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- (56) Fremdragne publikationer:
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DESCRIPTION

[0001] A group of inventions regarding the design of a plastic key fob with full-color printing equipped with a built-in RFID tag and the manufacturing method.

[0002] A plastic key fob with full-color printing and an RFID tag may be equipped with a built-in RFID tag conforming to ISO 14443, ISO 15693, ISO 18000 and ISO 11784 / ISO 11785 standards.

[0003] The key fob may successfully replace plastic cards and be used in transportation systems, as a social card, a loyalty card, a key card to enter secured areas, as well as for advertisements.

[0004] Key fobs with an RFID chip are known from prior art.

[0005] Key fobs and mini-cards manufactured by the Chinese company named Cet http://www.cetech.com.hk/en_us/products/detail/4. Key fobs come in a variety of shapes, including rectangular and trapezoid, and can be designed as animals and characters, etc.

[0006] The main disadvantage of key fobs is that they are fragile and unreliable in use, because the surface layer is usually made of epoxy coating, which is very brittle. When the key fob falls on a hard surface from a height of 1 or 2 meters, it cracks and delaminates, and its material is prone to scratching. Due to UV light exposure, the material turns yellow and the paint fades, the surface turns matte, and thus the key fob loses its appearance. When the fob is attached to keys on a common metal ring, it is more likely to be lost due to increased brittleness at the attaching point (eyelet). Epoxy resin is toxic.

[0007] In terms of the manufacturing method, the predecessor of the plastic fob is the plastic (smart) card.

[0008] There is a dual-interface card comprises two laminating layers with a support sheet between them, which forms the base in which the antenna is sealed, with a compensation sheet. A module with a built-in mini-antenna is located in the surface cavity of the smart card (ref. US 2015021402 A1).

[0009] Foldable fobs of multilayer material having one or more holes or apertures therein for holding key chains, or other devices for attaching the fobs to other items are known from US7156301 B1. This fob comprises a multilayer core of several layers made of polyvinylchloride (PVC) and polypropylene (PP) stuck together with protective layers made of flat sheet of polyvinylchloride (PVC) or polyethylene terephthalate (PET).

[0010] The objective of this invention group is to create a convenient, reliable, ergonomic, compact plastic key fob with full-color printing and an RFID tag that serves as a smart card,

and to develop a manufacturing method for the plastic key fob.

[0011] The technical effect of the claimed device and its manufacturing method consists in the following: to create a device able to operate as a key fob and a contactless smart card; increased its resistance to mechanical loads arising in everyday use; increased resistance to ambient temperature changes and UV radiation due to the materials used during its fabrication; increased device ergonomics and usability. The proposed manufacturing method automates the production process, reduces production costs, considerably improves production rate, and reduces the number of defects.

[0012] The technical effect is achieved by using the following combination of essential features:

The plastic key fob is made with color printing and is equipped with a built-in RFID tag that conforms to ISO 14443, ISO 15693, ISO 18000 or ISO 11784 / ISO 11785 standards. The key fob is made in the form of a rectangle with rounded corners, and is 50.95-51.05 mm long, 24.61-24.71 mm wide, and 3.34-4.34 mm thick. It has a round through-hole for a split ring with inner diameter of 4.00-4.50 mm. The key fob corners are rounded, wherein the corner near the hole has a bending radius $R = 5.00 \text{ mm} - 6.00 \text{ mm}$, while the other three corners of the key fob have bending radiuses $R = 3.00 \text{ mm} - 3.36 \text{ mm}$. The key fob weight is 4.65-4.95 g. The key fob consists of sequentially combined layers of a front protective plastic laminating layer, a decorative/informative layer on the front face, a pre-laminate center layer with at least one installed RFID tag, a decorative/informative layer on the reverse side, and back protective plastic laminating layer. These layers form the base that is coated with a composite convex layer made of polyurethane-based material on both sides. A unique serial number for the RFID tag may be applied on the surface of the decorative/informative layer, thus making it possible to identify the key fob.

