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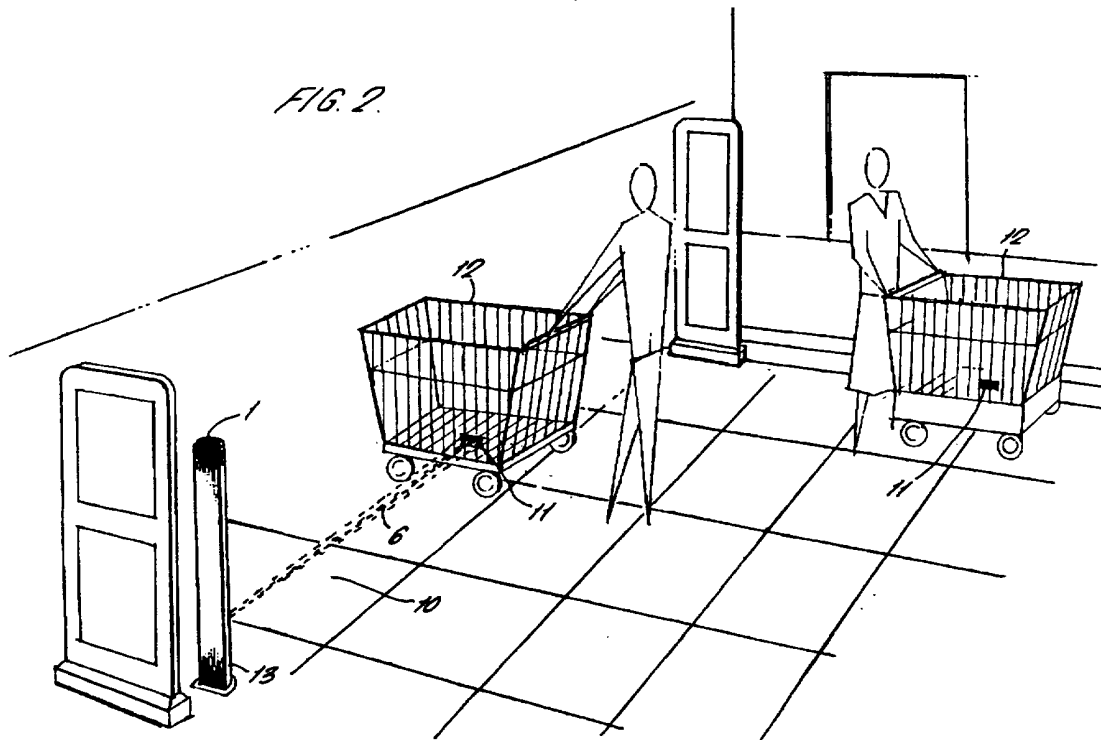
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(56) Documents Cited  
**GB 2302174 A      GB 2233084 A      GB 2028647 A**  
**EP 0629370 A1    US 5767765 A      US 4549182 A**  
**US 4327819 A      US 3882982 A**

