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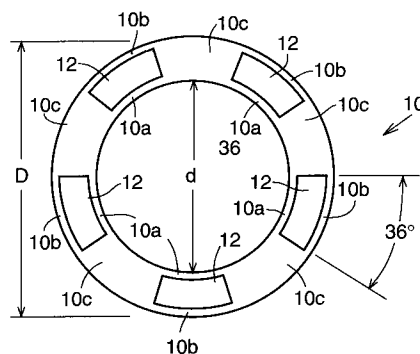
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BE DE DK FR GB IT NL SE(71) Applicant: **KNOGO CORPORATION**
350 Wireless Boulevard
Hauppauge New York 11788-3907 (US)(72) Inventor: **Zhou, Peter Y.**
49 Grandview Lane,
Smithtown, New York 117867 (US)
Inventor: **Solaski, Thomas P.**
19, Walnut street,
Ceniereuch, New York, 11720 (US)
Inventor: **Donaldson, Dennis P.**
28, North Lane
Huntington, New York 11743 (US)(74) Representative: **Schmidt-Evers, Jürgen,**
Dipl.-Ing. et al
Patentanwälte Mitscherlich & Partner,
Sonnenstrasse 33
D-80331 München (DE)(54) **Multidirectional surveillance marker.**

(57) A marker (10) to be used in article surveillance systems of the type which employ alternating magnetic interrogating fields. The marker comprises a closed loop band of material having high magnetic permeability and low magnetic coercivity; and it has cutouts (12) distributed along its length to form thin strips (10a,10b) of the marker material to increase the effective length to cross section ratio.

FIG. 1**EP 0 628 936 A1**

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to markers or targets for electronic article surveillance and more particularly it concerns a novel magnetically saturable marker characterized by a multidirectional sensitivity.

Description of the Related Art

United States Patents No. 3,820,103, No. 3,820,104 and No. 3,665,449 describe magnetically saturable markers for use in electromagnetic type surveillance systems. These systems are generally used to reduce theft by shoplifting but they are also used to detect the unauthorized movement of articles in other environments. The markers shown in these patents are elongated strips of magnetically soft material having a high magnetic permeability and a low magnetic coercivity. When exposed to an alternating magnetic field in an interrogation region, for example, the exit from a store, these targets or markers become magnetically saturated in opposite directions during each cycle of the alternating magnetic interrogation field. As a result they disturb the field in a characteristic manner to produce harmonics which can be detected.

These patents explain that the targets or markers should have the configuration of an elongated open strip with a high ratio of length to cross-sectional area for maximum sensitivity to the interrogating magnetic fields. When the ratio of length to the square root of cross sectional area is below 150, the magnetization reversal signal amplitude decreases radically and becomes noticeably dependent on orientation of the open strip within the magnetic field. It is also suggested in these patents that the open strip may have one or more major dimensions satisfying this criteria.

U.S. Patent No. 3,665,449 mentions the possibility of using a disc shaped marker but indicates that because of the low length to cross-section ratio such markers do not produce very large or distinctive response signals.

U.S. Patent No. 4,074,249 describes a crescent shaped target which is less sensitive to orientation than the straight elongated open strip markers.

U.S. Patent No. 4,075,618 describes thin elongated markers which have enlarged flux concentrators at the ends thereof to enable the markers to be shortened without reduction in their sensitivity. One problem that characterizes all prior art magnetically saturable markers for electronic article surveillance, is that the shape and size of the available space on the object to be protected by the marker often will not accommodate a thin elongated strip. Compact disc recordings, for example,

have only a small ring shaped region around a center opening that would allow for the placement of a marker. On the other hand, when the strips are shortened to fit into small areas, their sensitivity becomes highly dependent on their orientation relative to the interrogating magnetic field. This is a problem when the markers are used for theft detection because in that case, it is not possible to control their orientation when they are carried through an interrogation zone.

SUMMARY OF THE INVENTION

The present invention overcomes the above described problems of the prior art and makes possible the protection of articles which have minimal space for marker attachment. At the same time the invention reduces the dependency of the marker orientation on the direction of the magnetic interrogation field.

