PACKAGING FOR AN OPTICAL ARTICLE

Inventors: Kasiraman Krishnan, Clifton Park, NY (US); Marc Brian Wisnudel, Glen Rock, NJ (US); James Enrico Sabatini, Scotia, NY (US); Kaustubh Ravindra Nagarkar, Clifton Park, NY (US); Mathew Jeremiah Misner, Delanson, NY (US); Darren Feher, Fairfield, CT (US)

Correspondence Address:
GENERAL ELECTRIC COMPANY
GLOBAL RESEARCH
ONE RESEARCH CIRCLE, PATENT DOCKET
RM. BLDG. K1-4A59
NISKAYUNA, NY 12309 (US)

Assignee: GENERAL ELECTRIC COMPANY, SCHENECTADY, NY (US)

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Abstract
A packaging for an optical article comprises an electrical device configured to be in contact with the optical article; and an electrical circuit element configured to interact with an activation signal provided by a communication device configured to interact with the electrical device. A system and a method of packaging are also provided.
PACKAGING FOR AN OPTICAL ARTICLE
CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a non-provisional application of U.S. Patent Provisional Application No. 61/099,399, entitled "PACKAGING FOR AN OPTICAL ARTICLE", filed on Sep. 23, 2008, which is herein incorporated by reference.

BACKGROUND

[0002] The invention relates generally to packaging of an optical article. More particularly the invention relates to a packaging comprising an electrical device configured to activate the optical article. The invention includes a system and method for packaging of an optical article.

[0003] Shoplifting is a major problem for retail venues and especially for shopping malls, where it is relatively difficult to keep an eye on each customer while they shop or move around in the store. Relatively small objects, such as CDs and DVDs are common targets as they can be easily hidden and carried out of the shops without being noticed. Shops, as well as the entertainment industry, incur monetary losses because of such instances.

[0004] Even though closed-circuit surveillance cameras may be located at such places, theft still occurs. Consumer products sometimes are equipped with theft-deterrent packaging. For example, clothing, CDs, audiocassettes, DVDs and other high-value items are occasionally packaged along with tags that set off an alarm if the item is removed from the store without being purchased. These tags are engineered to detect and alert for shoplifting. For example, tags that are commonly used to secure against shoplifting are the Sensormatic® electronic article surveillance (EAS) tags based on acousto-magnetic technology. RFID tags are also employed to trace the items on store shelves and warehouses. Other theft-deterrent technologies currently used for optical discs include hub caps for DVD cases that lock down the disc and prevent it from being removed from the packaging until it is purchased, and "keepers" that attach to the outside of the DVD case packaging to prevent the opening of the package until it is purchased. In some cases, retailers have resorted to storing merchandise in locked glass display cases. In other stores, the DVD cases on the shelves are empty, and the buyer receives the actual disc only when purchased. Many of these approaches are unappealing because they add an additional inconvenience to the buyer or retailer, or they are not as effective at preventing theft as desired. Optical storage media, in particular, pose an additional problem in that their packaging and the sensor or anti-theft tags may be easily removed. Point-of-sale (POS) activation reduces retail shrinkage because the optical article, for example a DVD, may not be useful i.e., may not be playable, if removed from the store prior to activation.

[0005] Accordingly, there remains a need for an improved solution to the long-standing problem. The method described herein fills this need by providing a packaging and an activation system and employing a method of packaging that will permit use of the DVD only by an authorized user.

BRIEF DESCRIPTION

[0006] One embodiment of the present disclosure provides a packaging for an optical article. The packaging comprises an electrical device configured to be in contact with the optical article; and an electrical circuit element configured to interact with an activation signal provided by a communication device configured to interact with the electrical device.

[0007] Another embodiment of the present disclosure provides a system. The system comprises a packaging for an optical article; an electrical device configured to be in contact with the optical article; and an electrical circuit element configured to interact with an activation signal provided by a communication device configured to interact with the electrical device.

[0008] Yet another embodiment of the present disclosure provides a method for packaging of an optical article. The method comprises providing an electrical device configured to be in contact with the optical article; and wherein an electrical circuit element is configured to interact with an activation signal provided by a communication device configured to interact with the electrical device; fixing the optical article to the packaging and ensuring alignment of the electrical device, the electrical circuit element, the activation signal provided by a communication device, and the electrical device masking at least one mark of a plurality of optically detectable marks disposed on the optical article contained in the packaging.

BRIEF DESCRIPTION OF DRAWINGS

[0009] These and other features, aspects, and advantages of the present invention will become better understood when the following detailed description is read with reference to the accompanying drawings in which like characters represent like parts throughout the drawings, wherein:

[0010] FIG. 1 shows a packaging for an optical article configured in accordance with an embodiment described herein.

[0011] FIG. 2 shows an optical article configured in accordance with another embodiment described herein.

[0012] FIG. 3 shows a packaging for an optical article in accordance with another embodiment described herein.

[0013] FIG. 4 shows designs of an optical article in accordance with an embodiment described herein.

[0014] FIG. 5 shows packaging designs for an optical article configured in accordance with an embodiment described herein.

[0015] FIG. 6 shows a system for packaging and aligning an optical article in accordance with an exemplary embodiment described herein.

[0016] FIG. 7 shows a process for removing a removable electrical device from a packaging in accordance with an exemplary embodiment described herein.

[0017] FIG. 8 shows a packaging design containing a plurality of optical articles in accordance with another exemplary embodiment described herein.

[0018] FIG. 9 shows a packaging design containing a plurality of optical articles in accordance with another exemplary embodiment described herein.

[0019] FIG. 10 shows a packaging design containing a plurality of optical articles in accordance with still another exemplary embodiment described herein.

[0020] FIG. 11 shows a packaging design containing a plurality of optical articles in accordance with still another exemplary embodiment described herein.

[0021] FIG. 12 shows a packaging design containing a plurality of optical articles in accordance with still another exemplary embodiment described herein.
FIG. 13 shows a packaging design containing a plurality of optical articles in accordance with still yet another exemplary embodiment described herein.

DETAILED DESCRIPTION

The invention relates generally to packaging of an optical article. More particularly, the invention relates to a packaging comprising an electrical device configured to activate the optical article. The invention includes a system and method for packaging of an optical article.