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INT CL<sup>6</sup> **G01P 13/04 , G05D 1/03 , G07F 7/06 , G08B**  
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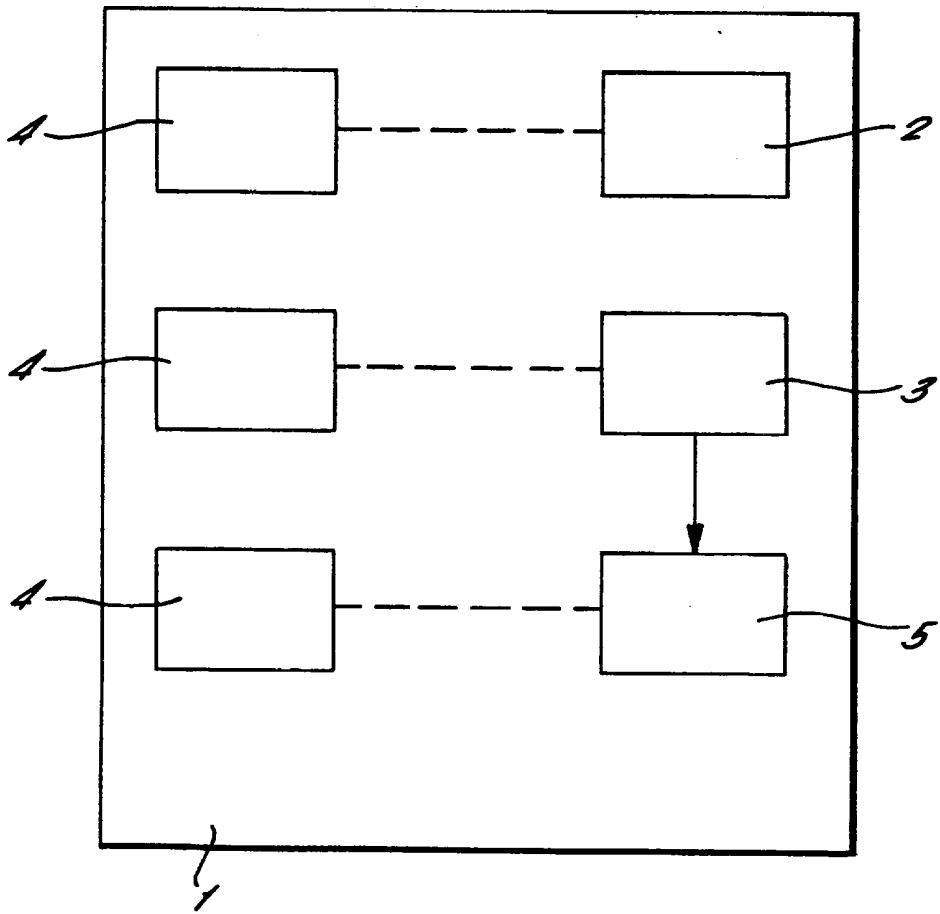
(54) Abstract Title  
**Trolley security system**

(57) The invention provides a system for detecting the movement of an item (12) through a zone (10), comprising one or more beam generating devices (2) for producing a beam (6) in the zone (10), one or more signal detecting devices (3), one or more reflective targets (11) securable to the item (12) for reflecting the beam (6) back to the signal detecting device (3) to produce a reflective signal upon movement of the reflective targets (11) across the beam (6), and an alarm (5) activatable by the signal detecting device (3) upon detection of the reflective signal. The targets may be on one or both sides of the item, and movement of the item in a specific direction may be detected. An infra-red beam may be used.



**GB 2 347 493 A**

FIG. 1.



