the inclusion of an RFID system affixed to the edge of circumference of a lens. Thereby, the RFID system assists with anti-counterfeiting, authentication, supply chain logistics and interconnectivity with software providing real time information about the lens and any associated information regarding its pedigree.

REFERENCE SIGNS LIST

[0053] **1** Lens: **2** Lens edge: **3** RFID chip: **4** Antenna: **11** Lens: **12** Lens edge: **13** RFID chip: **14** Antenna: **15** recess groove: **16** adhesive: **17** protective dome: **23** RFID chip

WHAT IS CLAIMED IS:

1. A lens, comprising

an RFID chip positioned on an edge portion of the outer circumference rim of the lens; and an antenna electrically connected to the RFID chip;

wherein the antenna conforms with the shape of the rim; and

wherein at least the antenna is fixed to the edge portion in a manner such that attempted removal of at least the antenna results in irreparable damage to the lens.

2. The lens according to claim 1, wherein the lens comprises a photonic chip.

3. The lens according to claim 1, wherein the antenna is fixed by at least one of an adhesive, a weld, a silver paste, antenna pins, a recess into a pre-cut groove or printing.

4. The lens according to claim 3, wherein the adhesive is selected from the group consisting of acrylic adhesives, adhesive films, adhesive tape, anaerobic adhesives, epoxies, heat activated adhesives, hot melt adhesives, hydrocolloids/hydrogel adhesives, moisture cured adhesives, polyester adhesives, pressure sensitive adhesives, silicone adhesives, urethane adhesives, light cured adhesives and UV cured adhesives.

5. The lens according to claim 3, wherein the peel strength of the adhesive is greater than the tensile strength of the RFID chip and antenna, or the tear strength of the lens.

6. The lens according to claim 1, wherein the RFID chip is fixed using an adhesive.

7. The lens according to claim 7, wherein the RFID chip is recessed into a pre-cut groove.

8. The lens according to claim 1, further comprising a protective layer covering the RFID chip.

9. The lens according to claim 8, wherein the protective layer is a resin layer selected from the group consisting of epoxies, acrylics, urethanes and silicones.

10. The lens according to claim 1, wherein the antenna is positioned along the outer circumferential rim of at least a lower edge of the lens.

11. The lens according to claim 1, wherein the antenna is a conductive ink.

12. Eyewear, comprising at least one lens according to claim 1.

13. The eyewear according to claim 12, wherein the eyewear is selected from the group consisting of wearable computer eyewear, 3D eyewear, protection eyewear, prescription eyewear, sunglasses, bioptics, anti-glare protection glasses, yellow tinted computer glasses, monocles and fashion eyewear.

14. The eyewear according to claim 13, wherein the wearable computer eyewear is augmented and virtual reality eyewear.

15. The eyewear according to claim 13, wherein the wearable computer eyewear is smartglasses.

16. A method of manufacturing a lens according to claim 1, comprising the steps of

fixing the antenna along the edge portion of the lens so as to conform with the shape of the rim,

wherein the antenna is fixed to the edge portion of the lens in a manner such that attempted removal of the antenna results in irreparable damage to the lens.

17. The method according to claim 16, wherein the lens comprises a photonic chip.

18. The method according to claim 16, wherein the antenna is fixed using an adhesive, welding, silver paste, antenna pins, recessed into a pre-cut groove or printing.

19. The method according to claim 18, wherein the adhesive is selected from the group consisting of acrylic adhesives, adhesive films, anaerobic adhesives, epoxies, heat activated adhesives, hot melt adhesives, hydrocolloids/hydrogel adhesives, moisture

cured adhesives, polyester adhesives, pressure sensitive adhesives, silicone adhesives, urethane adhesives, light cured adhesives, and UV cured adhesives.

19. The method according to claim 16, wherein the peel strength of the adhesive is greater than the tensile strength of the RFID chip and antenna, or the tear strength of the lens.