Approximating language, as used herein throughout the specification and claims, may be applied to modify any quantitative representation that could permissibly vary without resulting in a change in the basic function to which it is related. Accordingly, a value modified by a term or terms, such as “about” is not limited to the precise value specified. In some instances, the approximating language may correspond to the precision of an instrument for measuring the value. Similarly, “free” may be used in combination with a term, and may include an insubstantial number, or trace amounts, while still being considered free of the modified term. The singular forms “a”, “an” and “the” include plural referents unless the context clearly dictates otherwise.

One solution to the shoplifting problem, specifically for optical media articles such as DVDs, is to render at least a portion of the content of the DVD inaccessible unless the retailer at the point-of-sale (POS) has activated the DVD. One approach to rendering the content of the DVD inaccessible prior to activation is to employ an ink composition, to deposit a coating composition comprising an optical-state change material in or on the DVD, wherein the coating composition at least partially absorbs the incident laser light from an optical data reader so that the complete data directly in the optical path of the laser light cannot be read. The coating composition may be deposited in the form of marks or spots over data or command containing regions on the optical article. In this instance, the optical article has no value, and therefore there is no incentive for the shoplifter to steal it. However, upon converting the DVD to an “activated” state using an activation signal at the point-of-sale, the coating composition becomes sufficiently transparent, with respect to the wavelength of the laser light employed in the optical data reader, due to a change in the optical properties of the coating composition, and the complete data directly in the optical path of the laser light can now be read by the incident laser light from the optical data reader, therefore rendering the full content of the DVD accessible to an authorized user.

Various methods may be employed for using an activation signal to convert an optical article to an activated state. One approach is to have electrical devices disposed on or in the packaging of the optical article. The electrical devices may be configured to deliver an activation signal i.e., an external stimulus to at least a portion of the optical article coating composition rendering the coating composition transparent, and therefore rendering the full content of the DVD accessible to an authorized user. The activation signal may be delivered by a communication device which may be directly connected with the electrical devices, such as for example a POS equipment.

As used herein, the term “disposed over” or “deposited over” or “disposed between” refers to both disposed directly in contact with and indirectly by having intervening layers therebetween. “Operably coupled” is a relationship between listed parts that provides a stated function.

As used herein, the term “pre-activated” state of functionality refers to a state of functionality of the optical article where the mark comprising the coating composition has not yet been exposed to one or more activation signals, while the “activated” state refers to a state of functionality where the mark has been exposed to the activation signal. In one embodiment, the “pre-activated” state comprises at least one mark which inhibits portions of the optical data layer that are located directly in the optical path of the incident laser light of an optical data reader from being read. The activated state comprises a state of the optical article where the optical data layer can be read by the optical data reader as a result of the article being exposed to at least one external stimulus.

As used herein, the term “activated” state, refers to a state of functionality of the optical article where the optical data layer can be read by the optical data reader as a result of the optical article having been exposed to at least one authorized activation signal. In one embodiment, the optical-state change material is at least partially transparent to the laser from the optical data reader, and does not inhibit the data located directly in the optical path of the laser from being read. In another embodiment, the optical-state change material partially absorbs light from the laser from the optical data reader and prevents the data directly in the optical path of the laser from being read. As used herein the term “reflectivity” is defined as the ratio of reflected light to incident light.

One embodiment of the present disclosure provides a packaging for an optical article. The packaging comprises an electrical device configured to be in contact with the optical article; and an electrical circuit element configured to interact with an activation signal provided by a communication device configured to interact with the electrical device.

In one embodiment, the packaging includes a support element and a protective element for the optical article. As used herein, the term “support element” means an element whose primary function may be to secure the optical article in a pre-determined position in the packaging. The optical article may remain in the position it was secured in during the packaging, until the packaging is opened and the optical article is removed for use by an authorized user. In one embodiment, the support element comprises one or more of a hub, a spindel, or a nest to support the optical article.

As used herein the term “protective element” means an element whose primary function is to protect the optical article from any external damages such as for example, scratches and breakages. In one embodiment, the protective element comprises a cover or a backing to protect the optical article. A variety of protective elements are known in the art. These include jewel boxes, plastic cases, colored or tinted trays, view packs, cardboard mailers, and cardboard sleeves.

In one embodiment, the protective element comprises a section for incorporating the electrical device. In one embodiment, the section in the protective element may include one or more of a slit, a recess, or a slot. In one embodiment, the section in the protective element is configured to allow for the cover of the packaging to be closed over the optical article without damaging of the electrical device. The electrical device may suffer a variety of damages including crimping, abrasion, and breakage. The primary function of the section may be to allow for the electrical device to be accessible to an authorized store personnel without opening the packaging.

In one embodiment, the electrical device may be directly disposed on the protective element or the electrical
device may be built into the protective element. In one embodiment, the electrical device is removably coupled to the packaging. In one embodiment, the protective element comprises a region through which the electrical device is removably coupled. In one embodiment, the region in the protective element through which the electrical device is removably coupled may include one or more of a slit, a recess, or a slot. In one embodiment, the region in the protective element may be the same as the section in the protective element. In another embodiment, the region in the protective element may be different to the section in the protective element.

0035] If the region and the section are different then the region and the section may need to be aligned in a manner such that the electrical device placed in the section is removable from the section in the protective element. In one embodiment, when the electrical device in the packaging is removably coupled, the electrical device may be recyclable. In one embodiment, an authorized store personnel may remove the electrical device prior to handling over the optical article to an authorized user after ensuring that the optical article is usable by the authorized user. In one embodiment, the coupling mechanism may enable reuse of the electrical device, such as for example, the electrical device may be coupled and decoupled from the packaging more than once, as desired, and therefore it is envisioned that the electrical device could be a disposable device. Embodiments relating to the reuse of the electrical device with the same or different packaging are described in more detail below with regard to the adhesive components of the coupling layer. In one embodiment, when the electrical device is removably coupled to the packaging, a coupling layer discussed below may be employed to affix the electrical device to the packaging. In one embodiment, when the electrical device is removably coupled to the packaging the electrical device may be selected from one or more of a flexible tag, an inflexible tag, a card, a ribbon cable, an inter-connector, and a battery. In one embodiment, the cards may comprise printed circuit boards.

0036] As used herein, the term “flexible” is synonymous with the term bendable, and the flexible aspect of a tag is analogous to the flexible aspect of other known flexible electronic devices such as flexible organic light emitting diodes, flexible liquid crystal displays, flexible circuit boards, and flexible solar cells. The flexible quality of the tag stems from the use of bendable materials within the tag, such as thin metal foils, plastics or other polymeric materials.