According to the present invention, there is provided an electronic surveillance marker which has multidirectional sensitivity and which comprises a band of material extending in a flat plane and formed in a closed loop. The material of this marker has magnetic properties of high permeability, low coercivity and ready magnetic saturability. Also, this band has a plurality of spaced apart cutout regions which form narrowed strips along the band. These narrowed strips increase the ratio of length to cross section of regions of the band and thereby allow the band to produce sharp responses when it is interrogated by an alternating magnetic field. The regions of the band between the cutouts provide an increased mass which cooperate with the strip regions to produce higher energy responses than could be obtained with the narrow strip portions by themselves. Because the band is formed in a closed loop, its orientation sensitivity relative to the interrogation field is less than that of an open loop strip shaped marker of the same length.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a plan view of a marker according to the present invention;

Fig 2 is a plan view showing a compact disc to which the marker of Fig. 1 is attached;

Fig. 3 is a plan view of an alternate form of marker according to the present invention; and

Fig. 4 is a plan view of a further alternate form of marker according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

An electronic article surveillance marker 10 according to the present invention, is a band in the shape of a flat ring and is made of sheet metal having special magnetic properties, namely, it has high magnetic permeability and low magnetic coercivity and is easily magnetically saturable. The marker 10 may be made of permalloy or material having magnetic properties similar to permalloy, such as amorphous magnetic material. A suitable material is described in U.S. Patent No. 5,146,204.

The marker 10 of Fig. 1 has a plurality of elongated cutouts 12 spaced apart along the length of the band. Each cutout is contained entirely within the band and thereby forms a pair of very thin narrowed segments 10a and 10b which are parallel to each other and which interconnect full width segments 10c. These cutouts 12 are preferably evenly distributed around the marker 10.

By way of example, the marker 10 has an inner diameter d of 16 millimeters and an outer diameter D of 22 millimeters. The width of the band which forms the ring is thus about three millimeters. Also, by way of example, the marker 10 has a thickness of about 15 microns. The cutouts 12 have a width of about two millimeters and they extend over an arc of about 36° . Thus the thin narrowed segments 10a and 10b each have a width of about 0.5 millimeters and a length of about six millimeters.

It has been found that a marker with the above described shape and dimensions and made of permalloy will produce good responses to a magnetic interrogating field in an electronic article surveillance system, with reduced dependence on orientation relative to the interrogating field. These good responses are due firstly, to the fact that the cutouts 12 produce very narrow lengths 10a and 10b in which the ratio of length to cross-sectional area is high, and secondly, to the fact that the regions 10c between the strips provide large masses which will provide regions for deactivation purpose. In addition, because the marker is formed in a closed loop and because the lengths 10a and 10b extend in different directions at different locations along the marker, the orientation sensitivity of the marker relative to the direction of the interrogating magnetic field is minimized.

The marker 10 is preferably made from a sheet of high permeability low coercivity readily magnetizable material which is then formed into the above described configuration by means of conventional photoetching techniques. Other techniques, such as mechanical stamping, may also be used.

Fig. 2 shows the marker 10 of Fig. 1 as attached to a compact disc 14. As can be seen, the marker fits just around the center opening 14b of the disc 14. Preferably the marker is laminated into the disc during manufacture thereof. In this way the marker cannot be easily removed. The marker may also have laminated thereunder or thereon, segments 16 of a relatively highcoercivity magnetic material which can be magnetized by an authorized person to desensitize the marker so that it will not produce responses upon being carried through a magnetic interrogation field.

Figs. 3 and 4 show alternative configurations of the marker of the present invention. As shown in Fig. 3, a marker 20 is formed of a closed loop band in the shape of a square while in Fig. 4 a marker 30 is formed of a closed loop band in the shape of a triangle. In each case the marker is provided with spaced apart cutouts 22 and 32. Each of these cutouts form two thin strips of target material 20a and 20b and 30a and 30b, respectively, which are interspersed with segment 20c and 30c of full width material. As can be seen, the different thin strips in each marker extend in different directions to minimize orientation sensitivity. It will be appreciated that other polygonal marker configurations may be used in accordance with the present invention.

It follows from the foregoing, that narrowed regions could be formed by lateral cutouts, which are located on the inner or outer, or both the inner and outer sides of the band.

