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(54) **Cash/Valuable Degradation System**

(57) An item characterised by having at least one security marker (5-15) formed as part of the item, where

the at least one security marker is responsive to an external stimulus to undergo a permanent change.

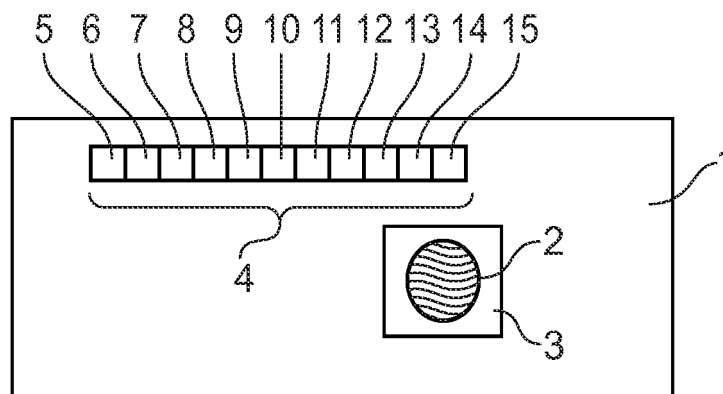


FIG. 1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a system for marking cash or other valuables. Such marking being designed so as to provide a permanent visible reaction upon contact with substances deployed by a security marking system in order to degrade or neutralise the value of the cash or valuables being marked. Such a system can also produce human readable markings which will provide information that can identify the security equipment that deployed the marking system.

BACKGROUND OF THE INVENTION

[0002] There continues to be a requirement to transport money between retail premises, banks, cash centres, automatic teller machines and the like. There are a number of designs of secure, locked containers that are deployed by security personnel to carry such money. These locked containers are designed to detect when an attack has taken place on the container and, under these circumstances, to cause a system to be deployed which will attempt to degrade or neutralise the value of the money within the container. Often the method of degradation or neutralisation is by ejecting ink from a reservoir into the protected area which contains the money. Similar systems are employed in other secure facilities such as vaults, drop safes and automatic teller machines.

[0003] Such security systems also often deploy taggants which are unique to the individual security container or other deploying system. Such taggants may comprise a unique combination of rare metals, or artificial DNA, to create a large number of 'codes'. Each item of security equipment is allocated such a unique 'code', which is included in the security ink. By analysing the taggant recovered from banknotes recovered after a theft, or from ink stains in vehicles, or on the clothing of people involved in the theft, it is possible to extract the 'code'. This code can then be compared with a database of the deployment of such codes within such security systems, and with records of attacks on such security systems so as to identify the attack from which the note or stained item came.

[0004] A disadvantage with such staining systems in general, and with staining systems containing such taggants in particular, is the cost of deployment and subsequent analysis of recovered stain in order to extract the code. In addition the resistance of such stains and taggants to removal by criminals is an ongoing problem for the developers of such systems. One problem is that there are a number of different substrates, inks and coatings used in the manufacture of banknotes in different countries, and even between denominations and series of banknotes within a single country. In addition the combination of different substrates, inks and coatings is constantly changing as banknote issuers try and make coun-

terfeiting more difficult.

[0005] In addition, banknote issuers are moving towards declaring such stained banknotes as either illegal tender or mutilated banknotes such that they are not accepted for normal transactions. A disadvantage with this move is that high speed banknote counters are often unable to detect the security stain on the banknotes, resulting in stained notes being dispensed from automatic teller machines and the like. The banks have an obvious problem in issuing via their automatic teller machines banknotes which they are declaring as illegal tender or mutilated.

[0006] The issuers of banknotes are also, inadvertently, working against those deploying such security systems. In order to reduce the whole of life cost of banknotes, issuers try to extend the average life of a banknote by providing stain resistant coatings. In addition, future issues of the Euro for example are likely to be manufactured on a polymer (plastic) substrate so making staining more difficult.

[0007] The advantages of effective cash degradation security systems is appreciated by most bank note issuers. They also understand the problem faced by the designers of such security systems in ensuring effective staining and resistance to removal of the stain and taggants. The European Central Bank in particular has recognised the need for the manufacturers of banknotes to work alongside designers of cash degradation systems in order to make such systems more effective.

SUMMARY OF THE INVENTION

[0008] According to a first aspect of the present invention there is provided an item characterised by having at least one security marker formed as part of the item, where the at least one security marker is responsive to an external stimulus to undergo a permanent change.

[0009] It is thus possible to provide a feature that can be applied during, for example, the manufacture of banknotes, which is able to interact and cause a permanent change in such feature when subjected to substances deployed in security systems.

[0010] Preferably, the change to the feature is visible to the naked eye so that members of the public, bank staff and the like are able to easily recognise that the banknote is no longer valid. Preferably, the change also generates a 'code', unique to the deploying security system, and which is also visible to the naked eye so that there are no costs involved in extracting the code.

