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(54) Title: METHOD AND DEVICE FOR THE RECOGNITION OF AN AUTHENTICATING MARK ON AN ENVELOPED SURFACE OF AN OBJECT

(57) Abstract: The method for the recognition of an authenticating mark on the surface of a packaging foil or an article by means of visual and/or electronic recognition means through an envelope is carried out by ultrasonic or X-ray techniques. In particular, the authenticating mark comprises at least one embossed authenticating mark having finest structures in the micrometer range, and the surface of the packaging foil or of the area of the article in which the authenticating mark is embossed is metallized or made of metal. In such a method, the package need not be opened or destroyed for inspection and the authenticating marks are not distinguishable from the outside in visible light.

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METHOD AND DEVICE FOR THE RECOGNITION OF AN AUTHENTICATING
MARK ON AN ENVELOPED SURFACE OF AN OBJECT

5 The present invention relates to a method and device for the
recognition of an authenticating mark that is embossed on a
surface of a packaging foil or of an article through an
envelope, according to the preamble of claim 1, and mainly
also to the authentication of cigarette packages, respective
of cigarettes.

10

An object to be identified whose surface is recognized
through an envelope that is impermeable to visible light is
known in the art from US 2005/206500 A1. On one hand, the
latter refers to relatively large objects and marks, and on
15 the other hand, the employed radiations capable of passing
through the envelope are only mentioned but not specified.
More particularly, X-rays, different types of RF radiation,
RMI technology or an acoustic imaging method are proposed.

20 DE 36 13 549 A1 discloses a method for reading bar-code
information by means of sound waves that makes use of the
fact that the bar-code is designed such that the spaces have
different transmissive properties.

25 From EP-B-1 236 192 to the applicant of the present
invention it is known to recognize an article by means of at
least one authenticating mark that is applied in addition to
other security elements, the authenticating marks being
embossed by means of an embossing device that produces a
30 special embossing pattern. In the introduction of this
patent specification, different documents referring to the
production of authenticating marks and elements are cited
which consequently will not be enumerated here.

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As explained in the specification and in claims 5 and 6 of EP-B-1 236 192, the authenticating mark should be recognized through the cigarette packet and more particularly through a corresponding window in the cigarette packet. However, an
5 indication of a concrete method for recognizing the features through the package is not given in this reference.

According to EP-A-1 216 819, marks that are embossed on a first layer are read through windows in a second layer, the
10 layers being cigarette packaging foils.

Similar authenticating marks may also be provided on packaging foils for foods such as chocolate or butter or for other articles - e.g. from the pharmaceutical industry, such
15 as capsules or pills - or else for objects such as PC cards, that are to be recognized through a package of cardboard or the like.

Another problem area is the authentication of timepieces,
20 more particularly wrist or pocket watches. In order to be able to recognize the authenticating marks, the latter have to be applied to the housing externally or the timepiece has to be opened, which generally requires specialized
personnel. Therefore, a recognition through the dial or
25 through the bottom would be very advantageous.

Recently, methods and devices for embossing ever smaller and thus increasingly fraud resistant authenticating marks have been developed by the applicant, e.g. according to
30 US 7 229 681, and based thereon, it is the object of the present invention to provide a method and a device that allow recognizing even very small security elements such as authenticating marks and/or elements in the micrometer range on the surface of packaging foils around tobacco products,
35 foods, pharmaceutical products or PC components through the

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package, or on the surface of timepieces through the envelope, e.g. the dial or the bottom, with sufficient accuracy and dependability. This object is attained by the method according to claim 1 and by the device according to
5 claim 15.

The invention will be explained in more detail hereinafter with reference to exemplary embodiments. Representatively for the above-mentioned articles, these examples refer to
10 the authentication of cigarette packets or cigarettes, respectively. The term "authenticating mark" stands for security or authentication features that have been embossed on packaging foils by means of the embossing methods and devices mentioned in the introduction, or according to a
15 conventional method on a part of a timepiece, on one hand, and on the other hand, for the entirety of characteristics that make up the nature of the object that is to be examined, such as e.g. embossing patterns on identical or different packaging foils.

20

The term "envelope" stands for packages of cardboard or paper that are impermeable to visible light and in the case of timepieces for dials or watch bottoms made of a material that is permeable to the applied sound waves or rays.