0037] In one embodiment, the electrical device may be configured to function as an irremovable device once affixed to a packaging. In this embodiment, the electrical device may not be removed by the authorized store personnel during the sale of the optical article. The electrical device may stay with the packaging of the optical article until the entire packaging is discarded. In one embodiment, when the electrical device is irremovably coupled to the packaging the various components of the electrical device discussed below may be printed or molded with a pedestal.

0038] In various embodiments, the coupling layer may include a plurality of individual sub-layers, which form a stack generally referred to as the coupling layer. In one embodiment, at least one sub-layer of the coupling layer comprises an adhesive component. Non-limiting examples of suitable adhesive components include one or more of a pressure sensitive adhesive, an epoxy based adhesive, a thermoset adhesive, acrylate based adhesives, a silicone-based adhesive, and an elastomer based adhesive. As used herein, the term “pressure-sensitive adhesive” includes all polymeric adhesive materials with a glass transition temperature (Tg) below about 50°C. In embodiments comprising an adhesive component, the coupling layer may include a first coupling surface with a first tack strength, and a second coupling surface with a second tack strength. As used herein, the term “tack strength” refers to “stickiness” of the coupling layer, and is a measurement of the strength of adhesion, typically measured in units of pounds-force per inch. The first surface of the coupling layer is typically coupled to the packaging to define a first region. The second surface of the coupling layer may be coupled to other components of the electrical device, such as the electrical circuit layer or an optional backing layer, to define a second region. In one embodiment, both the first and second surfaces of the coupling layer are coupled to the packaging.

0039] In embodiments where the coupling layer comprises an adhesive component, one aspect of the coupling layer is the ability of the electrical device to be decoupled from the packaging such that the electrical device undergoes a “clean adhesive failure” at the first region between the coupling layer and the optical article. As used herein, the term “clean adhesive failure” is defined as the removal of the electrical device from the packaging such that no significant residue of the coupling layer is left behind on the packaging. As used herein, and with respect to the term “clean adhesive failure”, the term “significant” refers to a quantity that affects or interferes with the reusability of the packaging. For example, “clean adhesive failure” of the electrical device from the surface of the packaging means that the quantity of residue of the coupling layer which might be left behind on the surface of the packaging, including the residue which is not visible to the naked eye or touch, is sufficiently small in quantity as to not leave a mark on the packaging. Also the amount of residue left behind may come in to contact with the optical article disposed in the packaging. In case the optical article is a DVD, the residue in the packaging that comes in contact with the DVD may not interfere with the readability of the DVD in a standard DVD reader.

0040] The attraction forces produced by the above mentioned coupling mechanisms may or may not be uniform at the interface between the coupling layer and the optical article. For example, the attraction forces may be weaker at the edges of the electrical device to facilitate removal, for example, peeling off of the electrical device once the predetermined and desired activation signal has been induced in the optical article.

0041] In one embodiment, the electrical device is a multi-component structure. In one embodiment, the electrical device may include, electrical traces and at least one electrode or at least one heating element; wherein the electrode and the heating element are configured to generate electrical energy and thermal energy respectively. In one embodiment, the electrical traces are made from a material selected from one or more of a conjugated polymer, carbon, silver, copper, gold, aluminum, platinum, lead dioxide, stainless steel, indium tin oxide, nickel, chromium, and any combinations and alloys thereof. In one embodiment, the electrode is made from a material selected from one or more of a conjugated polymer, carbon, silver, copper, gold, aluminum, platinum, lead dioxide, stainless steel, indium tin oxide, nickel, and any combinations and alloys thereof. In one embodiment, the heating element is made from a material selected from one or more of carbon, titanium, copper, gold, tantulum-nitride, aluminum,
molybdenum, titanium-tungsten, platinum, chromium, indium tin oxide, nickel, silver, conjugated polymers, and any combinations and alloys thereof.

[0042] In one embodiment, the input interfaces may include electrical traces and electrical connectors to assist in being operably coupled with the communication device that applies the activation signal to the electrical device. The electrical traces and electrical connectors carry an electric impulse from a communication device to the electrical device and the electrodes and/or convert the electrical impulses to electrical and heat energy respectively. In various embodiments, the electrical traces may be included in the electrical device using methods known to one skilled in the art, such as for example, the electrical traces may be patterned or printed on the surface of the electrical device. In one embodiment, a label, such as for example, a paper, a cardstock or a photograph may be placed over the electrical device to hide the electrical traces and the electrical connectors. In various embodiments, the electrical traces and electrical connectors may be fabricated using materials known to one skilled in the art.

[0043] In one embodiment, the packaging further comprises an input interface element in operably coupled with the electrical device disposed on the packaging to apply the activation signal to the optical article. In one embodiment, the input interface element may use the electrical device to apply a power component of the activation signal to the electrical device disposed on the packaging and masking at least one mark of the plurality of optically detectable marks; and may use a data component of the activation signal to regulate application of power. In one embodiment, the electrical device comprises one or more of a radio frequency circuitry, a thermocouple, a light-emitting diode, a strain gauge, a sound detecting element, a diode, an antenna, a dipole, an electrical receiver, a photocell, a resistor, a capacitor, a rectifier, an integrated circuit, a surface mount resistor, a chip resistor, an electrode, a conductive gap filler, an adhesive, and a heating element.

[0044] In one embodiment, the electrical device is placed on a pedestal as mentioned above. In one embodiment, the pedestal comprises a molded plastic placed on the packaging. In one embodiment, when the pedestal comprises a molded plastic placed on the packaging the pedestal is removably coupled to the packaging. In one embodiment, the pedestal comprises a molded plastic forming an integral part of the packaging. Since the electrical device is placed on a pedestal(s), when the optical article is placed in the packaging, the heaters (or electrodes) may be in direct physical contact with the optical article. In one embodiment, better heat transfer may be obtained by introducing a layer of conductive gap filler material between the heater and the optical article. In various embodiments the conductive gap filler material may be a thermal gap filler or an electrical gap filler.