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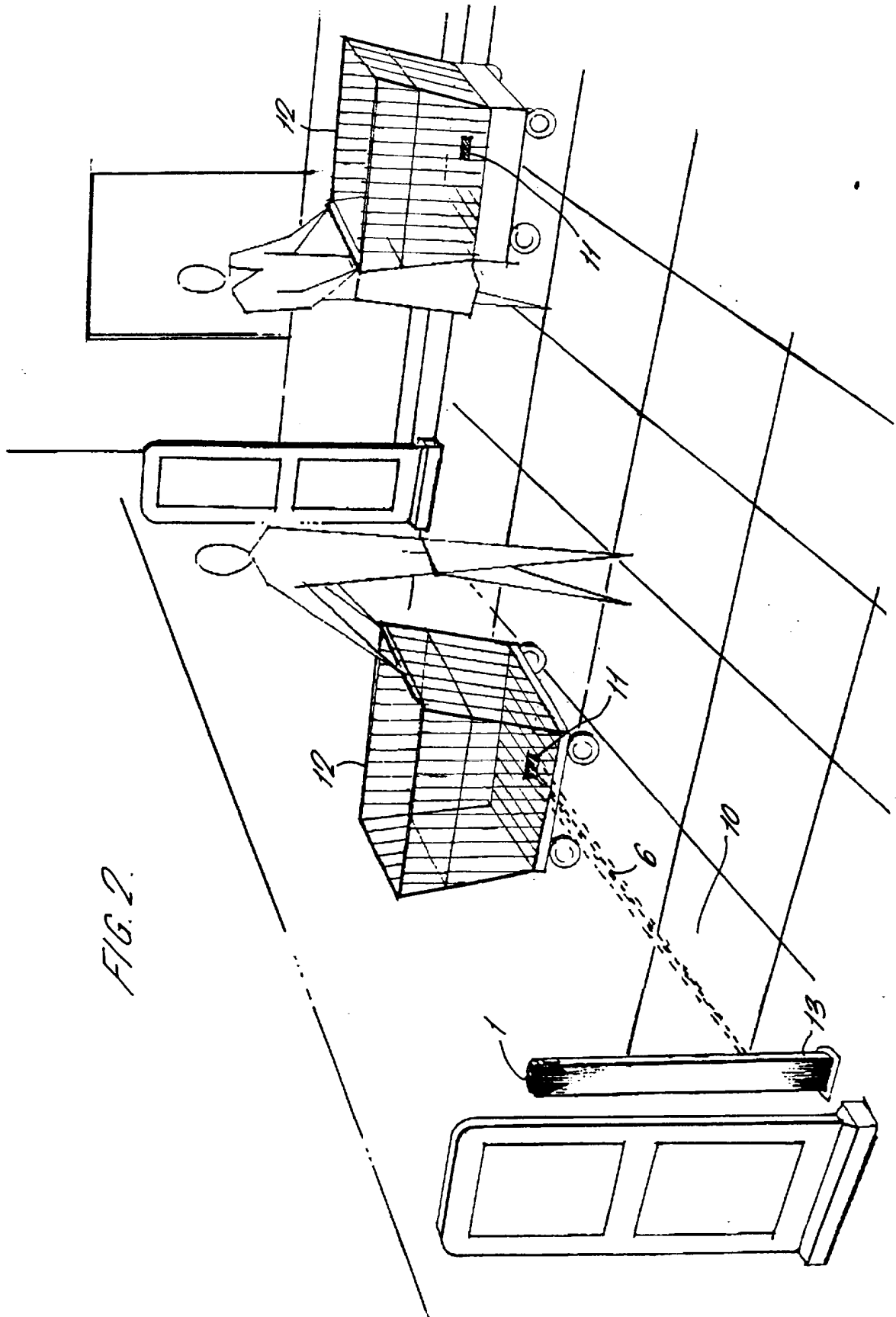
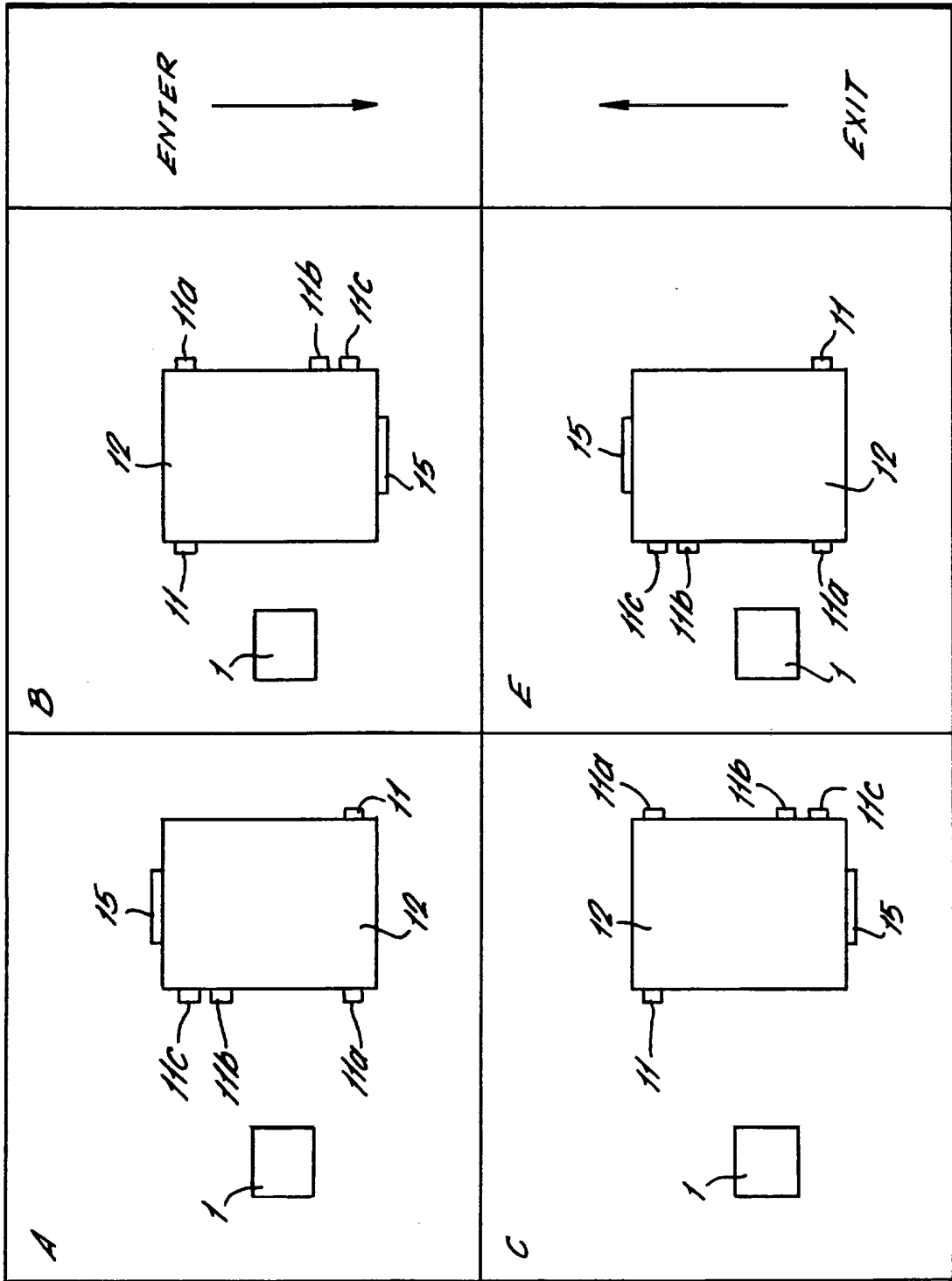


