SPRUSON & FERGUSON

AUSTRALIA

PATENTS ACT 1990

PATENT REQUEST: STANDARD PATENT

I/We, the Applicant(s)/Nominated Person(s) specified below, request I/We be granted a patent for the invention disclosed in the accompanying standard complete specification.

[70,71] Applicant(s)/Nominated Person(s):

Sensormatic Electronics Corporation, incorporated in Delaware, of 500 Northwest 12th Avenue, Deerfield Beach, Florida, 33442-1795, UNITED STATES OF AMERICA

[54] Invention Title:

Magnetomechanical Eas Components Integrated with a Retail Product or Product Packaging

[72] Inventor(s):

Stephen Winkler, Hans Witzky and Alan Willard

[74] Address for service in Australia:

Spruson & Ferguson, Patent Attorneys
Level 33 St Martins Tower
31 Market Street
Sydney New South Wales Australia (Code **SF**)

Details of Basic Application(s):

[31] Appl'n No(s):	[33] Country:	[32] Application Date:
314,087	US	28 September 1994

DATED this TWENTY SECOND day of SEPTEMBER 1995

Sensormatic Electronics Corporation

By:

Registered Patent Attorney

IRN: 306033

INSTR CODE: 60883

S 059646 220995

5845

C4-287 Australia

Australia
Patents Act 1990
NOTICE OF ENTITLEMENT

I, Walter A. Engdahl, Esq., Vice President - Corporate Counsel of Sensormatic Electronics Corporation , 500 Northwest 12th Avenue, Deerfield Beach, Florida 33442-1795, United States of America, being authorized by the Applicant/Nominated Person in respect of an application entitled MAGNETOMECHANICAL EAS COMPONENTS INTEGRATED WITH A RETAIL PRODUCT OR PRODUCT PACKAGING, state the following:

The Applicant/Nominated Person has entitlement from the actual inventors as follows:

The Applicant/Nominated Person is the assignee of the actual inventors.

The Applicant/Nominated Person is entitled to rely on the basic application listed on the Patent Request as follows:

The Applicant/Nominated Person is the assignee of the basic applicants.

The basic application listed on the Patent Request is the application first made in a Convention country in respect of the invention.

DATED this 26th day of May, 1995.

Walter A. Engdahl, Esq.
Vice President - Corporate Counsel

AU9532823

(12) PATENT ABRIDGMENT (11) Document No. AU-B-32823/95
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 696579

(54) Title
MAGNETOMECHANICAL EAS COMPONENTS INTEGRATED WITH A RETAIL PRODUCT OR PRODUCT PACKAGING

(51)[6] International Patent Classification(s)
G01V 015/00 G01V 003/08 G08B 013/24 G09F 003/02
G09F 003/03 H04B 001/59

(21) Application No. : 32823/95 (22) Application Date : 22.09.95

(30) Priority Data

(31) Number	(32) Date	(33) Country
314087	28.09.94	US UNITED STATES OF AMERICA

(43) Publication Date : 18.04.96

(44) Publication Date of Accepted Application : 17.09.98

(71) Applicant(s)
SENSORMATIC ELECTRONICS CORPORATION

(72) Inventor(s)
STEPHEN WINKLER; HANS WITZKY; ALAN WILLARD

(74) Attorney or Agent
SPRUSON & FERGUSON , GPO Box 3898, SYDNEY NSW 2001

(56) Prior Art Documents
US 5218342
EP 0214440
US 4510489

(57) Claim

1. A method of protecting an inventory of goods from theft, comprising the steps of:

a) forming at least some items of said inventory such that each of said at least some items has a member having a cavity integrally formed in said member;

b) housing a respective magnetostrictive element in each said cavity;

c) providing a respective biasing element located adjacent to and outside of each said cavity, said biasing element for providing a magnetic field to bias the respective magnetostrictive element in each said cavity;

d) generating an alternating electromagnetic field at a selected frequency, said biased magnetostrictive element being mechanically resonant when exposed to said alternating electromagnetic field; and

e) detecting said mechanical resonance of said magnetostrictive element;

each said cavity being sized and shaped to house the respective magnetostrictive element without constraining the mechanical resonance of the magnetostrictive element.

.../2

19. A magnetomechanical electronic article surveillance system for protecting an inventory of goods from theft, comprising:

(a) generating means for generating a magnetic field alternating at a selected frequency in an interrogation zone;

(b) an item of said inventory of goods, said item including a member having a cavity formed integrally in said member, a magnetostrictive element housed in said cavity, and a biasing element located adjacent to and outside of said cavity, said biasing element being magnetically biased to cause said magnetostrictive element to be mechanically resonant when exposed to said alternating field, said cavity being sized and shaped to house said magnetostrictive element without constraining said mechanical resonance of said magnetostrictive element; and

(c) detecting means for detecting said mechanical resonance of said magnetostrictive element.

23. A magnetomechanical marker integrated with an article of merchandise to be protected by an electronic article surveillance system, comprising:

(a) a member of said article having a cavity integrally formed in said member;

(b) a magnetostrictive element housed in said cavity; and

(c) a biasing element located adjacent to and outside of said cavity, said biasing element, when magnetically biased, for causing said magnetostrictive element to be mechanically resonant when exposed to an alternating electromagnetic field generated at a selected frequency by said electronic article surveillance system;

said cavity being sized and shaped to house said magnetostrictive element without constraining said mechanical resonance of said magnetostrictive element.