[0045] In one embodiment, the electrical device is removably coupled to the pedestal. In one embodiment, when the electrical device is removably coupled to the pedestal, a coupling layer as discussed above may be employed to affix the electrical device to the pedestal. In one embodiment, when the electrical device is removably coupled to the pedestal the electrical device may be selected from one or more of a flexible tag, an inflexible tag, a card, a ribbon cable, and an interconnect.

[0046] In one embodiment, the electrical device is irremovably coupled to the pedestal. In one embodiment, when the electrical device is irremovably coupled to the pedestal the various components of the electrical device discussed above may be printed or molded with the pedestal.

[0047] In various embodiments, the electrical traces, the electrodes and the heaters are deposited on the packaging or the pedestal through a printing method; wherein the printing method includes screen printing, inkjet printing, flexographic printing, gravure printing, offset printing, pad printing, doctor blading, thermal transfer printing, lithographic printing, or direct-write. In certain embodiments the electrical traces, the electrodes and the heaters can be pre-formed and subsequently disposed on the substrate, examples include metal foils for conductive traces, thermal gap fillers, adhesives, and chip resistors for the heater.

[0048] In one embodiment, the electrical device fixed on the packaging or removably coupled to the packaging masks at least one mark of a plurality of optically detectable marks disposed on the optical article contained in the packaging. In one embodiment, the plurality of optically detectable marks comprise an optical state change material.

[0049] In one embodiment, the marks may include one or more of a dye and a reactive material. As used herein the term “optical state change” material is used to describe a material which is capable of existing in at least two different forms, each form possessing a unique optical state, for example a unique wavelength associated with a maximum optical absorbance within a range from about 200 nanometers to about 800 nanometers, or a unique extinction coefficient at a specific wavelength between about 200 nanometers to about 800 nanometers. Non-limiting examples of optical-state change materials include halochromic optical-state change materials, photo-bleachable materials, polymeric materials, organic compounds, hydrogels, liquid crystalline materials, leuco dyes, inorganic compounds such as, but not limited to, metal oxides and organometallic compounds, materials capable of undergoing a sigmatropic bond rearrangement, and reactive adduct materials. In various embodiments, the optical-state change materials may undergo the optical-state change under the influence of a thermal stimulus i.e., may be thermochromic or an electrical stimulus i.e., may be electrically responsive. The term “thermochromic” as used herein, describes materials that undergo either a reversible or an irreversible thermally induced color change. The term “electrically responsive” as used herein, describes materials that undergo either a reversible or an irreversible electrically induced color change. In various embodiments, suitable optical-state change material known to one skilled in art may be employed.

[0050] In one embodiment, the plurality of marks may be printed on the surface of the optical article using a method selected from one or more of a screen-printing method, an ink-jet printing method, a direct-write method, a pad printing method, a microarray deposition method, a capillary dispensing method, a gravure printing method, a thermal transfer printing method, and adhesion of pre-made polymer films.

[0051] In various embodiments, the mark may be deposited in a discrete area on the optical article, such that at least one spot, at least one line, at least one radial arc, at least one patch, a continuous layer, or a patterned layer extends across at least a portion of the optical article. One or more marks may be deposited on the optical article in various forms, such as a discrete portion, a continuous film, or a patterned film. During authorization, the mark may be stimulated in a continuous, discontinuous or pulsed form.
Alternatively, instead of being deposited on the surface of the optical article, the mark may be deposited inside the structure of the optical article. In optical storage articles, the mark may be deposited in the substrate on which the optical data layer is deposited. In alternate embodiments, the mark may be deposited between the layers of the optical article, or may be deposited within a layer of the optical article. For example, the ink composition may be incorporated in the UV curable adhesive of the bonding (spacer) layer. In this case it should be appreciated that these marks should be thermally stable to withstand the manufacturing temperatures of the optical article. Also, these marks may preferably absorb the wavelength of the laser light in one of the activated, or the pre-activated state of the optical article. Upon interaction with external stimuli, the mark present inside the substrate changes color. As a result, the substrate may become transparent to the laser light, thereby facilitating the transmittance of laser light through the substrate and making the optical article readable.

In one embodiment, the POS equipment and the electrical device are operably coupled and the direct or remote connection between them may be employed to power the activation system on the electrical device. The heat energy or electrical energy from the electrical device may be then transmitted from the electrical device to at least one mark of the plurality of optically detectable marks disposed on the surface of the optical article.

In one embodiment, the activation signal applied to the electrical device results in a change in at least one physical property of the optically detectable mark, resulting in transforming the optical article from a pre-activated state of functionality to an activated state of functionality, i.e., the optical article may be transformed from an unplayable to playable state. In one embodiment, the change in at least one physical property of the optically detectable marks includes one or more changes selected from the group consisting of layer reflectivity, single layer reflectivity, dual layer reflectivity, refractive index, birefringence, polarization, opacity, absorbance, thickness, optical path length, and position. In one embodiment, the pre-activated state is characterized by an optical reflectivity of at least one portion of the optical article having a reflectivity of less than about 20 percent based on the reflectivity of the at least one portion of the optical article in the activated state. In one embodiment, the optical article includes an optical data layer for storing data, wherein the data is read from the optical data layer in the activated state of functionality.

It should be appreciated that there are analogous predetermined values of optical properties for activating different optical articles. For example, the specified (as per ECMA-267) minimum optical reflectivity for DVD-9 (dual layer) media is in a range from about 18 percent to about 30 percent and is dependent upon the layer (0 or 1).

The activation signal transmitted by the communication device to the electrical connectors is transmitted back via the electrical traces to the electrical device. The activation signal is converted to electrical energy or heat energy by the electrodes or heaters disposed on the electrical device. The conversion of the activation signal to electrical energy or heat energy may depend on the type of the optical-state change material used in the optically detectable marks, such as for example if the optical-state change material is a thermally responsive material, the heat generated by the heater in the electrical device will result in a change in at least one physical property of the optically detectable mark, resulting in transforming the optical article from the pre-activated state of functionality to the activated state of functionality as discussed above.

In one embodiment, the electrical device creates a mark upon the optical article on interaction with the activation signal. In one embodiment, the activation signal may result in forming a permanent pre-determined damage on the optical article and thus activate the optical article. The permanent damage may include imposing a permanent mark including one or more of a dimple, a scratch, or a physical modification formed in or on the data-containing region of the optical article.