25

In EP-B-1 236 192, cited in the introduction, different commercial levels are defined, and these are incorporated, as far as they are applicable to the present invention, into the present description as part of an exemplary embodiment.

30

According to US 2007/0289701 A1, the method according to EP-B-1 236 192 can be further developed in that an array of authenticating marks is embossed as a pattern on-line, read by a suitable apparatus, and evaluated by means of an image
35 processing method. With regard to the embossing pattern, all

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known embossing types can be applied. In addition to the embossing apparatus, the device used for carrying out the method comprises a reading unit and an evaluating unit. In particular, this method reducing the requirements with
5 respect to the embossing or reading quality without prejudicing the required safety.

According to the prior art, as mentioned in the introduction, either relatively large objects are recognized
10 through an envelope or the mentioned articles are read and recognized directly, which implies that the package must be opened to access the foil or the article in order to be able to read the authenticating marks. The proposal to recognize the articles through a window in the package makes the
15 manufacture more expensive as the window must be manufactured additionally, and the local application of the features is furthermore limited by the location of the window. This also applies analogously when the article is a timepiece.

20

In order to recognize ever smaller structures through a light-impermeable envelope, it is apparent to one skilled in the art in view of the prior art cited in the introduction that the radiation or the sound waves that are to be applied
25 must be capable of resolving such structures. However, this knowledge alone is not sufficient for attaining the intended object. On the contrary, this requires the realization that there must be an interaction between a particular surface of the article and the adapted sound waves or radiation.

30

There are essentially two ways of using the sound waves for detection purposes, namely in transmission mode or in reflection mode. In view of the fact that the sound waves or rays have to pass through the envelope first to subsequently
35 produce a useful signal, it has been recognized that the

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detection signal obtained through reflection offers advantages when the reflecting surface is metallized or metallic, e.g. a metallized packaging foil or an aluminum foil.

5

Recently, ultrasonic apparatus having a high resolution of less than 0.1 mm have been developed, thereby also allowing to resolve and thus recognize the authenticating marks and elements that are being considered here and have been referred to above. Such an ultrasonic camera is disclosed in a publication that is accessible in the Internet and can be downloaded under the title "Optel Ultrasonic Technology / Fingerprint recognition".

10 Another publication from the year 2004, entitled "ultrasonic microscopy", of the Technical University of Dresden describes an apparatus with a transducer having a nominal frequency of up to 230 MHz, thereby achieving a lateral resolution of up to 10 μm . According to one of these methods, i.e. the so-called impulse echo technique, the surfaces or indentations to be examined are scanned by means of a suitable transducer and a three-dimensional image of the inspected area is reconstructed through an evaluation of the amplitude, the phase, and the delays of the backreflected signals.

Digital signal processing and image processing methods may also be applied to this end. The latter may be used to separate the image areas of interest and to extract the relevant information, respectively. In this regard, additional correlation methods may be applied for a better extraction of certain hidden patterns.

30 According to EP-A1-1 437 213 to the applicant of the present invention it is possible to modify the teeth of embossing

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rolls in such a manner that macro- and microstructures are produced which are transmitted to the metallized surface of the packaging foil in the embossing procedure. Such a technique allows embossing the authenticating marks and
5 elements with macro- or microstructures that have been mentioned in the introduction.

These authenticating marks or elements must then be readable by the ultrasonic apparatus in reflection mode through the
10 package. To this end, a suitable sonic transducer will be used that is capable of reading the structures, i.e. the authenticating marks or elements, in the desired frequency range. More specifically, a sonic transducer having a
15 nominal frequency comprised in a range of 5 to 500 MHz can be used, thereby allowing to achieve a large bandwidth of the resolving capacity, which is necessary depending on the structure and size of the authenticating marks. Furthermore, the ultrasonic beam should be focused and directed such that it may reach the features through the package without
20 excessive losses and its backreflected rays can be detected.

Authenticating marks may furthermore be produced by differences in the arrangement of teeth, e.g. by individual teeth or groups of teeth of different shapes in the intended
25 locations, e.g. teeth having a round or rounded horizontal projection in the midst of teeth having a rectangular horizontal projection, or different distances between the teeth.