S & F Ref: 306033

AUSTRALIA

PATENTS ACT 1990

COMPLETE SPECIFICATION

FOR A STANDARD PATENT

ORIGINAL

Name and Address of Applicant: Sensormatic Electronics Corporation
500 Northwest 12th Avenue
Deerfield Beach Florida 33442-1795
UNITED STATES OF AMERICA

Actual Inventor(s): Stephen Winkler, Hans Witzky and Alan Willard

Address for Service: Spruson & Ferguson, Patent Attorneys
Level 33 St Martins Tower, 31 Market Street
Sydney, New South Wales, 2000, Australia

Invention Title: Magnetomechanical Eas Components Integrated with a Retail Product or Product Packaging

The following statement is a full description of this invention, including the best metnod of performing it known to me/us:-

FIELD OF THE INVENTION

This invention relates to electronic article surveillance (EAS) systems, and particularly to EAS systems which operate by detecting mechanical resonance of magnetostrictive elements.

BACKGROUND OF THE INVENTION

It is well known to provide electronic article surveillance systems to prevent or deter theft of merchandise from retail establishments. In a typical system, markers designed to interact with an electromagnetic or magnetic field placed at the store exit are secured to articles of merchandise. If a marker is brought into the field or "interrogation" zone, the presence of the marker is detected and an alarm is generated. Some markers of this type are intended to be removed at the checkout counter upon payment of the merchandise. Other types of markers are deactivated upon checkout by a deactivation device which changes an electromagnetic or magnetic characteristic of the marker so that the marker will no longer be detectable at the interrogation zone.

It is a common practice for the presence of the marker to be detected in the interrogation zone by detecting a signal reradiated by the marker in response to the field present in the interrogation zone. For example, U.S. Patent No. 4,063,229 issued to Welsh et al., discloses

several types of markers which generate harmonic signals in response to an alternating field provided in the interrogation zone. The Welsh et al. patent suggests that such markers may be integrated with a price label adhesively attached to an article of merchandise or that one or more markers may be imbedded or incorporated in the packaging for the article or in the article itself.

Other types of harmonic EAS systems are based on markers which include a thin strip or wire of magnetic material that responds to an alternating interrogation signal by generating a signal pulse that is rich in high harmonics of the interrogation signal. Such markers are disclosed in U.S. Pat. No. 4,660,025 to Humphrey and U.S. Pat. No. 4,980,670 to Humphrey et al.

Another type of EAS system employs magnetomechanical markers that include a magnetostrictive element. For example, U.S. Patent No. 4,510,489, issued to Anderson et al., discloses a marker formed of a ribbon-shaped length of a magnetostrictive amorphous material contained within a hollow recess in an elongated housing in proximity to a biasing magnetic element. The magnetostrictive element is fabricated such that it is mechanically resonant at a predetermined frequency when the biasing element has been magnetized to a certain level. At the interrogation zone, a suitable oscillator provides an AC magnetic field at the predetermined frequency, and the magnetostrictive element

mechanically resonates at this frequency upon exposure to the field when the biasing element has been magnetized to the aforementioned level. The resulting signal radiated by the magnetostrictive element is detected by detecting circuitry provided at the interrogation zone. The Anderson et al. patent points out the need to form the housing for the marker so that the mechanical resonance of the magnetostrictive element is not mechanically damped. Anderson et al. also teach that the marker should be formed so that the biasing magnet does not mechanically interfere with the vibration of the magnetostrictive element. The disclosure of the Anderson et al. '489 patent is incorporated herein by reference.

EAS systems which use magnetomechanical markers have proved to be very effective and are in widespread use. Systems of this type are sold by the assignee of this application under the brand name "Ultra*Max". In operating such systems, it is customary to attach magnetostrictive markers to the items of merchandise at retail stores which maintain equipment for generating the field for the interrogation zone. The attachment of the markers to the items of merchandise is typically carried out by means of a pressure sensitive adhesive layer provided on the marker, or, when the marker is intended to be removable, by a mechanical clamping device or the like. One example of such a device is disclosed in Patent No. 5,031,756, issued

to Buzzard et al., which is directed to a "keeper" which may be utilized in a retail store. The keeper includes a frame for holding a compact disk or similar item, and the compact disk may be locked within the frame to prevent removal of the compact disk from the keeper until the compact disk is paid for at a checkout counter. The keeper disclosed by Buzzard et al. includes an EAS marker which may be a magnetomechanical marker of the type described in the Anderson et al. patent.

In order to improve the efficiency of operation of retail establishments, it has been proposed that EAS markers, including magnetomechanical markers, be applied to the items of merchandise before shipment to the retail establishment. For example, it has been proposed that markers be attached to the goods by manufacturers thereof. This practice has been called "source tagging," which means that an EAS marker or "tag" is applied to goods at the source of the goods. While conventional techniques for attaching markers to goods, which include attaching markers to goods by means of adhesives, have been proposed for use by manufacturers, it would be desirable to provide still more efficient techniques for "source tagging" goods that will ultimately be subject to electronic article surveillance at a retail establishment. Although the Welsh et al. patent suggests that certain kinds of harmonic signal generating markers could be physically embedded in

a product or product packaging, that patent is not concerned with the type of marker used in magnetomechanical EAS systems and does not address how the elements making up such a marker could be embedded in a product without constraining the mechanical resonance of the magnetostrictive element and thereby preventing the marker from operating.

The following U.S. patents also propose incorporation of marker elements within an article to be subjected to electronic surveillance:

No. 3,665,449 to Elder et al., which discloses embedding a ferromagnetic strip in a library book.

No. 4,151,405 to Peterson, which discloses embedding ferromagnetic strips in plastic, paper, wood, aluminum, stainless steel, etc.

No. 4,626,311 to Taylor, which discloses embedding marker elements in a thermoplastic holder which is then fused within a garment.

No. 4,686,154 to Mejia, which discloses concealing a tag within a seam or lining of an article of clothing.