Claims

1. An electronic surveillance marker having multidirectional sensitivity comprising a band (10) of material extending in a flat plane said material having magnetic properties of high permeability, low coercivity and being readily magnetically saturable, and characterized in that said band is formed in a closed loop, and in that said band has a plurality of spaced apart cutout regions (12) therealong which form narrowed lengths (10a, 10b) along said band.
2. An electronic surveillance marker according to claim 1, further characterized in that said marker is permalloy.
3. An electronic surveillance marker according to claim 1, further characterized in that said material is an amorphous metallic alloy.
4. An electronic surveillance marker according to anyone of claims 1-3, further characterized in that said band (10) is in the shape of a ring.

5. An electronic surveillance marker according to anyone of claims 1-4, further characterized in that said cutout regions (12) are each completely within the band (10) and wherein each cutout (12) forms two narrowed lengths (10a, 10b). 5
6. An electronic surveillance marker according to anyone of claims 1-5, further characterized in that said cutout regions (12) are elongated in the direction of the band (10). 10
7. An electronic surveillance marker according to anyone of claims 1-6, further characterized in that different cutout regions (12) are located in regions of the band (10) which extend in different directions from each other. 15
8. An electronic surveillance marker according to anyone of claims 1-7, further characterized in that said band (10) has a width of about three millimeters and a thickness of about fifteen microns. 20
9. An electronic surveillance marker according to claim 8, further characterized in that said cutouts (12) have a width of about two millimeters and a length of about six millimeters. 25
10. An electronic surveillance marker according to anyone of claims 1-9, further characterized in that each cutout (12) is centered in said band so as to define two narrowed regions (10a, 10b) on opposite sides thereof each having a width of about 0.5 millimeters. 30
35
11. An electronic surveillance marker according to anyone of claims 1 to 10, further characterized in that said band is in the shape of an polygon (20, 30). 40
12. An electronic surveillance marker according to anyone of claims 1 to 10, further characterized in that said band (10) is in the shape of a square (20). 45
13. An electronic surveillance marker according to anyone of claims 1 to 10, further characterized in that said band (10) is in the shape of a triangle (30). 50
14. An electronic surveillance marker comprising a band (10) of material extending in a flat plane, said material having properties of magnetic permeability, coercivity and saturability similar to those of permalloy or amorphous magnetic metal, characterized in that said band is in the shape of a ring (10) and has a plurality of 55
- elongated arcuate cutout regions (12) spaced therealong such that each cutout forms a pair of parallel narrow segments (10a, 10b) of said material along the length of said band, whereby said marker has multidirectional sensitivity.
15. In combination, an article of merchandise (14) having attached thereto an electronic surveillance marker comprising a band (10) of material extending in a flat plane and having magnetic properties of high permeability, low coercivity and being readily magnetically saturable, characterized in that said band (10) is formed in a closed loop and has a plurality of spaced apart cutout regions (12) therealong which form narrowed lengths (10a, 10b) along said band whereby said combination has multidirectional sensitivity.
16. A combination according to claim 15, further characterized in that said article of merchandise is a compact disc record (14).

