

1

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LATENT IMAGE PRINTING DEVICE
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2 Claims

ABSTRACT OF THE DISCLOSURE

A latent image printing device comprising a substrate, a first layer of abrasive material, and a second layer of non-abrasive material placed as a negative facsimile of the image to be printed upon said first layer, said layers matched for similarity of properties of color, gloss and fluorescence, to render the image undetectable under normal or ultraviolet light. The image is developed by rubbing, for example, a metal object over the surface of said substrate, causing abrading of the object in the abrasive areas and "printing" of said image.

FIELD OF THE INVENTION

Devices, composition and structure, having a concealed message, image, or printing thereon, normally not detectable until said message, image, or printing is developed by rubbing, peeling, or mechanically working the surface of said device.

BACKGROUND OF THE INVENTION

In recent years, to induce customers to patronize their places of business, many commercial firms such as supermarkets, gasoline service stations, etc., have instituted "games" to lure customers. One of the more usual methods employed in these games is to give the customer a coupon each time the customer patronizes the business establishment. The coupon has a concealed message which is revealed when the customer removes the covering layer, such as by holding the coupon under water, under heat, or light. The message will usually be one part of many needed to complete the game, with cash prizes or awards being given for a customer who gets the requisite number of component parts. The prizes often range in the thousands of dollars value.

To maintain fairness to customers and to prevent fraud upon the companies issuing the games, it is necessary that the messages be concealed in such a manner as to assure the random distribution of these game coupons to customers. Further, it is necessary to assure that the coupons cannot be tampered with, so as to allow one to perpetrate a fraud upon the issuing company, such as by raising the amount of money on a coupon, or by changing the message on a coupon so as to complete one of the games to receive a higher cash award than would have been received, if any would have been received at all. Further, these coupons, being issued by so many gasoline service stations, supermarkets, etc., total millions of coupons annually distributed. Thus, the cost of the coupons must be kept at a minimal price, while still insuring both the random distribution and protection from fraud.

Ideally, it should be possible for a customer upon receipt of such a coupon to immediately be able to ascertain what the hidden message is, so that he may be able to ascertain immediately whether he has won something. Further, the customer should be able to do this with a minimum of inconvenience, which is not attendant those coupons currently requiring exposure to heat, light, or the use of a fluid, such as water, to expose the message.

Above all, no matter what method is used, it must not

2

only be convenient and tamper proof, but must so protect the hidden message that, prior to development, it cannot be detected by such means as light reflection or by fluorescence under ultraviolet light.

SUMMARY OF THE INVENTION

It is an object of this invention to prevent tampering with such game coupons by providing a coupon whose message cannot be revealed by normal light or by fluorescent radiation means.

Another object is to preserve the fairness of distribution of such coupons by providing a coupon whose message cannot be ascertained without destroying the coupon.

Still another object of this invention is to allow high speed commercial production of these game coupons by utilizing a structure adaptable to manufacture by high speed printing machines.

Another object is to allow high speed commercial production of such coupons by utilizing ink compositions suitable for gravure printing.

The problems of the prior art are overcome by the structure and composition of the present invention. Briefly stated, this invention comprises a latent image printing device comprising a substrate, a layer of abrasive material, and a layer of non-abrasive material, the image to be printed comprised of surface responsive areas of abrasive material. The layers are matched for similar properties of color, gloss, and fluorescence, to render the image undetectable under reflected light or ultraviolet light. As used herein, the word "similar," as applied to properties, means "sufficiently matched" to obtain the desired result of an image which is undetectable under normal or ultraviolet light. The image is developed by rubbing, for example, a key over the surface of the substrate, causing abrading of the key by the abrasive material, and thus "printing" of the latent or hidden image by particle capture at the abrasive areas from abrasion of the key. The layers above can be printed upon, for example, a paper substrate by the used of certain gravure inks, the gravure printing method being a high speed and accurate printing method. While the above is a description of one structure of this invention a better understanding of the invention may be had by reference to the general description of this specification.

GENERAL DESCRIPTION

This invention utilizes the relationship as to the properties of color, gloss, and fluorescence of adjacent layers of a multilayer structure to prevent the detection by reflected light or by fluorescence of the printing, or "hidden message," contained within the layers. For the purposes of this invention, the term "latent image" will be used to connote the message or image contained within the layers, and to be revealed by appropriate means, to be described later.

One form of the invention utilizes an abrasive ink to print a message or design upon a substrate capable of receiving the ink. The abrasive material, or ink, is thus placed upon the substrate. Over this and over the surrounding area, which may include the entire substrate surface, is applied a thin layer of a clear, hard, brittle resin. Such a resin may contain, for example, zinc stearate. If the abrasive material and the nonabrasive material, here the hard brittle resin, are matched in the properties of color, gloss, and fluorescence, the over layer of the resin will render the abrasive ink invisible, but does not render it non-abrasive to a metal object that may be rubbed over the printed area.