No. 4,835,028 to Dey et al., which discloses a magnetostrictive wire embedded in paper.

However, like the Welsh et al. patent, none of these patents is concerned with magnetomechanical markers and none teaches how the elements of such markers could be

embedded in a product without constraining the mechanical resonance of the magnetostrictive element.

Moreover, the prior art also fails to teach how to embed in a product magnetic elements like those disclosed in the above-referenced Humphrey and Humphrey et al. patents. U.S. Patent No. 4,342,904 proposes a marker structure that includes release sheets surrounding the ferromagnetic material within the marker structure to prevent or minimize transfer of stresses to the ferromagnetic material, because such stresses tend to "cold work" the ferromagnetic material and degrade its magnetic properties. Similarly, it is known to apply a lubricant to the type of magnetic material disclosed in the Humphrey '025 patent before forming a marker by laminating flexible sheets around the material. The lubricant prevents stress from being applied from the surrounding sheets to the magnetic material when the marker including the magnetic material is applied to a product. However, it has not heretofore been recognized that embedding the Humphrey or Humphrey et al. material in a product would also tend to produce stresses on the material that would degrade its performance.

OBJECTS AND SUMMARY OF THE INVENTION

It is accordingly a primary object of the invention to provide a technique for efficiently source tagging articles

of merchandise that are to be protected by a magnetomechanical EAS system. It is a further object to incorporate active components of a magnetomechanical EAS marker in an item of merchandise or in the packaging for an item of merchandise.

According to an aspect of the present invention, there is provided a method of protecting an inventory of goods from theft, including the steps of

forming at least some items of the inventory such that each of those items has a substantially rigid structural member having a cavity integrally formed in the member,

housing a respective magnetostrictive element in each of the cavities,

providing a respective biasing element located adjacent to an outside of each of the cavities, with the biasing element providing a magnetic field to bias the respective magnetostrictive element in the cavity,

generating an alternating electromagnetic field at a selected frequency, with the biased magnetostrictive element being mechanically resonant when exposed to the alternating electromagnetic field, and

detecting the mechanical resonance of the magnetostrictive element.

According to another aspect of the present invention there is provided a method of manufacturing an article to be sold in a retail store, comprising the steps of:

a) forming a member of the article so that a cavity is integrally provided in said member;

b) housing a magnetostrictive element in said cavity; and

c) providing a biasing element located adjacent to and outside of said cavity, said biasing element, when magnetically biased, for causing said magnetostrictive element to be mechanically resonant when exposed to an alternating electromagnetic field generated at a selected frequency by an electronic article surveillance system;

said cavity being shaped and sized to house said magnetostrictive element without constraining said mechanical resonance of said magnetostrictive element.

According to still another aspect of the present invention there is provided an article of merchandise to be protected from theft, the article comprising a member having a cavity formed integrally ins aid member, a magnetostrictive element housed in said cavity, and a biasing element located adjacent to and outside of said cavity, said biasing element, when magnetically biased, for causing said magnetostrictive element to be mechanically resonant when exposed to an alternating electromagnetic field generated at a selected frequency by an electronic article surveillance system, said cavity being sized and shaped to house said magnetostrictive element without constraining said mechanical resonance of said magnetostrictive element.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of an article of merchandise having magnetomechanical electronic article surveillance elements integrated therein in accordance with an embodiment of the invention.

FIG. 2 is an exploded view of a portion of the article of FIG. 1 showing how the EAS elements are integrated in the article of merchandise.

FIG. 3 is a sectional view, taken along the line III-III of FIG. 2, schematically illustrating a process for integrating the EAS elements into the article of FIG. 1.

FIG. 4 is a sectional view, similar to FIG. 3 but showing the EAS elements after integration into the article of merchandise.

FIG. 5 is a perspective view of an article of merchandise packed in shipping carton with use of a packing fixture which has magnetomechanical EAS elements integrated in the fixture in accordance with an embodiment of the invention.

FIG. 6 is a sectional view taken at line VI-VI of FIG. 5 showing additional details of the packing fixture having EAS elements integrated therein.

FIG. 7 is perspective view of a shipping carton having magnetomechanical EAS elements integrated therein in accordance with an embodiment of the invention.

FIG. 8 is a schematic block diagram of an electronic article surveillance system used in conjunction with the

integrated article of merchandise and magnetomechanical EAS marker of FIG. 1.

FIG. 9 is a perspective view, partially broken away, of a portion of an article of merchandise having a magnetic wire embedded therein in accordance with another embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A first embodiment of the invention will now be described with reference to FIGS. 1-4. In FIG. 1, reference numeral 10 generally indicates an article of merchandise (in particular, an electronic consumer appliance) having an integrated magnetomechanical EAS marker portion 12. As best seen in FIG. 2, the article 10 includes a substantially rigid housing 14 in the shape of a box defining a cavity 16 which contains functional components of the article 10 such as a circuit board 18. The housing is formed of a non-magnetic material such as molded plastic.

Another, smaller cavity 20 is integrally formed in a top wall 22 of the housing 14. As seen from FIGS. 2-4, the cavity 20 is shaped and sized to accommodate therein a magnetostrictive element 24. The element 24 may be of the same shape and size as magnetostrictive elements used in conventional stand-alone magnetomechanical markers and may be formed of a conventional material such as the amorphous

metal alloy known as Metglas® 2826 MB or any other suitable magnetostrictive material.

As somewhat schematically illustrated in FIG. 3, after the element 24 is placed in the cavity 20, the cavity is closed by affixing a sealing member 26 on the outer surface of the wall 22 in a position such that the sealing member 26 overlies the opening of the cavity 20. Like the housing 14, the sealing member 26 should be non-metallic and may be formed, for example, of plastic or paper.