30 Moreover, authenticating marks may also be produced by creating indentations, deformations or holes on the surface of the packaging foil by tools other than embossing rolls, e.g. by controlled pins or the like.

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In the case of timepieces, the authenticating mark is applied to a watch component that is either covered by the dial or by the bottom and is therefore invisible to the eye. In this case, the recognition is achieved by an adapted
5 ultrasonic or X-rays apparatus through the dial or through the bottom, whose material must be permeable to these sound waves or rays.

Problems might arise when operating at the limit of the
10 resolution, but error corrections may be performed for a reliable recognition of the features, e.g. by means of an adapted mathematical algorithm. In this regard, the above-mentioned method according to CH-01086/06 facilitates the application of an error correction.

15 An evaluation by means of an adapted mathematical error correction allows an analysis of the embossing pattern, which differs from one embossing roll to another and thus constitutes an identification characteristic of the
20 embossing system. In the embossing process, the surface profile of the embossing roll is transmitted to the paper.

Papers that have been embossed by different embossing rolls differ on a microscopic scale since the surface profiles of
25 different embossing rolls differ from one another without a specific treatment of the teeth of these rolls. These small differences, which serve as the authenticating mark, are to be measured and quantified.

30 The profile of the embossed paper is not only a function of the embossing roll that has been used but also of the paper properties and of the process parameters adjusted in the embossing process. By means of measurements it has been experimentally shown that the surface profiles of the
35 embossing roll and of the embossed paper differ from one

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another. Therefore, generally, measurements of embossed papers cannot be related directly to the embossing roll that has been used for embossing but to an embossed reference paper. This reference measurement is periodically renewed in order to compensate for process-related variations. It is therefore an aim to determine, by means of the authenticating mark, i.e. by means of deviations or correlations between the pattern on the paper and that of the embossing roll, whether the paper was embossed by a particular embossing roll.

Theoretical considerations have lead to the assumption that with a refinement of ultrasonic technology, more particularly of the impulse echo method, these small differences could also be detected by means of ultrasonic technology through a package.

However, if these differences are very small, especially in the case of a recognition of differences after embossing with embossing rolls whose teeth have not been altered, they may no longer be detectable through the package by ultrasonic techniques so that another detection method must be applied.

If X-rays are employed, the X-ray apparatus used in the references of the prior art cited in the introduction cannot be applied as they cannot sufficiently resolve the fine structures.

In recent years, developments in X-ray tomography and micro-CT (Computer Tomography) have allowed the creation of X-ray apparatus of the size of a cigarette packet on the basis of carbon nanotubes (CNT). Such apparatus are capable of producing self-focusing measuring spots in the submicrometer range.

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Tests have shown that such X-ray microdevices are capable of detecting authenticating marks through a cigarette packet in transmission mode. It is essential therefor that these
5 authenticating marks are applied to a metallized foil or a foil made of aluminum. The effect may be reinforced if the authenticating marks are located in structures such as folds or the like.

10 In analogy thereto, on a timepiece component, the authenticating marks, i.e. the embossed marks, are identified through the dial or the bottom.

The detection of the rays is achieved by means of suitable
15 semiconductor detectors that are connected to a processing unit of a similar design as that used in the ultrasonic detection of the inspected features.

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Claims

1. Method for the recognition of an authenticating mark on the surface of a packaging foil or an article by means of
5 visual and/or electronic recognition means through an envelope, the recognition method being carried out by ultrasonic or X-ray techniques, characterized in that the authenticating mark comprises at least one embossed authenticating mark having finest structures in the
10 micrometer range and the surface of the packaging foil or of the area of the article in which the authenticating mark is embossed is metallized or made of metal.
2. Method according to claim 1, characterized in that the
15 packaging foil contains tobacco products such as cigarettes, foods such as chocolate or butter, capsules or pills from the pharmaceutical industry, or PC cards, and is enclosed in a package of cardboard, paper, or plastics material.
- 20 3. Method according to claim 1, characterized in that the article is a timepiece and the authenticating mark embossed thereon is recognized through the dial or through the bottom thereof.
- 25 4. Method according to one of claims 1 to 3, characterized in that the ultrasonic source operates in a range of 5 - 500 MHz and in reflection mode.
- 30 5. Method according to claim 4, characterized in that the so-called impulse echo method is employed, the surfaces or indentations to be examined being scanned by means of a suitable sonic transducer and a three-dimensional image of the inspection area being reconstructed through an
35 evaluation of the amplitude, the phase, and the delays of the reflected signals.