FIG. 1

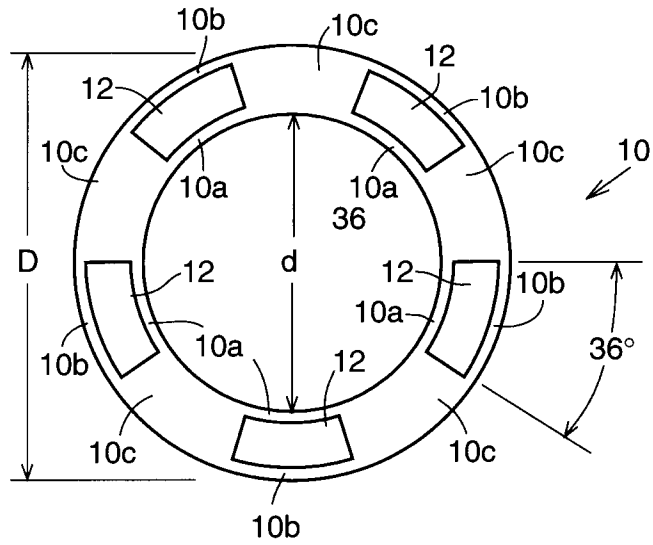


FIG. 2

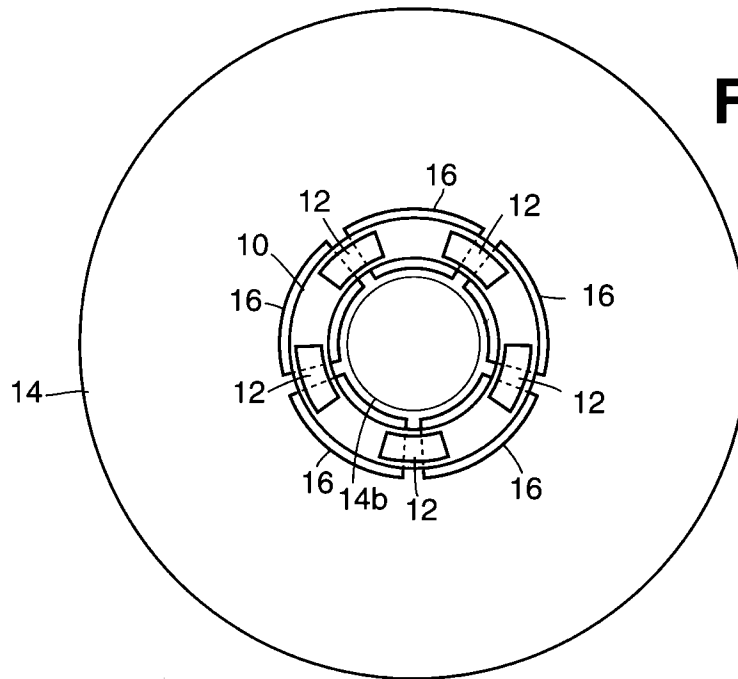


FIG. 3

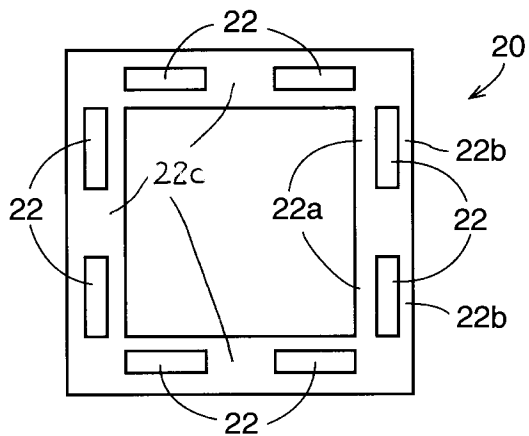
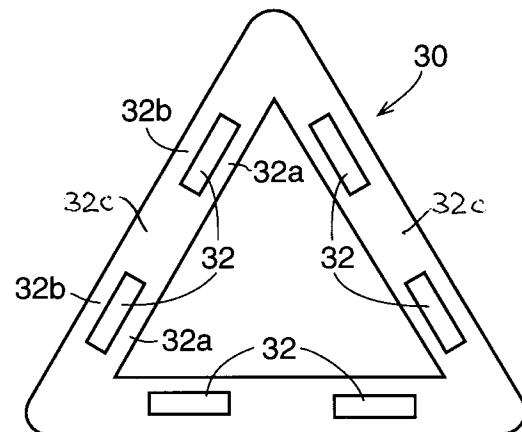


FIG. 4





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EUROPEAN SEARCH REPORT

Application Number
EP 94 10 7232

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
Y	EP-A-0 412 721 (MINNESOTA MINING AND MANUFACTURING) * column 5, line 13 - column 8, line 26; figures 1-4 *	1-4, 12, 14-16	G08B13/24
Y	US-A-4 967 184 (M. H. REGELSBERGER) * column 3, line 45 - line 68; figure 1 *	1-4, 12, 14-16	
A	US-A-4 910 625 (F. X. ALBRECHT ET AL) * column 4, line 1 - line 50; figures 1, 2 *	3, 16	
A	EP-A-0 260 830 (MINNESOTA MINING AND MANUFACTURING) * page 6, line 14 - line 38; figure 4 *	8, 12, 13	
A	EP-A-0 260 831 (MINNESOTA MINING AND MANUFACTURING) * column 15, line 17 - line 44; figure 16 *	13	
A	RESEARCH DISCLOSURE, no.304, August 1989, NEW YORK, US page 617 'article surveillance apparatus and systems for computer data disks' * the whole document *		
			TECHNICAL FIELDS SEARCHED (Int.Cl.5)
			G08B G11B
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 15 June 1994	Examiner Breusing, J
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	