FIG. 2.

FIG. 3.



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FIG. 4.

	A		B		C		E	
D1	L	S		0		0	S	L
D2	0		S	L	L	S		0

Improvements in or relating to trolley security systems

The invention relates to a system for detecting  
5 unauthorised removal of property from premises, and  
thus increases operational security. More  
specifically, it relates to a system for detecting the  
unauthorised removal of goods from trade  
establishments, such as retail outlets.

10

In large retail outlets, such as warehouse type  
stores, it has been noticed that some dishonest  
customers have been loading shopping trolleys with  
merchandise and taking the trolleys out of the store  
15 via the entrance, thus by-passing the point-of-sale  
cash registers. Stock is generally protected by  
Electronic Article Surveillance (EAS) Tagging Systems,  
which are relatively expensive and are thus usually  
located only at the exit to the stores. In addition,  
20 tagged items placed within metal shopping trolleys can  
be shielded from detection, due to the Faraday cage  
effect, thus affecting the reliability of the  
detection system.

25

It is the aim of the present invention to obviate, or  
reduce, the above mentioned problem by providing a  
cost effective solution, separate to that of the EAS  
Tagging Systems.

30

Accordingly, the invention provides a system for  
detecting the movement of an item through a zone,  
comprising one or more beam generating devices for  
producing a beam in the zone, one or more signal  
detecting devices, one or more reflective targets  
35 securable to the item for reflecting the beam back to

the signal detecting device to produce a reflected  
signal upon movement of the reflective targets across  
the beam, and an alarm activatable by the signal  
detecting device upon detection of the reflected  
5 signal.

Preferably the item is a shopping trolley.

10 Preferably the beam generating and signal detecting  
devices are located at the entrance to a premises. In  
particular, the alarm is activated only upon movement  
of the item in a direction out of the premises through  
the entrance.

15 In one embodiment of the invention, the reflective  
target is attached only to one side of the item and  
the beam generating and signal detecting devices are  
located at one side only of the zone.

20 In another embodiment of the invention, the reflective  
target comprises at least three discrete reflective  
surfaces secured to the item, spaced apart at  
dissimilar intervals.