The assembly of the integrated marker portion 12 of the article 10 is completed by mounting a biasing element 28 in a position adjacent to the cavity 20 and the magnetostrictive element 24 housed in the cavity 20. For example, as suggested by FIG. 3, the biasing element 28 may be mounted (by an adhesive, for example) to an outer surface of the sealing member 26. This may be done either before or after the sealing member is affixed to wall 22 of housing 14.

FIGS. 2-4 show the biasing element 28 in the form of a strip of magnetic material which has a higher coercivity than the magnetostrictive element 24, and which is of the type provided in conventional free-standing magnetomechanical markers. However, according to an alternative embodiment of the invention, the biasing element 28 may be formed as a layer of magnetic ink,

printed on the outer surface of the sealing member 26 or at another suitable location adjacent to the cavity 20. Alternatively, the biasing element 28 may be formed as a suitable layer of material provided by processes such as vapor deposition, electro-deposition or sputtering. Again, the layer constituting the biasing element 28 may be formed on the sealing member 26 either before or after attachment of the sealing member 26 to the wall 22 of housing 14.

As is the case with free-standing markers, magnetization of the biasing element 28 to provide the necessary biasing field may be performed either before or after assembly of the components 24 and 28 into the integrated marker portion 12 of the article 10.

It will be recognized that the sealing member 26, in addition to retaining the magnetostrictive element 24 in the cavity 20, also serves as a spacer between the magnetostrictive element 24 and the biasing element 28, so that the biasing element 28, when magnetized, does not "clamp" the magnetostrictive element 24 and thereby prevent the magnetostrictive element 24 from exhibiting the desired mechanical resonance upon exposure to an interrogation field.

FIG. 4 illustrates the integrated marker portion 12 in its final assembled form. It should be noted that in the drawing the thickness of the elements 24, 26, and 28 has been exaggerated for clarity of illustration. In actual

practice, the magnetostrictive element 24, the sealing member 26 and the biasing element 28 may all be made quite thin, particularly if the biasing element is formed of magnetic ink, so that the integrated marker portion 12 is nearly flush with the upper surface of the housing 14. The cavity 20 is dimensioned so that the magnetostrictive element 28 can exhibit mechanical resonance upon exposure to a suitable interrogation field without being constrained by the walls of the cavity 20.

It will be appreciated that an integrated marker portion 12 as illustrated in FIGS. 3 and 4 can be incorporated in many types of articles of merchandise besides electronic appliances. It is also possible to integrate the marker portion 12 within a structural element of an article of merchandise other than the housing of the article. By way of example, an integrated marker portion could be included in the handle of a hand tool, in the protective case of a recording medium such as a compact disk or a magnetic tape, or in the carrying strap of an article of luggage.

Activation and deactivation of the integrated marker portion 12 can be performed according to conventional techniques. For example, deactivation may be carried out by placing the article 10, or at least the integrated marker portion 12 thereof, within a magnetic field provided for degaussing the biasing element 28.

According to other embodiments of the invention, one or more integrated marker portions 12 may be provided in packing materials provided for protecting an article of merchandise from damage during shipment. For example, as shown in FIG. 5, an integrated marker portion 12 is provided in a packing fixture 30, in the form of a molded plastic foam block which is used in cooperation with a second foam block packing fixture 35 to securely nest an article of merchandise 32 in the interior 33 of a packing carton 34. As best seen in FIG. 6, the packing fixture 30 includes an inner portion 36 which is formed to fit the contour of the article 32 and an outer portion 38 formed to fit the carton 34. The integrated marker portion 12 of the packing fixture 30 may be the same as the marker portion illustrated in FIGS. 4 and 5 and discussed above. Alternatively, for example, parallel deep narrow slots may be provided extending into the body of packing fixture 30 for accommodating therein the magnetostrictive element 24 and the biasing element 28.

It should be understood that the size and shape of the packing fixture 30 having the integrated magnetomechanical EAS marker is subject to variation depending on the respective sizes and shapes of the packing carton and the article of merchandise to be nested in the carton. For example, rather than using a pair of cooperating fixtures as shown in FIG. 5, there may be provided only a single

fixture 30 (with an integrated marker portion 12), shaped to have the article of merchandise nested in the fixture 30. It should also be recognized that the fixture 30 may be formed of other suitable materials, such as cardboard, instead of plastic foam.

According to another embodiment of the invention, as shown in FIG. 7, a packing carton 34' is provided with an integrated marker portion 12 like that shown in FIGS. 3 and 4. Like the carton 34 of FIG. 5, it will be recognized that the carton 34' includes walls which define a large cavity 33 (FIG. 5, not shown in FIG. 7), for enclosing an article of merchandise 32 for shipment within the carton 34'. As before, the integrated marker portion 12 includes a small cavity 20 (FIGS. 3 and 4, not shown in FIG. 7) shaped and sized to accommodate a magnetostrictive element 24 without constraining mechanical resonance of the magnetostrictive element. It is to be appreciated that integration of magnetostrictive EAS marker elements into a product or product packaging, as disclosed above, relieves the retailer from the labor-intensive task of applying stand-alone markers to an inventory of goods, and that the formation of the cavity for the magnetostrictive element and the installation of the marker components in the product or product wrapping can be efficiently incorporated in the manufacturing process.

FIG. 8 illustrates a magnetomechanical system used for

detecting unauthorized passage through an interrogation zone of an article of merchandise that has an integrated marker portion or that is wrapped in a wrapping structure or with a packing fixture having an integrated marker portion.