In one embodiment, the support element of the packaging comprises an insert. The insert may be placed inside the packaging and may help to hold the optical article to avoid any movement during the shipping and handling of the packaging, ensuring alignment of the electrical device, the electrical circuit element, the activation signal provided by the communication device. As mentioned above, the electrical device marks at least one mark of a plurality of optically detectable marks disposed on the optical article contained in the packaging. In one embodiment, the insert may include one or more of a piece of a plastic or a cardboard adhered to the support element, an adhesive tape, and a layer of adhesive.

In one embodiment, the electrical device is operably coupled with the communication device. In one embodiment, the electrical device is brought in direct electrical contact with the communication device. In another embodiment, the communication device is located at a remote location or at a distance from the electrical device and is brought in contact with the communication device using methods known to one skilled in the art. In one embodiment, the activation signal comprises one or more of a laser, thermal energy, electromagnetic radiation, gamma rays, acoustic waves, electrical energy, chemical energy, magnetic energy, mechanical energy, radio frequency waves, and ultraviolet radiation.

In certain embodiments, the activation signal may be computed as a function of a unique optical article package identifier. The package identifier may be stored in the electrical device that may be operatively coupled to the optical article, and a non-public dataset, such as a cryptovariable. The cryptovariable may be electrically entered into the electrical device.

As used herein, the term “optical article” refers to an article that includes an optical data layer for storing data. The stored data may be read by, for example, an incident laser of an optical data reader device such as a standard compact disc (CD) or digital versatile disc (DVD) drive, commonly found in most computers and home entertainment systems. In some embodiments, the optical article may include one or more data layers. Furthermore, the optical data layer may be protected by employing an outer coating, which is transparent to the incident laser light, and therefore allows the incident laser light to pass through the outer coating and reach the optical data layer. Non-limiting examples of optical articles include a compact disc (CD); a digital versatile disc (DVD); multilayered structures, such as DVD-5 or DVD-9; multi-sided structures, such as DVD-10 or DVD-18; a high-definition digital versatile disc (HD-DVD); a Blu-ray disc; a near field storage disc; a holographic storage medium, packaging of an optical article; and a volumetric optical storage medium, such as, a multi-photon absorption storage format. In other embodiments, the optical article may also include an
identification card, a passport, a payment card, a driver’s license, a personal information card, or any other documents or devices, which employ an optical data layer for data storage. In one embodiment, the first surface of the optical article comprises a polycarbonate.

[0062] In one embodiment, the packaging includes a plurality of optical articles. For example, a packaging containing DVDs including one or more of a complete season of a soap or tele-seaerial, a seasons fashion, a movie with its sequel and others. In one embodiment, the packaging may directly include the optical articles. In one embodiment, the combined packaging may include optical article that are already packed in their individual packaging cases.

[0063] In one embodiment, the communication device may include a POS equipment. The POS equipment generally includes electrical connections, a power supply and a logic board. The logic board includes information that enables the board to determine if the user is an authorized user. The logic board uses this information to provide an activation signal to activate the optical article i.e., if the optically detectable mark comprises a thermochromic material, an electric impulse generated by the logic board is transmitted to the electrical device and the heaters in the electrical device convert the electric impulse to heat energy resulting in a change in the state of the optical-state change material included in the marks disposed on the optical article. The logic board may then use this information to activate the DVD. For example, once a user has selected a DVD/DVD case from the retail shelf, the user takes the DVD to the point of sale. A person operating the point of sale equipment may then bring the DVD in direct contact with the POS equipment, such as for example, pass the DVD through a slot or region provided in the POS equipment. The electrical connectors connected to the electrical device by the electrical traces may thus be brought in direct contact with the communication device, i.e., the POS equipment. Once the person operating the point of sale equipment determines if the user is an authorized user, for example if the user has paid for the DVD, the information may be fed to the logic board of the POS equipment resulting in the generation of an activation signal from the POS equipment. The activation signal is then sent back to the POS equipment via the electrical connector in direct contact with the POS equipment and the electrical traces on the surface of the DVD, resulting in the activation of the DVD. In one embodiment, the activation signal may be configured in such a manner that only certain electrical traces may be energized, thus activating only certain marks on the surface of the DVD, resulting in the activation of the DVD.

[0064] In one embodiment, the POS equipment may also comprise an RFID reader that reads an identification code from the DVD or the DVD case. The logic board then uses that identification code to determine whether the DVD requires activation, and if it does, which electrical traces are to be energized. In one embodiment, the POS equipment may have an external interface i.e., may be connected to an external network such that the information regarding which electrical traces may be energized may be provided externally. Again as discussed above, the logic board may then use this information to activate the DVD.

[0065] In one embodiment, a self-service equipment, i.e., a kiosk may be used as the communication device. As used herein the term self-service means that the steps for activating the DVD have to be performed by the user who has picked up the DVD packaging from the shelf. There may be no person operating the kiosk. Once the user has picked up the DVD packaging from the shop, the user can access the kiosk before leaving the shop. Again as discussed above the kiosk may also have a slot for the DVD packaging which results in bringing the DVD packaging in contact with electrical connections in the kiosk, resulting in the generation and transmission of an activation signal, if it is determined that the user is an authorized user. In one embodiment, the kiosk may include a graphical user interface, where the user may need to key in a code to determine if the user is an authorized user. In another embodiment, the kiosk may also include a payment element such as a credit card reader. In one embodiment, the payment element may be used as the source to determine if the user is an authorized user i.e., if the user has paid for the DVD the user is an authorized user. Again as discussed above in the description of the POS equipment, the kiosk may have a slot where the DVD packaging can be brought in contact with the electrical connections.

[0066] Another embodiment of the present disclosure provides a system. The system comprises a packaging for an optical article; an electrical device configured to be in contact with the optical article; and an electrical circuit element configured to interact with an activation signal provided by a communication device configured to interact with the electrical device.

[0067] Yet another embodiment of the present disclosure provides a method for packaging of an optical article. The method comprises providing an electrical device configured to be in contact with the optical article; and wherein an electrical circuit element is configured to interact with an activation signal provided by a communication device configured to interact with the electrical device; fixing the optical article to the packaging and ensuring alignment of the electrical device, the electrical circuit element, the activation signal provided by a communication device, and the electrical device masking at least one mark of a plurality of optically detectable marks disposed on the optical article contained in the packaging.