20. The lens according to claim 16, wherein the antenna is a conductive ink.

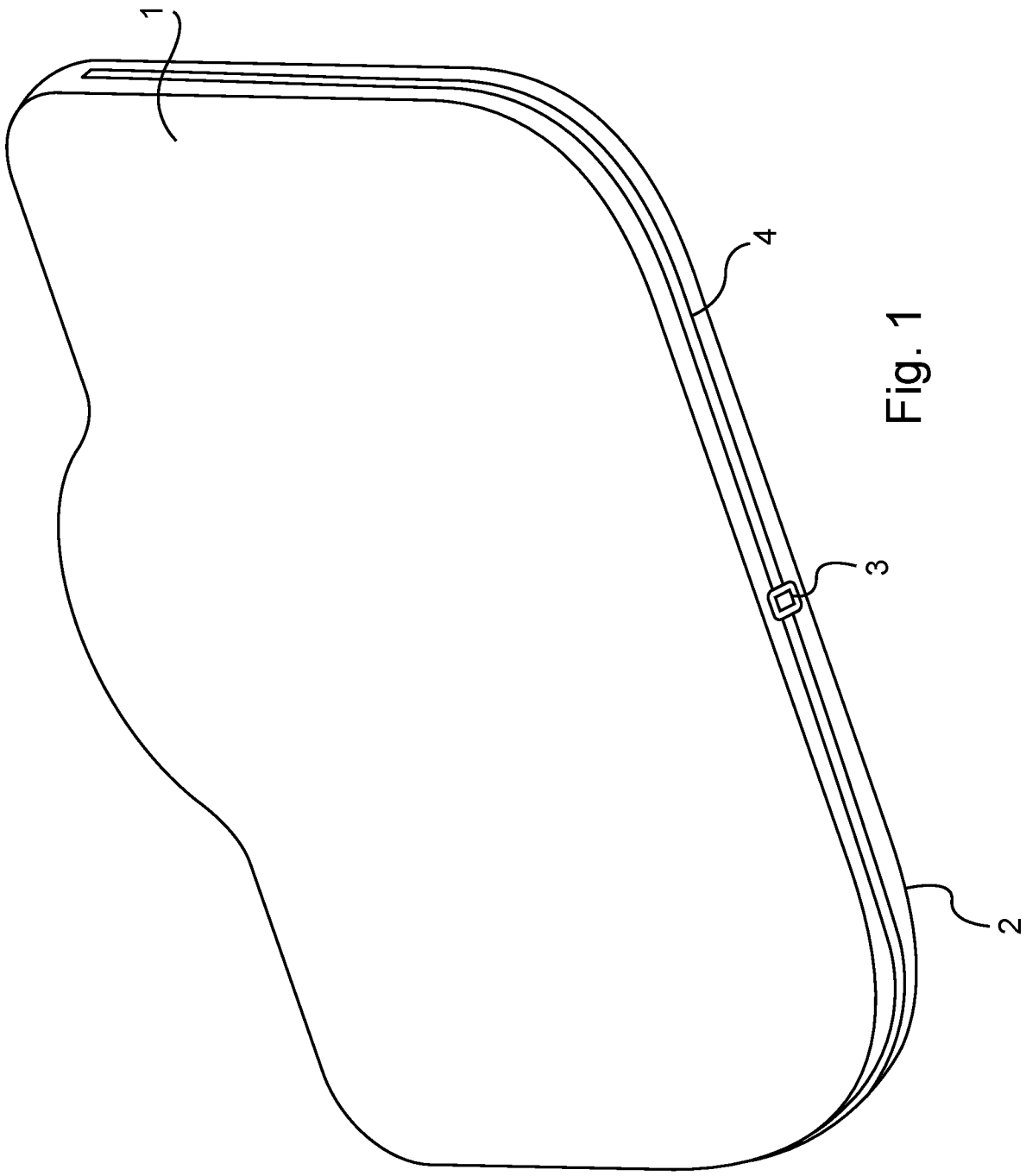

Fig. 1

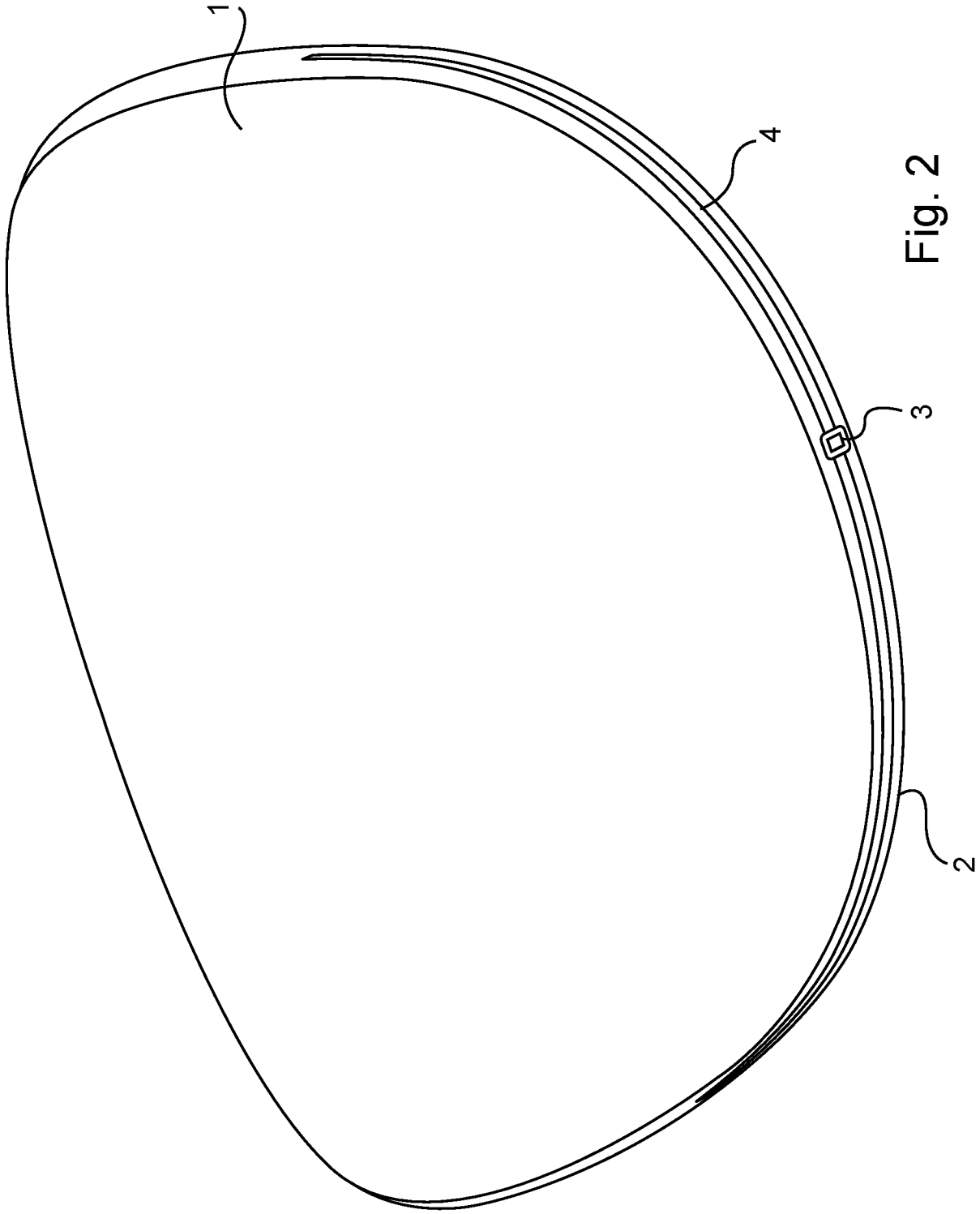

Fig. 2

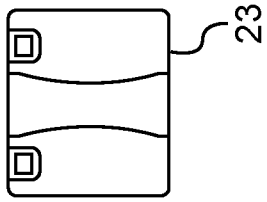

Fig. 3c

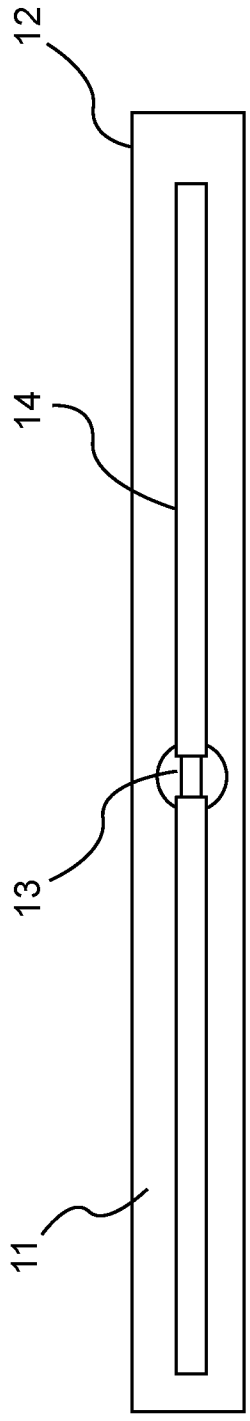

Fig. 3a

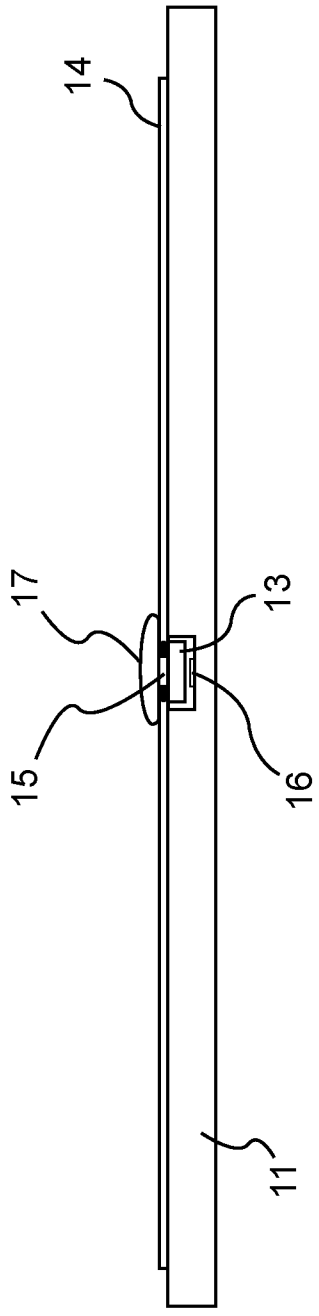

Fig. 3b

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2018/031577

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G02C 1/00; G02C 5/00; G02C 7/00; G02C 7/02; G02C 11/00; G06K 19/07; H01Q 1/20 (2018.01)
CPC - G02C 7/083; G02C 11/10; G06K 19/07; G06K 19/077; H01Q 1/22; H01Q 1/2225; H01Q 7/00 (2018.05)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 340/568.1; 340/572.3; 340/572.7; 340/572.8; 351/41; 351/106; 351/159.39 (keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2010/0177277 A1 (KOKONASKI et al) 15 July 2010 (15.07.2010) entire document	1-20
A	US 2007/0060311 A1 (ROWE et al) 15 March 2007 (15.03.2007) entire document	1-20
A	US 2015/0226984 A1 (MITSUI CHEMICALS, INC.) 13 August 2015 (13.08.2015) entire document	1-20
A	KR 10-2009-0072279 A (SUNCHON NATIONAL UNIVERSITY) 02 July 2009 (02.07.2009) see machine translation	1-20
A	US 2010/0265456 A1 (MATSUI) 21 October 2010 (21.10.2010) entire document	1-20

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 June 2018	12 JUL 2018
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Facsimile No. 571-273-8300	Authorized officer Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)