The system shown in FIG. 8 includes a synchronizing circuit 200 which controls the operation of an energizing circuit 201 and a receiving circuit 202. The synchronizing circuit 200 sends a synchronizing gate pulse to the energizing circuit 201, and the synchronizing gate pulse activates the energizing circuit 201. Upon being activated, the energizing circuit 201 generates and sends an interrogation signal to interrogating coil 206 for the duration of the synchronizing pulse. In response to the interrogation signal, the interrogating coil 206 generates an interrogating magnetic field, which, in turn, excites the integrated marker portion 12 of the article of merchandise 10 into mechanical resonance.

Upon completion of the pulsed interrogating signal, the synchronizing signal 200 sends a gate pulse to the receiver circuit 202, and the latter gate pulse activates the circuit 202. During the period that the circuit 202 is activated, and if an active marker is present in the interrogating magnetic field, such marker will generate in the receiver coil 207, a signal at the frequency of mechanical resonance of the marker. This signal is sensed

by the receiver 202, which responds to the sensed signal by generating a signal to an indicator 203 to generate an alarm or the like. In short, the receiver circuit 202 is synchronized with the energizing circuit 201 so that the receiver circuit 202 is only active during quiet periods between the pulses of the pulsed interrogation field.

Although FIG. 8 illustrates use of the integrated article of merchandise and EAS marker in connection with a pulsed-interrogation type of magnetomechanical EAS system, it is also contemplated to use such integrated article of merchandise and marker with a swept-frequency magnetomechanical system like that disclosed in the above-referenced patent no. 4,510,489, or any other system designed to operate with magnetomechanical markers.

Another embodiment of the invention provides an integrated article of merchandise and EAS marker suitable for surveillance by a harmonic EAS system. This embodiment may be like the embodiment described above in connection with FIGS. 1-4 with the following differences: (a) no biasing element 28 heeds to be provided, and (b) the magnetostrictive element 24 is replaced by a magnetic wire or strip of a type disclosed in the Humphrey 4,660,025 or the Humphrey et al. 4,980,670 patents referred to above. Also, the cavity 20 in this embodiment is shaped and sized so that the magnetic wire or strip is permitted to move within the cavity. It is to be noted that such a cavity

serves to prevent or limit transfer of mechanical stress from the housing 14 to the magnetic wire or strip. Accordingly, the magnetic wire or strip does not suffer the degradation of its magnetic properties that would occur if the wire or strip were simply embedded in the housing 14.

It will be recognized that variations of this embodiment may be provided in which the magnetic wire or strip is integrated with a packing fixture like that of FIGS. 5 and 6, or in a packing carton like that shown in FIG. 7.

Another embodiment of the invention is illustrated in FIG. 9. According to this embodiment, a magnetic wire 40 (of the Humphrey or Humphrey et al. type, for example) is directly embedded in the housing 14' of an article 10'. For example, the housing 14' may be of plastic and formed by molding around the wire 40. A lubricant coating 42, including silicone for example, is applied to the wire 40 before it is embedded in the housing 14'. The coating 42 serves to eliminate or limit mechanical stress that would otherwise be applied to the wire 42 during the process of molding the housing 14'. Again, this embodiment may be varied by embedding a lubricant-coated wire in a packing fixture or shipping carton, for example.

Up to this point there have been described theft-deterrence or theft-detection uses of articles of merchandise, wrapping structures, and so forth having EAS

components integrated therein. However, other uses of such items are also contemplated. For example, the presence of an integrated marker portion or an embedded marker element in an article of merchandise may be detected to verify the authenticity of the article of merchandise.

More specifically, it is not uncommon for certain kinds of merchandise, such as compact discs or magnetic tapes, to be "pirated," i.e., duplicated by unauthorized persons and packaged so as to resemble authorized copies of musical or audio-visual works. The pirated CDs or tapes may then be distributed through normal retail channels, often without the knowledge of legitimate retail establishments that would not knowingly sell pirated goods.

In order to prevent or deter distribution of pirated goods through legitimate channels, sales of magnetic and magnetomechanical EAS components can be limited to legitimate manufacturers who embed or incorporate the components in, e.g., the protective cases of CDs or magnetic tapes. Retailers can then verify the authenticity of the goods by detecting the presence of the integrated or embedded EAS components in the goods. For this purpose, a suitable detection system, similar to a conventional EAS system, may be provided at the stock room or on the shipping dock. Alternatively, the presence of the EAS components may simply be detected by visual inspection in

cases where the EAS components are integrated at visually accessible portions of the goods.

Various other changes in the foregoing articles and modifications in the described practices may be introduced without departing from the invention. The particularly preferred embodiments of the invention are thus intended in an illustrative and not limiting sense. The true spirit and scope of the invention is set forth in the following claims.

The claims defining the invention are as follows:

1. A method of protecting an inventory of goods from theft, comprising the steps of:

a) forming at least some items of said inventory such that each of said at least some items has a member having a cavity integrally formed in said member;

b) housing a respective magnetostrictive element in each said cavity;

c) providing a respective biasing element located adjacent to and outside of each said cavity, said biasing element for providing a magnetic field to bias the respective magnetostrictive element in each said cavity;

d) generating an alternating electromagnetic field at a selected frequency, said biased magnetostrictive element being mechanically resonant when exposed to said alternating electromagnetic field; and

e) detecting said mechanical resonance of said magnetostrictive element;

each said cavity being sized and shaped to house the respective magnetostrictive element without constraining the mechanical resonance of the magnetostrictive element.

2. A method according to claim 1, wherein said step of providing the respective biasing element includes printing magnetic ink adjacent the respective cavity.

3. A method according to claim 1, wherein the respective member of one of said items is a housing for defining a second cavity which encloses functional components of said one of said items.