25 In another embodiment still, the reflective targets  
are attached to two opposing sides of the item.  
Specifically, a reflective target comprising a single  
discrete reflective surface is located on one side of  
the item, and a reflective target comprising a number  
30 of discrete reflective surfaces is located on the  
opposing side of the item.

In one particular embodiment the detectors are located  
on either side of the entrance to the premises.

35

In another embodiment still, the signal detecting device is activated only by reflections from the reflective target.

5 Preferably, the alarm comprises audible and/or visual warnings.

Advantageously, the beam generating device and the signal detecting device are combined into a single  
10 unit.

Preferably, the beam comprises infra-red waveforms.

The following is a description of specific embodiments  
15 of the invention, by way of example only, reference being made to the accompanying drawings in which :

Figure 1 is a schematic representation of a beam  
generating device, a signal detecting device, and a  
20 alarm device;

Figure 2 is a diagrammatic representation an  
embodiment of the trolley surveillance system of the  
present invention in operation at the entrance to a  
25 retail outlet;

Figure 3 is an illustration of a particular  
reflector/detector configuration, under various  
trolley entry (A and B) and exit (C and E) situations;  
30

Figure 4 is a logic table illustrating the various  
trolley entry/exit situations when either one  
detector, or two detectors located on either side of  
the entrance to the retail outlet, are used with the  
35 reflector configuration shown in Figure 3.



The system of the present invention consists of a detector device, typically mounted at a fixed location, such as the entrance to a retail premises, and a reflector mounted to an item to be monitored, in this case a shopping trolley.

As shown in Figure 1, the trolley detector 1 comprises a beam generator 2, a signal receiver or detector 3, a power supply 4, and an alarm system 5. These various devices can of course be combined into a single housing with a common power source.

The beam generator 2 produces a continuous beam 6 which is directed over a security zone 10, e.g. the entrance to a premises as shown in Figure 2. Typically, the security zone extends up to 10 metres from the trolley detector 1, and is dependent upon the actual beam generator 2, and signal detector 3 used. This beam 6 is preferably an infra-red beam, although other waveforms, such as radio frequency waveforms, may alternatively be used.

Figure 2 shows shopping trolleys 12, to which are attached reflectors 11. The reflector 11 is attached to the trolley 12 by security nuts to prevent, or at least hinder, unauthorised removal. The reflector 11 comprises prismatic lenses formed in a transparent synthetic resin, sealed and backed with a pre-coated pressure sensitive adhesive which is protected by a removable plastic liner e.g. Scotchlite™.

As also shown in Figure 2, the trolley detector 1 is fitted into a steel bumper post housing 13, which can be used to protect existing EAS Tagging System antennae. The bumper is preferably located on one

side of an entrance to a store.

Ordinarily, the beam 6 can be broken without the alarm system 5 being activated e.g. by persons walking  
5 through the beam. However, if the reflector 11 cuts the beam 6, the beam 6 will be reflected back towards the signal receiver 3, which in turn will activate the alarm system 5. The alarm system 5 may be an audible and/or visual warning of any desired form e.g. a voice  
10 alarm, beeper, flashing light, Xenon beacon, etc.

It is important that the system comprises so called "retro-reflective" devices and beams. Thus, the system will only be actuated by reflections from the  
15 reflector 11 and not by reflections from, for example, the trolley 12, as would be the case with so called "passive reflective" systems.

For the signal receiver 3 to activate the alarm system 5, it must receive at least one pixel of the reflected beam 6. Thus, it is advantageous to size the reflector 11 such that it is not easily shrouded. For example, if the reflector 11 is manufactured to be wider than the width of a human leg, it can not be  
25 easily concealed by someone walking along side the trolley.

In one specific embodiment, the detector 1 is placed only on one side of the entrance and the reflector 11 is attached only to one side of the trolley 12 such  
30 that, when the trolley is pushed in the conventional manner (ie. facing forward) through the security zone 10 on entering the retail outlet, the reflector 11 faces away from the detector 1 so that it does not  
35 reflect the beam 6 to activate the alarm 5. However,

if someone attempts to leave the premises via the entrance, again pushing the trolley in a conventional manner, the reflector 11 will now face the detector 1 and so will reflect the beam 6 and activate the alarm 5.