The abrasive material may be, for example, substantially one part by weight Super Floss Celite Mineral Filler, a product of Johns-Manville Corporation, which is a di-

atomaceous earth; 12½ parts by weight methanol or denatured alcohol; and 10 parts by weight Vinac S-5-50, a product of Air Reduction Company, a 50% solution of polyvinyl acetate in methanol. The non-abrasive material, in the form of a non-abrasive ink, may be substantially 1 part by weight of zinc stearate, 20 parts by weight of Dow Resin PS-2 (a product of Dow Chemical Corporation), a low viscosity polystyrene, and 60 parts by weight of toluene. The total viscosity of the non-abrasive material should be less than 30 seconds' viscosity using a No. 2 Zahn Cup test.

The above inks may be applied by gravure printing techniques.

In the above formula the Celite mineral filler is the abrasive, though it is by no means the only abrasive that could serve the purpose. The Vinac S-5-50 material serves as an adhesive to hold the abrasive particles in place. Other adhesives could be substituted in the formula with similar results. The zinc stearate is used as the lubricant so that the printed paper can be rubbed with a metal object with greater ease and with less tendency to disrupt the surface of the paper. Other lubricants may be substituted for the zinc stearate with similar results. The polystyrene resin gives the entire area to which it is applied a similar appearance, making the message printed with abrasive ink invisible until developed by rubbing with, for example, a metal object. Though the polystyrene is left as a film over the abrasive ink, it is such a hard, thin and brittle film that it does not prevent the abrasive ink from acting on the metal object. Thus, as the metal object is rubbed across the image, the polystyrene film will crack or chip, exposing the abrasive material, causing the abrasive to abrade part of the metal. The abraded particles are captured by the abrasive material, leaving a visible image behind. Thus, the latent image is developed, or printed.

In most applications it is desirable to print over the latent image a light pattern or scroll using colored ink. This scroll is similar to that which appears on safety check paper. This scroll not only has a decorative effect but also makes it more difficult to see the latent image before it is developed. It also makes it more difficult to make any alterations to the latent image without defacing the document. We have found that the colored gravure inks which are used to print these scrolls are made extremely sensitive to erasure if a metallic soap such as zinc stearate is blended into the gravure ink. While safety gravure inks are most sensitive to erasure when treated in this manner, we have been able to modify even the so-called permanent inks to make them very sensitive to erasure.

Thus, the above structure comprises a substrate, an abrasive layer in the form of the image to be printed, and a non-abrasive layer overcoating the entire area of the abrasive layer. The two layers, chosen to be similar in the properties of color, gloss, and fluorescence, renders the latent image undetectable by reflection or by fluorescence. For further protection, printed scroll work may be placed upon the final layer.

It is important to keep in mind that this invention relates to the printing of images which cannot be detected when examined under normal or even ultraviolet light, but which can be made distinct by rubbing the printed surface with a metal object such as the edge of a key. Single application of abrasive ink would provide an image that can be developed by rubbing with the key, but such an image would be visible due to differences in light reflection, color, or fluorescence of the inks in the paper, or substrate. To make the latent image non-visible until rubbed with metal, or other abradable objects, we have developed combinations of abrasive and of non-abrasive materials or inks which have similar properties of color, gloss, and fluorescence. These inks can be used to form structures achieving the objects of this invention in different ways. Thus, for example, the abrasive ink can be

laid down in a solid area without design and the non-abrasive ink can be printed over it in a negative facsimile of the desired image to be printed, forming a protective surface in selected areas which are not to be developed with a metal object.

Another way is to print the non-abrasive ink over the substrate to provide a background with suitable color and gloss on which to apply the abrasive ink, which would be applied in the form of a positive facsimile, or the positive image, which is to be made visible by rubbing with the metal object.

Further, a substrate could be made having an abrasive material incorporated therein, where the abrasive material forms at least a part of at least one surface of the substrate. A layer of non-abrasive material may then be placed upon this abrasive layer in a negative facsimile of the image to be printed. Again, as before, it is important that the non-abrasive material be chosen similar in the properties of color, gloss, and fluorescence, to the background of the substrate in this case. Conversely, a substrate may be utilized having at least one surface being substantially non-abrasive, and then placing the layer of abrasive material upon the surface in the positive facsimile or image of that to be printed, and matching the abrasive material in the properties of color, gloss, and fluorescence to the non-abrasive surface.

In all of the above, it is realized that every material, to some extent at least, can be considered as abrasive. The important feature to keep in mind is that an area chosen to be abrasive, or more abrasive, in relation to its adjacent area, will cause a greater amount of abrading in that area. Thus, even if two abrasive areas were placed next to each other, the more abrasive area would cause a greater amount of abrading, or a greater amount of deposition or capture of abraded material in that area, rendering, at the very least, a contrast between the two areas, rendering the latent image visible.