4. A method according to claim 1, further comprising the step of sealing each said cavity with a respective sealing member after housing said respective magnetostrictive element in said cavity.

5. A method according to claim 4, wherein said step of providing said respective biasing element includes affixing said respective biasing element to an outer surface of said respective sealing member.

6. A method according to claim 4, wherein said step of providing said respective biasing element includes forming a magnetic layer on an outer surface of said respective sealing member and magnetically biasing said magnetic layer.

7. A method according to claim 6, wherein said forming of said magnetic layer on said outer surface of said sealing member includes a process selected from the group consisting of printing with magnetic ink, vapor deposition, electro-deposition, and sputtering.

8. A method of manufacturing an article to be sold in a retail store, comprising the steps of:

(a) forming a member of the article so that a cavity is integrally provided in said member;

Magnetomechanical EAS Components Integrated with a Retail Product or Product Packaging

Abstract

An inventory of goods is protected from theft by means of electronic article surveillance (EAS) markers (12) integrated with items (10) of the inventory. Each such item (12) has a structural member (14) in which a cavity (16) is integrally formed. A respective magnetostrictive element (24) is housed, free of mechanically clamping constraint, in each cavity (16). A respective biasing element (23) is located adjacent to the cavity (16) on each such item (10) of inventory. The biasing element (28) provides a magnetic field to bias the respective magnetostrictive element (24). EAS equipment is provided at a retail store where the inventory is maintained. The EAS equipment generates an alternating electromagnetic interrogation field, and when an item (10) of inventory having the intergrated EAS marker (12) is exposed to the interrogation field, the biased magnetostrictive element (24) is excited into mechanical resonance that is detected by the EAS equipment. Alternatively, the integrated EAS marker (12) includes a magnetic element (40) that provides a harmonic signal in response to the interrogation field, and a lubricant coating (42) is provided on the magnetic element (40) to prevent transmission of mechanical stress to the magnetic element (40).