[0013] The plastic fob manufacturing method employs equipment designed to manufacture plastic smart cards, as well as sheet materials with equal dimensions, for example, of the 295 x 480 mm format. The pre-laminate center sheet is formed, first of all. For this reason, plastic sheets are placed, on both sides, on the sheet with installed RFID tag(s), and are joined together by thermal compression. Then, the multilayer structure - the body sheet - is formed by placing an informative/decorative sheet and a protective laminating layer on both sides of the prelaminate center sheet. Then, all sheets are joined together by thermal compression, and a number of key fob blanks, for example, 24, 48, 72 or more, with a round through hole in each blank, are cut out from the produced multilayer structure. At the same time, all fobs are left on the body sheet, which are retained by the semicircle located at the corner near the hole; wherein, two notches are made on the semicircle that later facilitate the retrieval of the key fobs from the body. Then, key fob blanks are first coated with a liquid polyurethane-based material on one side, put on a tray and left for (4 to 6) hours for polymerization and drying. During polymerization, the composite convex layer material sticks firmly to the PVC support, which prevents it from delaminating during key fob use and storage. The temperature and viscosity of the liquid material used to obtain the necessary volume and height of the composite convex layers is selected empirically. Simultaneously, various additives including an

antimicrobial one are added to the material. As a result of these additives, the composite convex layers become resistant to pollution and multiple bends; it does not permit ultraviolet light to pass through. After drying, the body sheet with key fob blanks is turned over, and covered with the polyurethane-based liquid material on the other side to form the composite convex reverse layer. The finished key fobs manufactured by the method described are dried, retrieved from the body and packaged.

[0014] A special type of key fob.

[0015] The composite convex layer is made of polyurethane-based material of 1.4 mm thick. A plastic covering sheet on the reverse side contains an informative layer with a unique RFID serial number. Therefore, additional counterfeit protection is provided, as well as a convenient way to identify the key fob. The decorative/informative layer on the front face contains the inscription TROIKA (trio of horses) on a plain blue background with the image of three white horses (TROIKA transport card in the key fob format). The informative/decorative layer surface contains the embossed inscription AIRTAG. This inscription becomes visible when the light is refracted at a certain viewing angle, thus the key fob is protected against counterfeit. An NXP MIFARE Plus type RFID tag is installed on the key fob. The key fob is made as a 24.63 mm x 51.03 mm rectangle with rounded corners and contains a round through-hole with 4.3 mm in diameter located in the upper right corner of the fob. The fob thickness varies from 3.4 mm to 3.8 mm.

[0016] The method for manufacturing the key fob involves one antenna being installed by ultrasonic soldering on one side of a 295 x 480 mm plastic sheet. Then, a compensation sheet is placed over the plastic one on the antenna side, and the sheets are joined together by thermal compression. A decorative/informative layer comprising the front face is placed on one side of the pre-laminate sheet produced. It contains the image of three white horses and TROIKA inscription. The other side of pre-laminate sheet is covered with a decorative/informative layer that contains the card ID number on a plain blue background. Then, additional protective plastic laminate sheets are placed on both sides; therefore, a multilayer structure (a stack) is formed for the subsequent press-lamination process. After assembling, the sheet edges are fixed together by thermal compression and scorched. The multilayer structure produced is referred to as the body sheet. 72 blanks with round through-holes in each are cut out from the body sheet; at the same time, the fobs are retained in the body sheet by the semicircle located at the corner near the hole until the manufacturing process is completed. A through-hole is made in the fob in such a way that the distance to its edges allows for subsequent application of the polyurethane-based liquid material on the fob surface, which uniformly covers the whole key fob surface during polymerization. The polyurethane-base liquid material is applied first on one side of the body, resulting in formation of the composite convex front layer. After drying, the multilayer structure is turned over, and covered on the opposite side to make the composite convex layer reverse side. Then, the multilayer structure with key fob blanks is dried, after which finished key fobs are taken from the body sheet and packaged.