[0068] Referring to FIG. 1, a packaging for an optical article 100, for example a DVD packaging, includes a protective element 110 comprising a case made of plastic and a supportive element 112. The plastic case includes a cover 114 and a holder 116. The holder includes a nest 118 and a spindle 120 located at the center of the nest. The spindle and nest function to hold the DVD in place during any kind of movement, say for example, transportation. An electrical device 122 is disposed on the DVD case. The electrical device is so positioned that a part of the electrical device may be aligned with at least one mark of a plurality of optically detectable marks disposed on the surface of the DVD (not shown in figure) that will be packed in this packaging.

[0069] In another embodiment, as shown in FIG. 2 and described below, a packaging for an optical article 200, for example a DVD packaging, includes a protective element 210 comprising a case made of plastic and a supportive element 212. The plastic case includes a cover 214 and a holder 216. The holder includes a nest 218. The case also includes an insert 220 located on the cover of the packaging. The nest and the insert function to hold the DVD in place during any kind of movement, say for example, transportation. Specifically in one embodiment, the insert 220 serves the function of pressing against the DVD and preventing it from rotating during shipping and handling of the case before POS activation. In another embodiment, the insert functions to hold the DVD and the electrical device in place. An electrical device 222 is
disposed on the DVD case. The packaging includes a region 224 that comprises a slit for accommodating the electrical device. Placing the electrical device in the slit, when the cover of the packaging is lowered on the base of the supportive element allows for the cover of the packaging to be closed over the optical article without damaging of the electrical device. As mentioned above in the discussion for FIG. 1, the electrical device is so positioned that a part of the electrical device may be aligned with at least one mark of a plurality of optically detectable marks disposed on the surfaces of the DVD that will be packed in this packaging. A magnified image of the electrical device 226 shows electrical traces 228 and an heating element 230 printed on the surface of a plastic pedestal 232. As discussed above in one embodiment, the pedestal is removably coupled with the holder surface and can be removed by an authorized store personnel from the slit which now functions as the region through which the electrical device is removable. In another embodiment, the pedestal is configured to function as an irremovable device once affixed on the packaging.

[0070] In yet another embodiment, as shown in FIG. 3 and described below, a packaging for an optical article 300, for example a DVD packaging, includes a protective element 310 comprising a case made of plastic or cardboard and a supportive element 312. The plastic case includes a cover 314 and a holder 316. The holder includes a nest 318 and a spindle 320. The nest and the spindle function to hold the DVD in place during any kind of movement, say for example, transportation. An electrical device 322 is disposed on the DVD case. The packaging includes a section 324 that comprises a slit for accommodating the electrical device. The electrical device is molded with plastic forming the holder of the plastic case and the electrical traces 326 and the heating element 328 which together form the electrical device are inlaid in the holder of the plastic case. The electrical device is further connected to an electrical pad 330 placed outside the section comprising the slit. The communication device (not shown in figure) may be brought in direct or indirect contact with the electrical pad and the activation signal provided by the communication device may be transmitted to the heating element via the electrical traces resulting in activation of the DVD. The holder may also optionally include an RFID device 332 or a SENSORMATIC™ device 334 integrated with the electrical device molded with the holder. The communication device has a corresponding RFID reader (not shown in figure) to read the RFID code generated by the RFID device.

[0071] Referring to FIG. 4, the electrical devices 400 may be designed in different shapes including a rectangular shape with a sharp edge 410, a rectangular shape with a rounded edge 412, a rectangular shape with beveled edge 414. The electrical traces 416 are disposed on the shaped edge and the heating element 418 may be disposed on the top surface of the electrical device. In one embodiment, the electrical device may include a plurality of heating elements.

[0072] In still yet another embodiment, as shown in FIG. 5 and described below, different types of packaging 500 and ways of disposing the electrical devices in these packaging are indicated. A cardboard packaging, alternatively called as “green packaging” 510 provides a sleeve having a cover 512 and a holder 514. In a first embodiment 516, a section 518 in the cover of the packaging may function as the slit for inserting the electrical device 520 such that the electrical traces 522 and the heating elements 524 are inside the cardboard sleeve on the base or underside of the cover and the electrical pads 526 are disposed outside the cardboard sleeve and are available for direct or indirect contact with the communication device (not shown in figure). In a second embodiment 528, the electrical device may be disposed on the surface of the holder of the packaging with the such that the electrical traces and the heating elements are inside the cardboard sleeve and the electrical pads (not shown in figure) may be folded over the cover portion or the holder portion on the outside of the cardboard sleeve and are available for direct or indirect contact with the communication device. FIG. 5 also shows a clamshell packaging 530 including an electrical device 532 disposed on the holder side 534.

[0073] Referring to FIG. 6, the packaging of a optical article 600, for example a DVD packaging, shows how the DVD 610 may be aligned to the activation signal 612 provided by a communication device 614. The DVD includes a data storage region 616 and an inner hub 618. The data storage region includes an optical data layer (not shown in figure), which stores the data, whereas the inner hub is the non-data storage region of the DVD. An optically detectable mark 620 is disposed on the surface of the DVD in a region over the data storage region. The DVD is in the pre-activated state as the mark renders the DVD unplayable. The DVD is placed in a protective element 622 comprising a case made of plastic. The plastic case includes a cover (not shown in figure) and a holder 624. The holder includes a nest 626 and a spindle 628 to hold the DVD in place. The holder also includes an electrical device 630 that is disposed in a manner such that the electrical device masks at least a portion of the optically detectable mark disposed on the surface of the DVD. The electrical device is operably coupled to a voltage source (not shown in figure). The voltage source functions as the communication device. The voltage source generates and transmits the activation signal to the electrical device. The electrical device includes electrodes or heat sources to convert the activation signal to electrical energy or thermal energy and the energy may then be transmitted to the optically detectable mark. The optically-detectable marks on the DVD upon interaction with the activation signal undergo an optical state change, whereby the optical absorbance of the optical-state change material is altered, thereby changing the state of functionality of the DVD to provide an activated optical article (not shown in figure). For example, in the pre-activated state of the DVD, the optical-state change material of the mark 118 may be opaque to the incident laser that is used to read the optical article 110. That is, in the pre-activated state the optical-state change material may inhibit the incident laser from reaching the optical data layer (not shown in figure), whereas after interacting with the activation signal the optical-state change material may become transparent to the wavelength of the incident laser. As noted above, this change in the optical state may be caused by chemical changes within the optical-state change material, which are caused by exposure to the activation signal. The activated mark (not shown in figure) may cover at least a portion of the region over the data storage region of the DVD. In the pre-activated state, the DVD may be unplayable or unreadable at least in the portions where the optically detectable mark is disposed. In other words, the DVD in the pre-activated state has a reflectivity of less than about 20 percent based on the reflectivity of the at least one portion of the optical article in the activated state where the optically-detectable mark is disposed.