32823/95

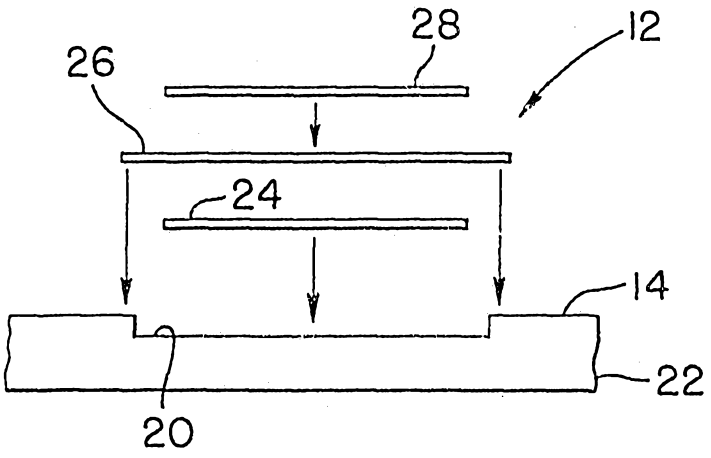

FIG. 3

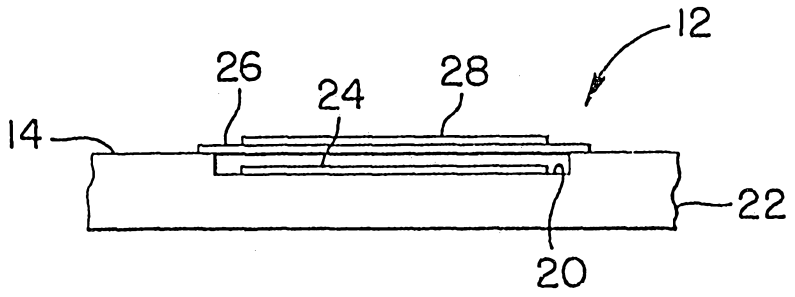

FIG. 4

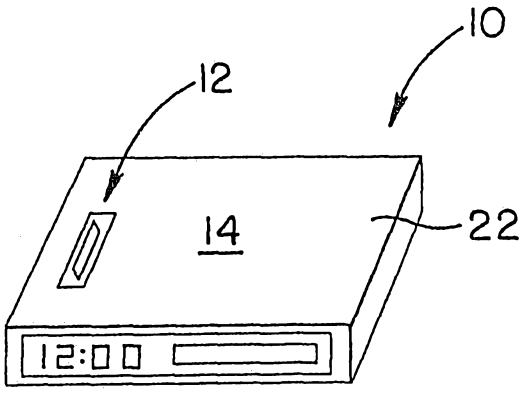

FIG. 1

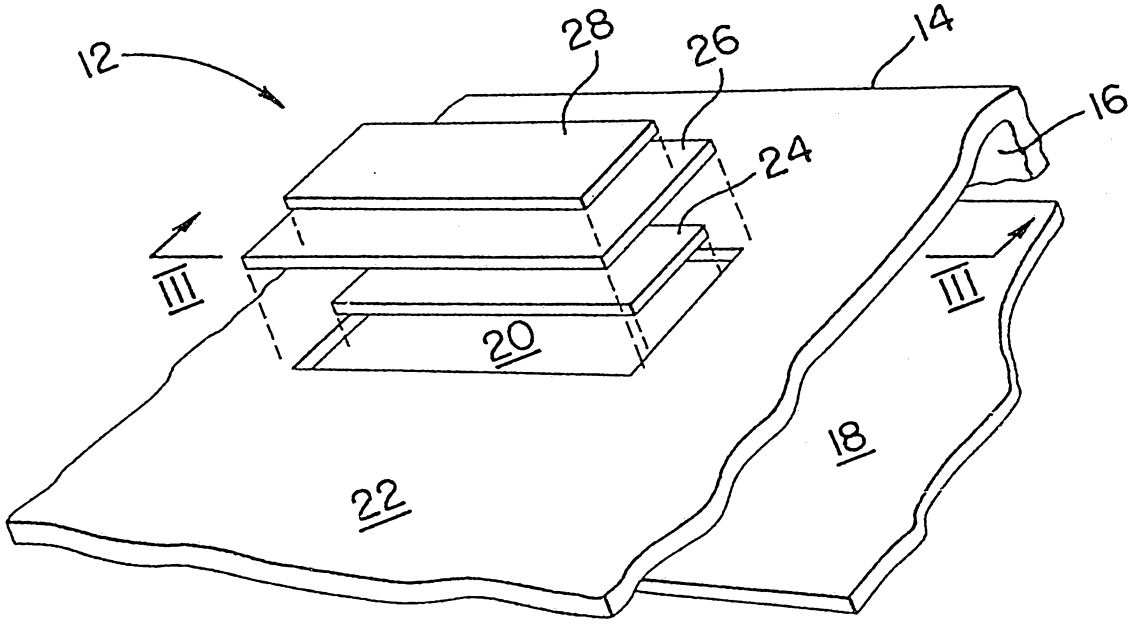

FIG. 2

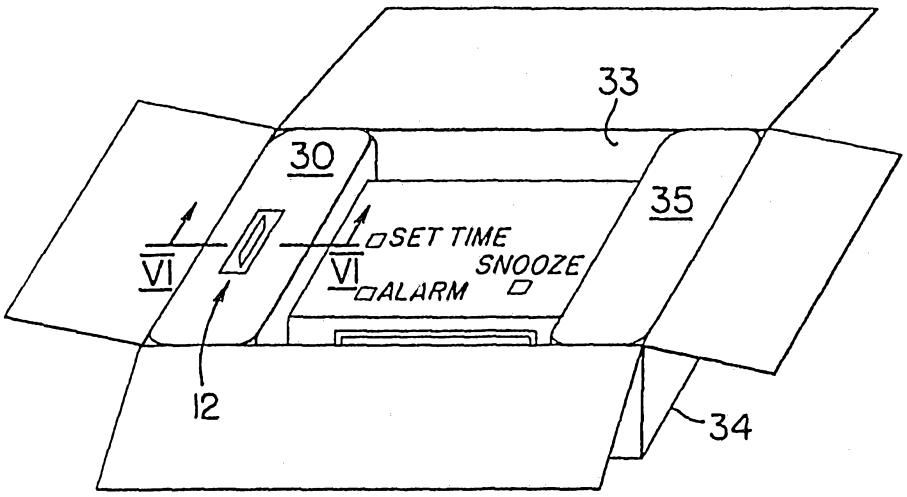

FIG. 5

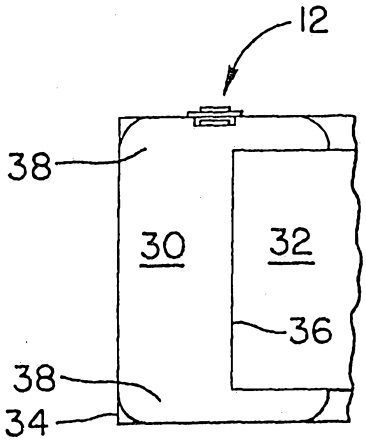