[0017] Thus, the manufacturing method for key fobs allows to produce 72 plastic fobs using one sheet, which are easy to use and have a number of advantages, such as: high strength (high tensile strength); elasticity; good resistance to abrasion; resistance to mechanical stress. The key fob coating provides the following advantages: high resistance to tearing and deformation; high resistance to thermal effects; temperature range from - 40 °C to + 80 °C, i.e. can be used indoors or outdoors; resistance to external impacts (weather conditions, frost, etc.); high resistance to chemicals (resistance to oil and gasoline, acids). The coating is resistant to microorganisms; it has a good damping ability; resistant to radiation; it does not crack or corrode. Polyurethane resin is absolutely transparent, non-toxic, does not contain heavy metals, and does not turn yellow with time.

[0018] This manufacturing method employs equipment designed for manufacturing smart cards, and the key fob geometry and dimensions are selected as a convenient and efficient production method. A shape is created with specific dimensions that allows simultaneously to minimize manual labor, to automate the process, and to achieve the maximum output of useful products during the sheet-processing method. For the customer, the procedure for getting plastic key fobs is the same as for plastic cards packaged according to sequence numbers. Moreover, polyurethane-based liquid material contains an anti-microbial additive, which does not permit UV light to pass through, is resistant to pollution and multiple bends, and glues securely to the PVC body during polymerization. During manufacturing of the key fob, the body thickness is selected in such a way that the fob blank conforms to the thickness requirements specified in Specification (TU) 4084-001-85729412-2015.

[0019] The claimed group of inventions is explained in the drawings, where Fig. 1 illustrates the general appearance of the key fob (from the front and side).

[0020] Hypoallergenic materials are used in the manufacturing of key fobs in compliance with European Regulation (EC) 1907/2006, which confirms their safety for everyday use. The fob composite convex layers are anti-bacterial and protects from fading (UV protection). The composite convex layers material may contain a flavoring agent to smell the key fob, colorants and/or fluorescent additives, glitter.

[0021] The elasticity of the composite convex layers' material allows the fob to "recover" after being dented or scratched, for example, by keys. The composite convex layers also provide high resistance to environmental impacts and corrosive media (petrol, detergents, etc.). The plastic fob produced in this way can be easily used as a key fob, a plastic card, transport card, school card, social card, loyalty card, security pass to guarded facilities or for advertisement.

[0022] The key fob dimensions make it easy to store and use in different ways. The key fob can be attached to keys, handbags, and other goods using the round through-hole.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US2015021402A1 [0008]
- US7156301B1 [0009]

Krav:

1. Farvetrykt plastnøglebrik omfattende et indbygget RFID-mærke, nævnte plastnøglebrik omfatter et legeme af sekventielt kombinerede lag af:
 - et frontbeskyttende lamineringslag,
 - et dekorativt/informativt overfladelag,
 - et prælamineret midterlag med mindst et installeret RFID-mærke,
 - et dekorativt/informativt bagsidelag, og
 - et bagbeskyttende lamineringslag,
 - yderligere med en rektangulær form med de følgende dimensioner:
 - en længde på 50,95 mm til 51,05 mm,
 - en bredde på 24,61 mm til 24,71 mm,
 - yderligere med et rundt hul nær et hjørne til fastgørelse af en nøglering;
 - yderligere med afrundede hjørner;kendetegnet ved at nævnte plastnøglebrik
 - yderligere har en vægt mellem 4,65 g og 4,95 g;
 - yderligere har en tykkelse på 3,34 mm til 4,34 mm;
 - hvori det runde hul har en diameter fra 4,00 mm til 4,50 mm;
 - hvori hjørnet nær det runde hul har en krumningsradius $R = 5,00$ mm til 6,00 mm, mens de andre tre hjørner har krumningsradier $R = 3,00$ mm til 3,36 mm;og på begge sider af legemet yderligere omfatter henholdsvis et sammensat konvekst frontlag og et sammensat konvekst bagsidelag fremstillede af polyurethanbaseret materiale.
2. Nøglebrik ifølge krav 1, kendetegnet ved at det prælaminerede midterlags materiale og de dekorative/informative lags materiale er malet i forskellige farver.
3. Nøglebrik ifølge krav 1, kendetegnet ved at den yderligere omfatter et elektronisk kredsløb med en LED-pære.
4. Nøglebrik ifølge krav 1, kendetegnet ved at det sammensatte konvekse lag er mindst 1,4 mm i dets midterste del.
5. Nøglebrik ifølge krav 1, kendetegnet ved, at mindst ét af de dekorative/informative lag indeholder et præget billede eller en indskrift, der er synlig, når lys rammer nøglebrikkens overflade i en bestemt vinkel.