[0074] Referring to FIG. 7, a process for removing a removable electrical device from a packaging 700 is shown. In a first
step of the process 710, we have an optical article, for example a DVD, in a closed package. The package includes a cover 716 and a holder 718. The package also includes a region 720, in the form of a slit, for inserting the electrical device 722. The electrical device in so placed in the packaging that the authorized personnel can activate the optical article at the POS. Once the authorized personnel activates the optical article for an authorized user, the authorized user can now open the packaging in a second step 712. In the opened package the DVD 726 is placed in the nest (not shown in figure; obscured by the DVD) and is supported by the nest and a spindle 724. The electrical device is seen placed over the data containing region of the DVD. The authorized user may now remove the electrical device and separate it from the DVD packaging in the third step 714. In another embodiment (not shown in figure), once the authorized store personnel has activated the DVD, the electrical device may be removed from the region 720, before the DVD packaging is handed over to the authorized user. In this packaging the region for placing the electrical device in the packaging and the section for removing the electrical device from the packaging are the same. In one embodiment, when the store personnel removes the electrical device the electrical device may be reused.

[0075] Referring to FIG. 8, a packaging design containing a plurality of optical articles 800 is shown. The figure also shows the design and placement of the electrical devices in these packaging to enable for example, a one-step activation of all the optical articles packed in the packaging. The packaging design includes a cardboard box 810. A plurality of optical articles, in this case a plurality of DVD cases 820 containing DVDs is placed in the cardboard box. Each DVD case has an electrical device 814 placed in a manner as described in FIG. 1 above. The electrical devices projecting out of each DVD case are connected by a common link 816. The common link may be similar to the electrical traces described herein. The common link may in turn connect the electrical devices of each DVD to an external connection 818. The external connection is disposed on the cardboard box in a manner such that it can be operably coupled with a communication device (not shown in figure) that can provide an activation signal resulting in activating the DVD’s packed in the DVD cases. The electrical devices placed in the DVD cases are aligned with the DVD’s as described in FIG. 6 above. In one embodiment, the box may include different shapes including rectangular, cube, spherical, and cylindrical. In one embodiment, a plastic box may be used in place of a cardboard box.

[0076] Referring to FIG. 9, a packaging design containing a plurality of optical articles 900 is shown. The packaging design includes a cardboard box 910. A plurality of optical articles, in this case a plurality of DVD cases (not shown in figure) containing DVDs are placed in the cardboard box. Each DVD case has an electrical device (not shown in figure) placed in a manner as described in FIG. 1 above. The cardboard box includes a region 912, in this case a slit, through which a plank 914 having the printed circuitry may be permanently affixed inside the package or can slide in and out 916. The printed circuit in the plank is operably coupled with the electrical devices in all the DVD cases in the package. In one embodiment, the plank makes direct contact with the electrical devices in all the DVD cases in the package. The plank is operably coupled with a communication device (not shown in figure) that can provide an activation signal (not shown in figure) resulting in activating the DVD’s packed in the DVD cases. In one embodiment, the box may include different shapes including rectangular, cube, spherical, and cylindrical. In one embodiment, a plastic box may be used in place of a cardboard box.

[0077] Referring to FIG. 10, a packaging design containing a plurality of optical articles 1000 is shown. The packaging design includes a cardboard box 1010. A plurality of optical articles, in this case a plurality of DVD cases (not shown in figure) containing DVDs are placed in the cardboard box. Each DVD case has an electrical device (not shown in figure) placed in a manner as described in FIG. 1 above. The cardboard box may be brought in contact with a corner shaped activation hardware 1012. The activation hardware may include pins that make contact with the circuitry in the box that connects with the electrical devices disposed in the individual cases inside. The corner shaped activation hardware is operably coupled with a communication device 1014 in this case a programmable power supply located at the POS, that can provide an activation signal (not shown in figure) resulting in activating the DVD’s packed in the DVD cases. In this embodiment, the corner shaped activation hardware may include pins that may make contact with electrical pads on the surface of the multi-disc package, which is operably coupled with the individual optical articles inside. One skilled in the art will appreciate that any rectangular shaped box can be pressed against the corner irrespective of the size. In one embodiment, a plastic box may be used in place of a cardboard box.

[0078] Referring to FIG. 11, another design for combined packaging 1100 of optical articles already packaged in their individual packaging cases is provided. A printed circuitry 1112 comprising electrical pads is disposed on the surface of the cardboard box 1110. The printed circuitry may be connected with the individual packaging cases for example DVD cases, (not shown in figure) packed inside the cardboard box. Each DVD case has an electrical device (not shown in figure) placed in a manner as described in FIG. 1 above. A hand-held wand 1114 may be employed as the communication device to provide an activation signal 1116 to activate the optical articles in their individual cases. In one embodiment, the box may include different shapes including rectangular, cube, spherical, and cylindrical. In one embodiment, a plastic box may be used in place of a cardboard box.

[0079] Referring to FIG. 12, another design for combined packaging 1200 of optical articles already packaged in their individual packaging cases is provided. A battery 1212, for example a 9 volts battery may be placed inside the cardboard box 1210. The 9 volts battery may be connected 1216 with the individual packaging cases for example DVD cases (not shown in figure) packed inside the cardboard box via electrical traces 1214. Each DVD case has an electrical device (not shown in figure) placed in a manner as described in FIG. 1 above. The battery may in turn directly connect the electrical devices of each DVD case to an external connection 1220 via electrical traces 1218. The external connection is disposed on the cardboard box in a manner such that it can be operably coupled with a communication device (not shown in figure) that can provide an activation signal (not shown in figure) resulting in closing of the battery circuit and activating the DVD’s packed in the DVD cases. The electrical devices placed in the DVD cases are aligned with the DVD’s as described in FIG. 6 above. In one embodiment, the box may include different shapes including rectangular, cube, spherical-
cal, and cylindrical. In one embodiment, a plastic box may be used in place of a cardboard box.