FIG. 6

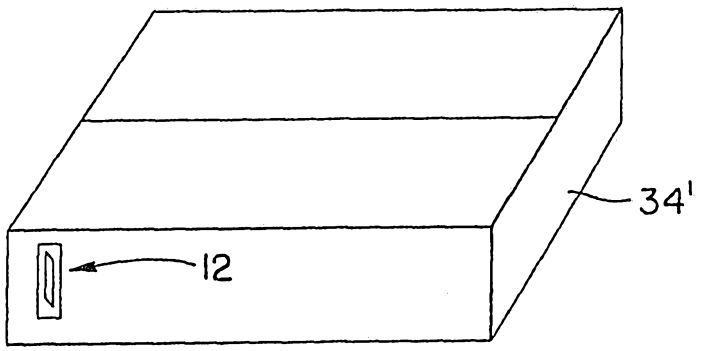

FIG. 7

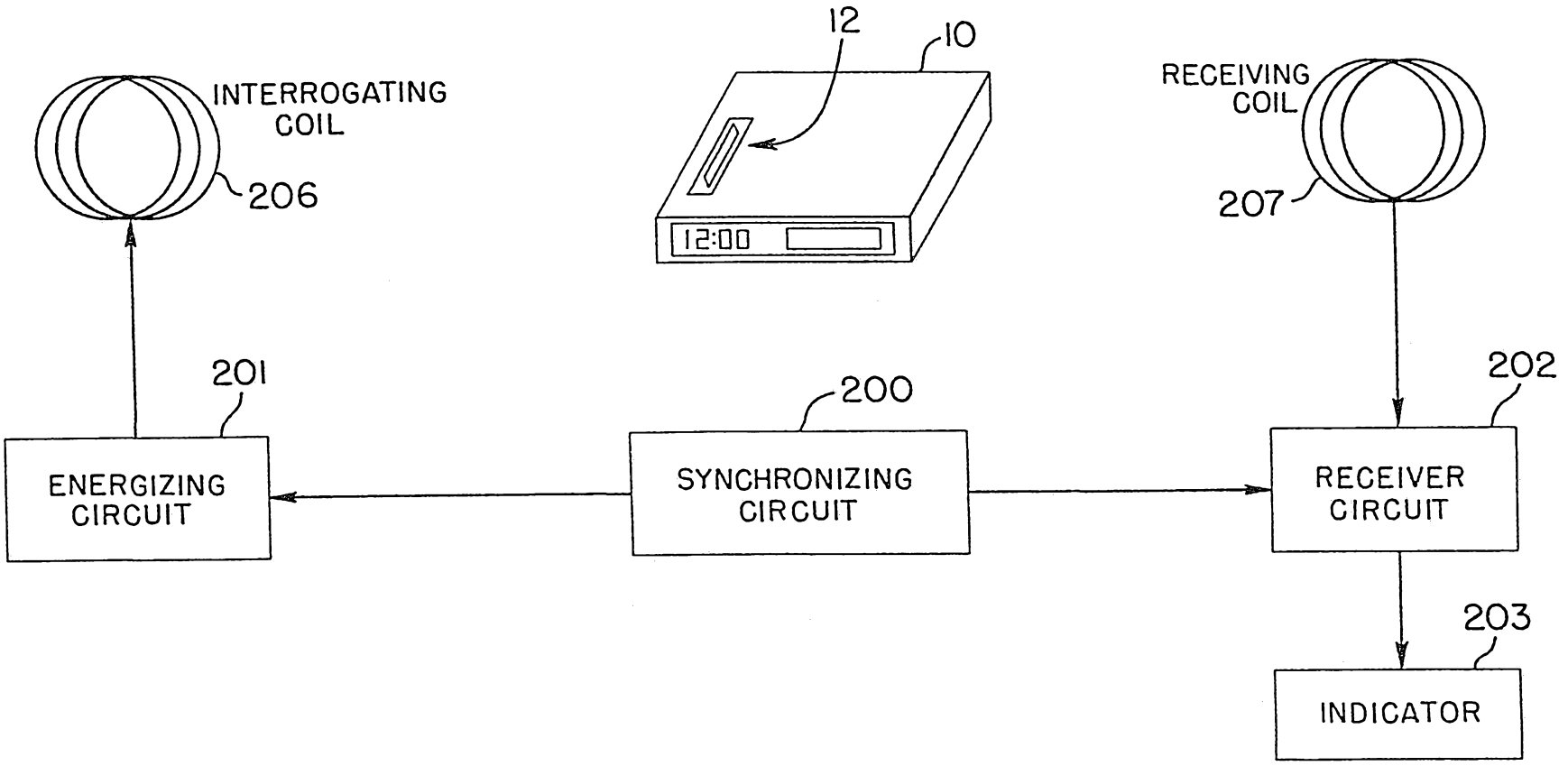
12
10
INTERROGATING COIL
206
RECEIVING COIL
207
12:00
201
200
202
ENERGIZING CIRCUIT
SYNCHRONIZING CIRCUIT
RECEIVER CIRCUIT
203
INDICATOR

FIG. 8

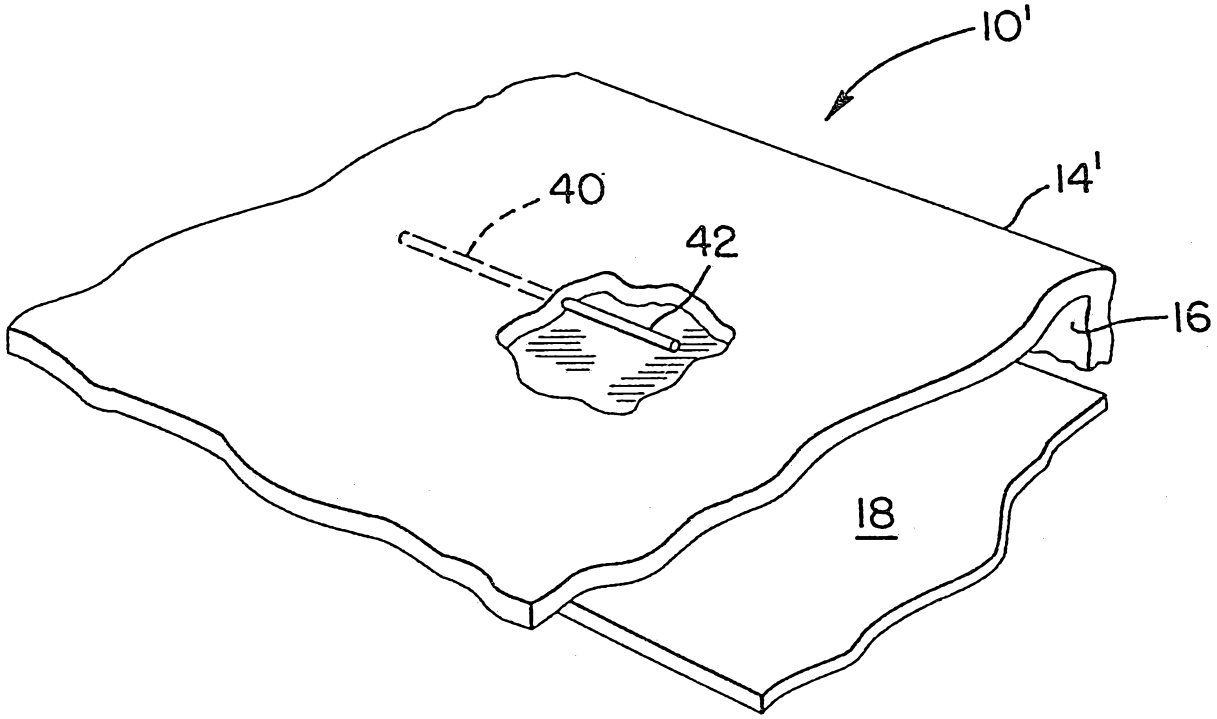

FIG. 9