6. Nøglebrik ifølge krav 1, kendetegnet ved at det front- og bagbeskyttende lamineringslag er lavet af PVC, PET eller PC materiale.
7. Fremgangsmåde til fremstilling af en plastnøglebrik ifølge krav 1, kendetegnet ved de følgende trin:
 - at tilvejebringe et antal ark af samme størrelse;
 - at danne det prælaminerede midterlag ved at dække et første ark af nævnte antal ark med anden og tredje plastark af nævnte antal af ark på dets front- og bagside, nævnte første ark omfatter det mindst ene RFID-mærke, og yderligere at sammenføje nævnte første, andet og tredje ark ved termisk kompression, hvorved der dannes det prælaminerede midterlags flerlagsstruktur;
 - at dække det prælaminerede midterlags nævnte flerlagsstruktur på én side med det dekorative/informative overfladelag og det frontbeskyttende lamineringslag, og på den anden side med det dekorative/informative bagsidelag og det bagbeskyttende lamineringslag; og
 - at sammenføje det prælaminerede midterlags nævnte flerlagsstruktur og dets dæklag med termisk kompression, hvorved et ark af legemers flerlagede struktur dannes;
 - at udskære flere nøglebrik-udgangsemner, for eksempel 24, 48, 72 eller flere, fra arket af legemer, og at udskære et rundt gennemgående hul i hvert udgangsemne, og at tilbageholde nævnte nøglebrik-udgangsemner i arket af legemer ved hjælp af halvcirkler placeret i tomme hjørner, der er nær nævnte gennemgående huller;
 - at lave to hak i nævnte halvcirkler for at gøre det lettere at hente udgangsemnerne fra arket af legemer senere;
 - at dække alle udgangsemner på én side med det polyurethanbaserede flydende materiale, dermed yderligere polymerisering, der resulterer i dannelsen af det konvekse sammensatte frontlag,
 - at vende arket af legemer om, og at dække alle udgangsemner med det polyurethanbaserede flydende materiale på bagsiden, hvilket efter polymerisering resulterer i dannelsen af det konvekse sammensatte bagsidelag;
 - at tørre det resulterende flerlagsark, der har udgangsemner;
 - at hente de færdige nøglebrikker fra arket af legemer og pakke dem ind.
8. Fremgangsmåde til fremstilling ifølge krav 7, kendetegnet ved at temperaturen og viskositeten af det flydende materiale, der anvendes til at opnå det nødvendige volumen og højde af det sammensatte konvekse lag, vælges empirisk.

9. Fremgangsmåde til fremstilling ifølge krav 7, kendetegnet ved at det sammensatte konvekse lags materiale indeholder et antimikrobielt additiv.
10. Fremgangsmåde til fremstilling ifølge krav 7, kendetegnet ved at det sammensatte konvekse lags materiale indeholder et aromatisk additiv, der giver produktet en duft.
11. Fremgangsmåde til fremstilling ifølge krav 7, kendetegnet ved at det sammensatte konvekse lags materiale indeholder glitter.
12. Fremgangsmåde til fremstilling af krav 7, kendetegnet ved at det sammensatte konvekse lags materiale indeholder farvestoffer eller fluorescerende additiver.
13. Fremgangsmåde til fremstilling ifølge punkt 7, kendetegnet ved at det sammensatte konvekse lags materiale ikke tillader UV-lys at passere derigennem.