[0080] Referring to FIG. 13, another design for combined packaging 1300 of optical articles already packaged in their individual packaging cases is provided. A battery 1312, for example a 9 volts battery may be placed inside the cardboard box 1310. The 9 volts battery may be connected 1316 with the individual packaging cases for example DVD cases (not shown in figure) packed inside the cardboard box via electrical traces 1318. The RF activated switch 1320 via electrical traces 1318. The RF activated switch may be used for closing the battery circuit and thereby providing an activation signal (not shown in figure) to the electrical devices disposed in the DVD cases. The RF activated switch is operably coupled to a communication device (not shown in figure) that is capable of providing low RF power sufficient to close the switch. In one embodiment, the RF activated switch is wirelessly coupled with the communication device. Once the circuit is closed an activation signal is generated resulting in activating the DVD’s packed in the DVD cases. The electrical devices placed in the DVD cases are aligned with the DVD’s as described in FIG. 6 above. In one embodiment, the box may include different shapes including rectangular, cube, spherical, and cylindrical. In one embodiment, a plastic box may be used in place of a cardboard box.

[0081] While only certain features of the invention have been illustrated and described herein, many modifications and changes will occur to those skilled in the art. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and changes as fall within the true spirit of the invention.

1. A packaging for an optical article comprising: an electrical device configured to be in contact with the optical article; and an electrical circuit element configured to interact with an activation signal provided by a communication device configured to interact with the electrical device.

2. The packaging of claim 1, comprising a support element and a protective element for the optical article.

3. The packaging of claim 2, wherein the support element comprises one or more of a hub, a spindle, or a nest, to support the optical article.

4. The packaging of claim 2, wherein the protective element comprises a cover or a backing to protect the optical article.

5. The packaging of claim 4, wherein the protective element comprises a plastic case or cardboard sleeve.

6. The packaging of claim 2, wherein the protective element comprises a section for incorporating the electrical device.

7. The packaging of claim 6, wherein the section in the protective element comprises a slit, a recess, or a slot.

8. The packaging of claim 6, wherein the section in the protective element is configured to allow for the cover of the packaging to be closed over the optical article without damaging the electrical device.

9. The packaging of claim 1, wherein the electrical device is removably coupled to the packaging.

10. The packaging of claim 9, wherein the protective element comprises a region through which the electrical device is removable.

11. The packaging of claim 10, wherein the region in the protective element comprises a slit, a recess, or a slot.

12. The packaging of claim 1, wherein the electrical device is configured to function as an irremovable device once affixed on the packaging.

13. The packaging of claim 1, wherein the electrical device is placed on a pedestal.

14. The packaging of claim 13, wherein the pedestal comprises a molded plastic placed on the packaging.

15. The packaging of claim 13, wherein the pedestal is removably coupled to the packaging.

16. The packaging of claim 13, wherein the electrical device is removably coupled to the pedestal.

17. The packaging of claim 13, wherein the electrical device is irremovably coupled to the pedestal.

18. The packaging of claim 13, wherein the electrical device is printed or molded with the pedestal.

19. The packaging of claim 18, wherein the electrical device is removably coupled to the pedestal.

20. The packaging of claim 1, wherein the electrical device is selected from one or more of a flexible tag, an inflexible tag, a card, a ribbon cable, an inter-connect, and a battery.

21. The packaging of claim 1, further comprising a coupling layer configured to couple the electrical device to the packaging.

22. The packaging of claim 1, wherein the electrical device masks at least one mark of a plurality of optically detectable marks disposed on the optical article contained in the packaging.

23. The packaging of claim 1, wherein the electrical device contains a mark upon the optical article on interaction with the activation signal.

24. The packaging of claim 1, further comprising an input interface element configured to be in contact with the electrical device disposed on the packaging to apply an activation signal to the optical article.

25. The packaging of claim 24, wherein the input interface element applies a power component of the activation signal to the electrical device; and uses a data component of the activation signal to regulate application of power.

26. The packaging of claim 25, wherein the electrical device comprises one or more of a radio frequency circuitry, a thermocouple, a light-emitting diode, a strain gauge, a sound detecting element, a diode, an antenna, a dipole, an electrical receiver, a photocell, a resistor, a conductor, a capacitor, a rectifier, an integrated circuit, a surface mount resistor, a chip resistor, an electrode, a conductive gap filler, adhesives, and a heating element.

27. The packaging of claim 1, wherein the activation signal applied to the electrical device results in a change in at least one physical property of at least one of the plurality of optically detectable marks, resulting in transforming the optical article from a pre-activated state of functionality to an activated state of functionality.

28. The packaging of claim 1, wherein the electrical device is a multi-component structure.

29. The packaging of claim 28, comprising electrical traces and at least one electrode or at least one heating element, wherein the electrode and the heating element are configured to generate electrical energy and thermal energy respectively.

30. The packaging of claim 2, wherein the support element comprises an insert.
31. The packaging of claim 30, wherein the optical article is held in place by the insert to avoid any movement during the shipping and handling of the packaging, ensuring alignment of the electrical device, the electrical circuit element, the activation signal provided by the communication device, and the electrical device masking at least one mark of a plurality of optically detectable marks disposed on the optical article contained in the packaging.

32. The packaging of claim 30, wherein the insert can be one or more of a piece of a plastic or a cardboard adhered to the support element, an adhesive tape, and a layer of adhesive.

33. The packaging of claim 1, wherein the optical article comprises a CD, a DVD, a HD-DVD, a Blu-ray disc, a near field optical storage disc, a holographic storage medium, another like volumetric optical storage medium, an identification card, a passport, a payment card, a driving license, packaging of an optical article, or a personal information card.

34. The packaging of claim 1, wherein the packaging comprises a plurality of optical articles.

35. A system comprising:
   a packaging for an optical article;
   an electrical device configured to be in contact with the optical article; and
   an electrical circuit element configured to interact with an activation signal provided by a communication device configured to interact with the electrical device.

36. A method for packaging of an optical article comprising:
   providing an electrical device configured to be in contact with the optical article; and wherein an electrical circuit element is configured to interact with an activation signal provided by a communication device configured to interact with the electrical device;
   fixing the optical article to the packaging and ensuring alignment of the electrical device, the electrical circuit element, the activation signal provided by a communication device, and the electrical device masking at least one mark of a plurality of optically detectable marks disposed on the optical article contained in the packaging.

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