[0011] Recent developments in the field of chromogenic polymers have provided the knowledge whereby polymers can be produced which change their visible optical properties in response to an external stimulus. Such polymers can be used to create a sensing device which can change colour, indicating exposure to the specified stimulus. The stimulus sensed could be temperature, light (visible, infrared or ultra violet), electric field, pressure, ion concentration or biochemical reaction.

[0012] In a preferred embodiment, the invention provides a sensor polymer which is affixed to a banknote during manufacture. Preferably banknote degrading security systems are deployed which contain within the staining ink the substance to which the sensor polymer is designed to sense. Upon the sensor polymer coming in contact with the said substance the polymer changes its colour, for example.

[0013] Such change of colour would be recognised by the public as indicating a void banknote.

[0014] Alternatively the polymer may change from opaque to transparent (or visa versa) such that a printed image under the sensor polymer can appear or disappear.

[0015] Such an area that is made visible by a change of opacity may be designed as to reveal a word such as 'VOID'.

[0016] Advantageously such an area covered by such a sensor polymer may obscure one or more security features of the banknote so that high speed note counters will reject the banknote, so preventing the banknote from returning into global circulation.

[0017] A plurality of sensor polymers may be affixed to a banknote during manufacture. Such polymers maybe affixed into an array or be affixed sequentially along the face of the banknote. Preferably each sensor polymer is designed to react with a different substance. Banknote degrading security systems can be deployed which contain within the staining ink a combination of substances to which the sensor polymers are designed to react. A unique code can therefore be created by mixing various combinations of such substances in the staining ink. Upon the sensor polymer array coming into contact with the ink containing a mixture of substances the polymer array changes its appearance. Those sensor polymers which react with the combination of substances contained within the security ink change colour, whilst any other sensor polymers would remain unchanged. The changed polymer array would therefore generate a unique pattern which is visible and readable by the human eye.

[0018] Such resultant pattern would effectively form a binary code. A code created by the combination of 20 different substances can generate over one million unique codes.

[0019] Advantageously each degradation security system has a unique or rare combination of substances designed to react with the individual elements of such a sensor array.

[0020] Preferably the array of sensor polymers is deployed in addition to a single larger sensor polymer, which reacts to a substance common to all staining inks.

[0021] Preferably, one or more sensor polymers are affixed to banknotes during manufacture, each of which is capable of effecting a number of different colour changes according to the combination of substances detected. In this way a smaller number of sensors maybe deployed.

[0022] It will be appreciated that the invention, in all of its embodiments, benefits from a solution which involves

features incorporated into the manufacture of a banknote which are designed to interact with features built into systems intended to protect such banknotes. This maximises the effectiveness of the staining system and in particular the resilience to removal of such stain.

[0023] Furthermore the ability to obscure existing security features which are used by high speed banknote counters enables such banknotes to be easily removed from circulation. Finally the ability to produce a unique code that can be read by the human eye is a significant advantage over the current solutions.

[0024] According to a second aspect of the present invention there is provided a security system for transporting an item, whereby in the event of a theft or an attempted theft a spoiling agent release mechanism releases a spoiling agent such that it contacts the security marker to cause it to undergo a permanent change.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The invention will now be described by way of example only with reference to the accompanying drawings in which:

Figure 1 is a schematic drawing of a banknote incorporating a number of sensor polymers, and a security feature in its manufactured state; and

Figure 2 is a schematic drawing of such a banknote after contact with a staining system as described.

DESCRIPTION OF PREFERRED EMBODIMENT

[0026] The banknote 1 illustrated in Figure 1 has a security feature 2 imprinted upon its face. Such security feature may be, for instance, an infrared emitter which can be detected by high speed banknote counters. Also affixed to the banknote 1 is a transparent sensor polymer 3 which is laid over the security feature 2 such that the security feature can still be detected. The banknote 1 also contains an array 4 of individual sensor polymers 5, 6 etc. through to 15. Each of the individual sensor polymers 5, 6 etc. through to 15, and the larger area sensor polymer 3 is responsive to a different substance.

[0027] The same banknote 1 is illustrated in Figure 2 after being subjected to staining ink containing a mixture of substances to which sensor polymers 3, 5, 7, 8, 11 and 14 are responsive. Each of these polymers 3, 5, 7, 8, 11 and 14 have changed colour in response to the staining ink as indicated by shading on Figure 2. Further the changed opacity of sensor polymer 3 has obscured security feature 2 which will no longer be detected by a high speed counting machine. Such a note being processed by such a machine would therefore be diverted to the banknote reject pile and removed from circulation. Sensor polymers numbers 5, 7, 8, 11 and 14 in Figure 2 have also changed colour in response to the staining ink as indicated by shading on the figure. Sensor polymers

6, 9, 10, 12, 13 and 15 have not changed colour in response to the staining ink, as this sample of ink did not contain the substances to which these sensor polymers respond to. A binary code 10110010010 has therefore been generated which relates to the code of the ink sample deployed in the security system.