Where a non-abrasive layer overlays an abrasive area, no printing will occur, except in that example wherein a chippable surface layer is deposited over the abrasive layer. Those abrasive areas which represent the image to be printed may thus be called the surface responsive abrasive material areas; that is, those areas that will respond to development with an abradable object by abrading said object.

Thus, the above illustrations may be summarized in brief by describing them as a latent image device comprising a substrate having at least one of its surfaces comprised thereon of abrasive material and non-abrasive material, the image to be printed comprised of surface responsive areas of said abrasive material, the abrasive and non-abrasive materials being chosen to be similar in the properties of color, gloss, and fluorescence.

The abrasive material, such as in ink form, can be made abrasive by incorporating pigments such as diatomaceous earth or other forms of silica, titanium dioxide, clay, talc or calcium carbonate into a suitable vehicle. The non-abrasive material, such as in ink form, can be prepared by incorporating metallic soap, finely divided resins, or finely divided starch, flour, or other organic substances into a vehicle. It can even be prepared with soft, finely divided inorganic materials as long as they are substantially less abrasive, but similar in color, gloss, and fluorescence, to the pigments used in the abrasive ink.

While our experiments have been mostly with gravure inks, the same principle may be applied to letterpress, lithographic and flexographic inks, and other methods of application of an abrasive and non-abrasive material to a suitable substrate.

An example of a combination of inks suitable for application on a gravure press is as follows: the abrasive ink comprises substantially 5 parts titanium dioxide, 5 parts vinyl acetate, and 15 parts methanol; and the non-abrasive ink comprises substantially 1 part zinc stearate, 5 parts vinyl acetate, and 15 parts methanol. If, as applied

5

on the press, these two inks are not a perfect match, they can be made to match by a slight increase or decrease in the amount of zinc stearate in the non-abrasive ink.

The latent image devices of this invention, as utilized in, for example, game coupons, thus meet the objects of this invention. The latent image cannot be detected under normal or ultraviolet light, due to the matching of properties of the layers in color, gloss, and fluorescence. Tampering with the surface of such coupons, due to the abrasive nature of the abrasive ink, will cause the image to be revealed, and thus expose such tampering. Changing the printed image by additions of additional abrasive ink in a given manner, or covering a portion of the abrasive ink with a non-abrasive material, is easily revealed due to differences between the materials used in attempting to change the latent image by reflection under normal light or by fluorescence under ultraviolet light, unless a perfect match of inks is achieved, which is not likely in the common situation of fraud.

The structures of this invention are clearly applicable for use on high speed printing presses, such as gravure presses, for which specific ink compositions are disclosed. Further, if a final overlayer of scroll printing with a colored tamper-proof type ink is utilized, the underlying image is made further undetectable, and the card made virtually tamper proof.

It should be noted that while gravure printing is generally done upon paper, and this disclosure has been described predominantly with reference to a paper substrate, other substrates, such as certain plastics or plastic-impregnated papers, may also be used, as well as any other substrate that may be adapted for this purpose. It is only necessary, of course, that the inks or materials utilized adhere to the substrate, and do not undergo such chemical reactions as to change their properties in any substantial manner.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. A latent image printing device comprising:

a substrate having at least one of its surfaces comprised of abrasive material in the positive image of the image

6

to be printed, and a layer of hard, brittle non-abrasive material overlying said surface of said substrate, said abrasive material and said non-abrasive material being similar in the properties of color, gloss and fluorescence, so as to cause said image to be printed to be rendered undetectable by light reflection or by fluorescence,

whereby by rubbing said surface with an abradable object said non-abrasive material chips off from and exposes said underlying abrasive material layer, said image being printed by particle capture from abrasion of said abradable object.

2. In a latent image printing device comprising a substrate having at least one of its surfaces comprised of abrasive material in the positive image of the image to be printed, and a layer of hard, brittle non-abrasive material overlying said surface of said substrate, said abrasive material and said non-abrasive material being similar in the properties of color, gloss and fluorescence, so as to cause said image to be printed to be rendered undetectable by light reflection or by fluorescence, wherein said materials in the form of inks are placed upon the surface of said substrate as successive layers by gravure printing means, the combination of inks comprising:

an abrasive ink comprising substantially one part by weight of diatomaceous earth, 12½ parts by weight methanol, and 10 parts by weight of a 50% solution of polyvinyl acetate in methanol; and

a non-abrasive ink comprising substantially one part by weight zinc stearate, 20 parts by weight of polystyrene resin, and 60 parts by weight of toluene.

References Cited

UNITED STATES PATENTS

696,633	4/1902	Hall	117—1.7
730,823	6/1903	Hall	117—1.7
3,001,886	9/1961	Shrewsbury et al.	117—1

OTHER REFERENCES

"Dino Dollars," May 8, 1967, 283—6.

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