This is the simplest solution and is effective in a majority of situations. However, problems arise with this configuration if the trolley is pushed backwards (or pulled by the handle) out of the exit. Under these circumstances, the reflector is still positioned on the wrong side, with respect to the detector, and thus the detector will not receive a reflected signal and the alarm will not be activated.

In another specific embodiment, the reflector 11 comprises at least three discrete reflective surfaces, secured to one side of the trolley, spaced apart at dissimilar intervals. Again, when the reflector 11 crosses the security zone 10, the beam 6 is reflected back to the signal detector/receiver 3. However, in this case, the reflected beam will comprise a number of corresponding dissimilarly spaced discrete signals, from which can be determined the direction of motion of the trolley 12. This spacing will primarily be one of time increment, i.e. the interval between each of the discrete signals and not their respective durations. For example, dependent upon the actual arrangement of the discrete reflective surface, one discrete signal followed, one second later, by two successive discrete signals, the time between these two signals being half a second, may indicate that the trolley is moving forwards. Correspondingly, two successive discrete signals, spaced apart by half a second, followed one second later, by one discrete

signal would indicate the trolley is moving backwards. It is of course, due to the number of variables, which includes for example the velocity of the trolley, the relative difference between the time intervals, and  
5 not the actual time intervals themselves, which would be used to determine the direction of motion of the trolley 12. A Logic Timer Circuit (not shown) is then used to calculate the direction of movement.

10 This arrangement of three reflectors on one side of the trolley and one detector on one side of the entrance will therefore detect the backwards movement of the trolley through the entrance. However, it will not detect the trolley being pushed forwards, in a  
15 normal manner, out of the entrance of the store, as the reflectors would be positioned on the wrong side of the trolley and be facing away from the detector.

Thus, the optimum system will be able to distinguish  
20 between the four situations A, B, C and E, where A and B represent a trolley entering the store, being pushed forwards by the handle (as normal) and a trolley being pulled by the handle, and C and E represent a trolley exiting the store, being pushed forwards by the handle  
25 and being pulled by the handle, respectively. The alarm should only be activated in situations C and E.

A simple way to achieve this is to use different configurations of the reflector on each side of the  
30 trolley, for example one side having three (or more) dissimilarly spaced reflectors and the other side having a single reflector, and using two detectors each positioned on either side of the entrance. Alternatively, the three discrete reflectors could be  
35 replaced by two discrete reflectors (not shown).

One particular reflector 11/detector 1 configuration is illustrated in Figure 3, with a corresponding logic table, in Figure 4, showing the signals received by detectors for when both a single detector D1 is used (as shown in Figure 3), and when one detector is positioned on either side of the store entrance (D1 and D2).

Figure 3 shows, for a particular reflector configuration, four situations A, B, C and E of the trolley 12 in relation to a single detector 1 (D1 of Figure 4) located only on one side of the store entrance. As mentioned above, configurations A and B are for situations upon entrance to the retail outlet, with the trolley being pushed in the conventional manner A (i.e. the handle 15 being used to push the trolley 12), and an unconventional manner B (i.e. the handle 15 being used to pull the trolley 12). Situations C and E correspond to the condition on exit from the retail outlet, where the trolley is being pushed in a conventional manner C, and unconventional manner E. The direction of motion of the trolleys 12 are indicated by the arrows.

The reflector configuration shown in Figure 3 utilises reflectors on both sides of the trolley 12; a single reflector 11 on one side of the trolley 12, and three discrete reflectors, 11a, 11b and 11c, spaced apart at dissimilar intervals on the other side of the trolley 12.

Thus, in situation A, as the trolley is pushed passed the detector 1, the detector 1 initially receives a reflected signal from the first reflector 11a, followed by a relatively long gap L until it receives

a second reflected signal from reflector 11b. The third reflected signal is reflected from 11c. However, the gap S, between the second and third reflected signals, is shorter in duration than L. In situation  
5 B however, the detector only receives a single signal O.