[0028] The sensor polymer can be selected from suitable candidate polymers. Suitable polymers include hydrogels. A stimuli responsive hydrogel is a long chain polymer that expands or contract when it comes into contact with specific stimuli. It is known that the changes can be made reversible and repeatable if some cross linking is provided within the polymer. To make the change non-reversible the cross linking is broken. This may be achieved by a component within the stimulant or by the swelling of the hydrogel exceeding the parameters of the cross linked polymer. It is also known that the polymers can be made responsive to specific bio-molecules - see for example Hoffman, "Bioconjugates of Intelligent Polymers and Recognition Proteins for use in Diagnostics and Affinity Separation", Clinical Chemistry, 1478 - 1486, 2000. Similarly components in a stimulant can cause the formation of permanent cross links, and such permanent cross linking to give rise to irreversible changes.

[0029] Examples of suitable materials are also disclosed in WO2004/081624 or EP 1369681.

Claims

1. An item **characterised by** having at least one security marker (5-15) formed as part of the item, where the at least one security marker is responsive to an external stimulus to undergo a permanent change.
2. An item as claimed in claim 1, **characterised in that** the item is a banknote.
3. An item as claimed in any of the preceding claims, **characterised in that** the security marker comprises a sensor polymer.
4. An item as claimed in claim 3 in which the sensor polymer is responsive to substances within a spoiling agent of a security system.
5. An item as claimed in claim 4, **characterised by** the item having a plurality of security markers responsive to specific components in a spoiling agent such that a spatial pattern can be formed on the item which indicates which spoiling agent was used to mark the item.
6. An item as claimed in claim 4 or 5, **characterised in that** the sensor polymer is responsive to a plurality of substances within a spoiling agent, and in which different substances result in a different permanent change.
7. An item as claimed in any of the preceding claims in which at least one security marker changes opacity in response to a predetermined external stimulus so as to either hide or reveal a marking on the item.
8. An item as claimed in any of the preceding claims in which the entirety of the item is coated with a polymer.
9. A security system for transporting an item, whereby in the event of a theft or an attempted theft a spoiling agent release mechanism releases a spoiling agent such that it contacts the security marker to cause it to undergo a permanent change.
10. A security system as claimed in claim 9 in which the spoiling agent contains a plurality of reagents that, the combination of reagents identifying the user or owner of the security system, such that the response of the security marker identifies the security system that stimulated the marker.

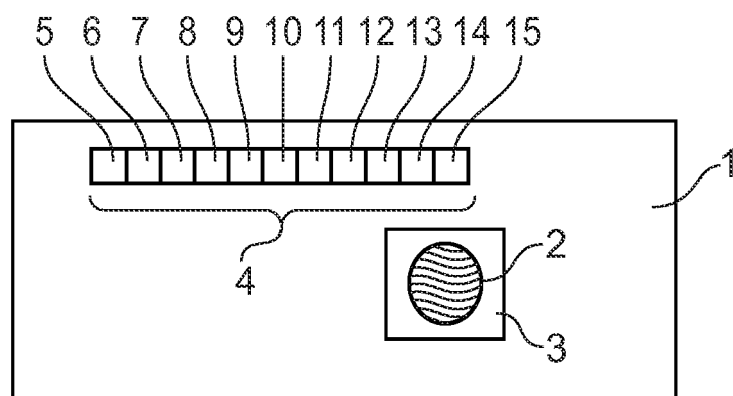


FIG. 1

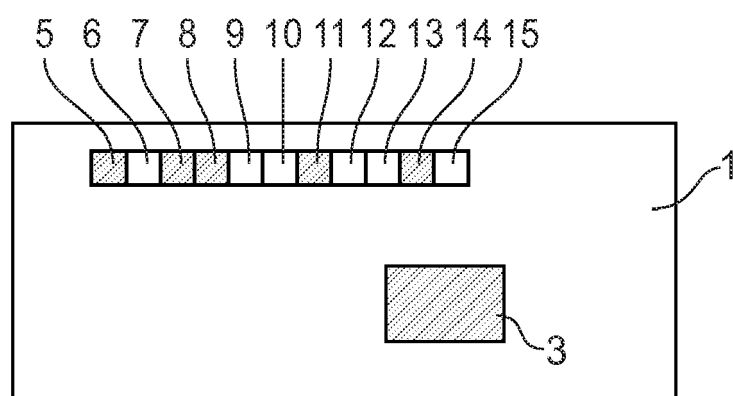


FIG. 2

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2004081624 A [0029]
- EP 1369681 A [0029]

Non-patent literature cited in the description

- **HOFFMAN.** Bioconjugates of Intelligent Polymers and Recognition Proteins for use in Diagnostics and Affinity Separation. *Clinical Chemistry*, 2000, 1478-1486 [0028]