DRAWINGS

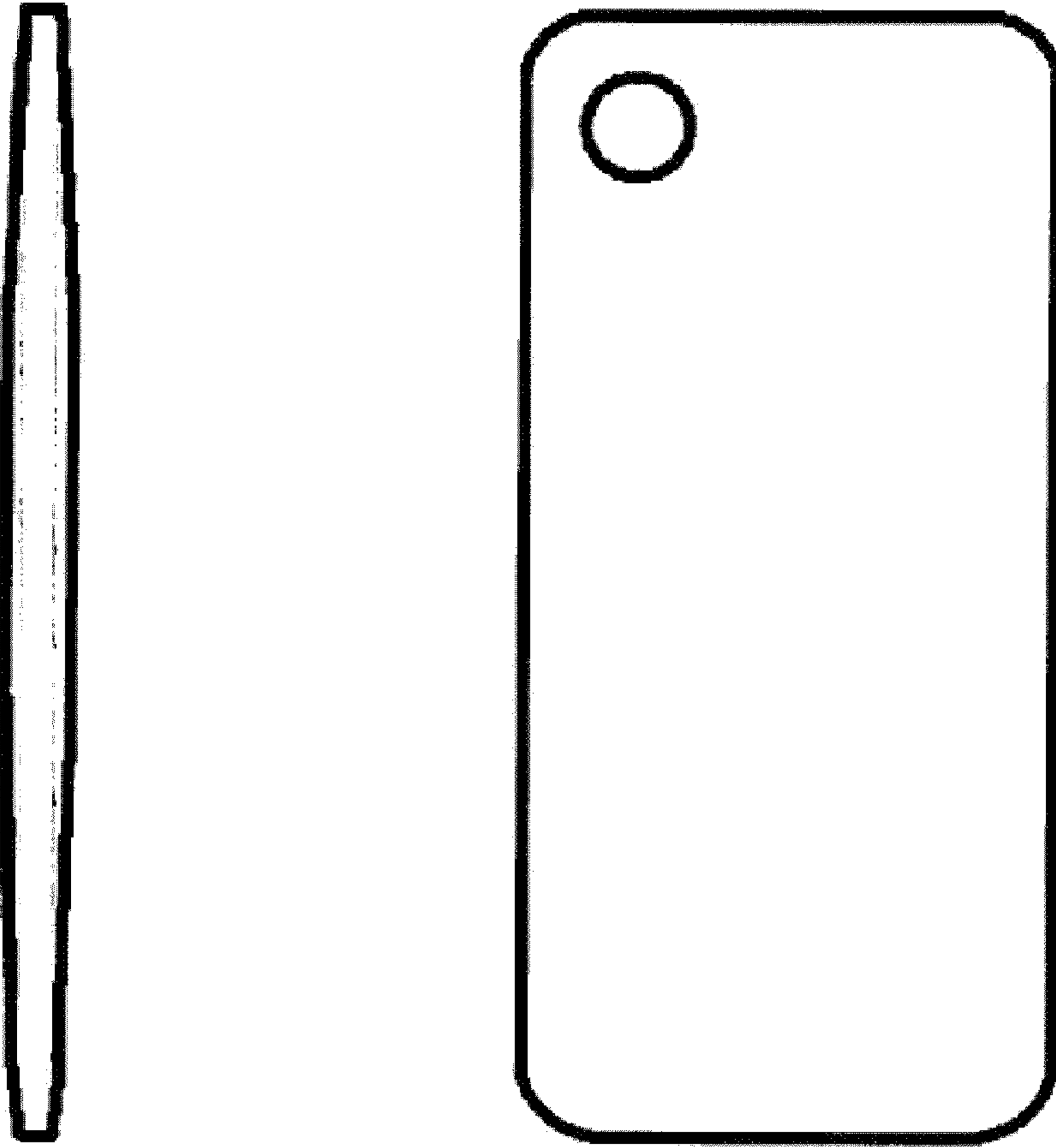


Fig. 1