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6. Method according to one of claims 1 to 4, characterized
in that the identification method is carried out in
transmission mode using an X-ray apparatus whose radiation
5 can be focused onto a spot in the submillimeter range.

7. Method according to claim 6, characterized in that the
X-ray apparatus operates on the basis of carbon nanotubes
delivering radiation spots in the submicrometer range.

10

8. Method according to one of claims 1 to 7, characterized
in that digital signal processing and image processing
methods are applied in order to separate the image areas of
interest and to extract the relevant information,
15 respectively.

9. Method according to one of claims 1 to 8, characterized
in that an array of authenticating marks is embossed on-line
as a pattern and evaluated by an image processing method.

20

10. Method according to one of claims 1 to 9, characterized
in that additional correlation methods are applied for a
better extraction of certain hidden patterns.

25 11. Method according to one of claims 1 to 10,
characterized in that teeth of the driven embossing roll are
modified such that authenticating marks are embossed in the
corresponding locations of the packaging foil.

30 12. Method according to one of claims 1 to 10,
characterized in that no teeth of the driven embossing roll
are modified and differences in the embossing pattern that
are due to the manufacture of the rolls and/or to the paper
quality are used as a authenticating mark, and identified.

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13. Method according to one of claims 1 to 10,
characterized in that the authenticating marks are created
by differences in the arrangement of teeth, individual teeth
or groups of teeth in the intended locations having a
5 different shape, more particularly teeth that have a round
or rounded horizontal projection in the midst of teeth that
have a rectangular horizontal projection, or the teeth
having different distances between them.
- 10 14. Method according to one of claims 1 to 10,
characterized in that the authenticating marks are produced
by tools other than embossing rolls, e.g. by controlled
pins, in the form of indentations, deformations or holes on
the surface of the packaging foil.
- 15 15. Device for carrying out the method according to any
one of claims 1 to 5, 8-14, characterized in that it
comprises an ultrasonic transducer.
- 20 16. Device according to claim 15, characterized in that
the ultrasonic transducer operates in a range of 5 to 500
MHz.
- 25 17. Device according to any one of claims 6 to 14,
characterized in that it comprises an X-ray apparatus whose
radiation can be focused onto a spot in the submillimeter
range.
- 30 18. Device according to claim 17, characterized in that the
X-ray apparatus operates on the basis of carbon nanotubes
delivering radiation spots in the submicrometer range.

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INTERNATIONAL SEARCH REPORT

International application No

PCT/CH2008/000204

A. CLASSIFICATION OF SUBJECT MATTER
 INV. G07D7/08 G07D7/06

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)
 G07D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/073414 A1 (SPAHN MARTIN [DE]) 7 April 2005 (2005-04-07) abstract paragraph [0009] paragraph [0012] - paragraph [0013] paragraph [0016] - paragraph [0017] paragraph [0031] - paragraph [0036] paragraph [0039] - paragraph [0055] figures ----- -/--	1-4, 15, 16

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 document 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)

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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

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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.

G document member of the same patent family

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INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>DE 33 08 278 A1 (ZEPPELLINI SERGE [FR]) 13 September 1984 (1984-09-13)</p> <p>abstract page 4 - page 5, paragraph FIRST page 6, paragraph FIRST - page 7, last paragraph page 8, last paragraph - page 9, last paragraph figures</p>	1-3, 6-14,17, 18
X	<p>-----</p> <p>US 2005/206500 A1 (FERREN BRAN [US] ET AL) 22 September 2005 (2005-09-22) paragraph [0012] - paragraph [0014] paragraph [0016] figure 1</p>	1,4,5, 15,16
X	<p>-----</p> <p>DE 36 13 549 A1 (STORCK WOLFGANG [DE]; BICZ WIESLAW [DE]) 29 October 1987 (1987-10-29) abstract column 1, line 45 - line 54 column 2, line 19 - column 3, line 24</p> <p>-----</p>	1,4,15, 16

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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DE 3613549 A1	29-10-1987	NONE	