Accordingly, the various signals received by the single detector D1, in the four situations A, B, C and  
10 E, are summarised in Figure 4. As can be seen by Figure 4 row D1, on the assumption that, on entrance to the retail outlet the trolley 12 is most likely always to be pushed in the conventional manner (i.e. ignore situation B), the Logic Circuit will be able to  
15 distinguish between the situations A, C and E due to the different signals produced under each of these situations, and thus can be configured to activate the alarm in situations C and E when the customer is attempting to leave the store via the entrance.

20

However, if situation B cannot be ignored, then using this particular reflector configuration, detectors will be required on either side of the entrance to the retail outlet. The various signals received by  
25 detectors D1 and D2 under these circumstances are shown in Figure 4. As is shown in the table, by comparing the signals received by D1 and D2, the situations A, B, C, and E are now fully distinguishable. In particular, situations A and E  
30 are distinguishable by the fact that in situation A, for example, D1 initially receives a signal from 11a, and at the same time D2 also receives a signal from the reflector 11 positioned on the opposite side of the trolley 12. However, in situation E, when the  
35 detector D1 receives an initial signal from 11c, D2

does not receive a corresponding signal. In fact, D2 receives a signal at a similar time to when D1 receives a signal from 11a, only after D1 has received signals from 11c and 11b.

5

Thus, using the above mentioned configurations as examples, the most robust solution is provided when the reflector configuration of Figure 3 is used with a detector on each side of the entrance to the store.

10

However, it will be appreciated that there are numerous configurations of reflectors and detectors which can be used to achieve the desired end result, i.e. the alarm is activated whenever a trolley is moved out of the entrance to the premises.

15

For example, a number of detectors could be arranged on the same side of the entrance to the retail outlet, for example, two detectors side by side (not shown), and may both be fitted to the same bumper post housing

20

13. Thus, the direction of motion of a single reflector 11, attached to trolley 12, can be identified by the sequence in which the adjacent detectors receive reflected signals.

25

The system is not limited to use at entrances and with shopping trolleys. It can of course be used in any system in which it is desired to monitor movement of an item in an unauthorised direction through a given zone.

30

The invention thus provides an improved and cost effective system for detecting unauthorised removal of property from premises, particularly for detecting the removal of shopping trolleys through a store entrance.

35

Claims

1. A system for detecting the movement of an item through a zone, comprising one or more beam generating devices for producing a beam in the zone, one or more signal detecting devices, one or more reflective targets securable to the item for reflecting the beam back to the signal detecting device to produce a reflected signal upon movement of the reflective targets across the beam, and an alarm activatable by the signal detecting device upon detection of the reflected signal.
2. A system as claimed claim 1 wherein the item is a shopping trolley.
3. A system as claimed in claims 1 or 2, wherein the beam generating and signal detecting devices are located at the entrance to a premises.
4. A system as claimed in claim 3, wherein the alarm is activated only upon movement of the item in a direction out of the premises through the entrance.
5. A system as claimed any of the preceding claims, wherein the reflective target is attached only to one side of the item and the beam generating and signal detecting devices are located at one side only of the zone.
6. A system as claimed in any of the preceding claims, wherein the reflective target comprises at least three discrete reflective surfaces secured to the item, spaced apart at dissimilar intervals.



7. A system as claimed in any of the preceding claims, wherein the reflective targets are attached to two opposing sides of the item.

5 8. A system as claimed in claim 7, wherein a reflective target comprising a single discrete reflective surface is located on one side of the item, and a reflective target comprising a number of discrete reflective surfaces is located on the  
10 opposing side of the item.

9. A system as claimed in claim 3, wherein detectors are located on either side of the entrance to the premises.

15

10. A system as claimed in any of the preceding claims, wherein the signal detecting device is activated only by reflections from the reflective target.

20

11. A system as claimed any of the preceding claims wherein the alarm comprises audible and/or visual warnings.

25

12. A system as claimed in any of the preceding claims wherein the beam generating device and the signal detecting device are combined into a single unit.

30

13. A system as claimed in any of the preceding claims wherein the beam comprises infra-red waveforms.

14. A system as hereinbefore described and with reference to the drawings.



Application No: GB 9904767.2  
Claims searched: 1 to 14

Examiner: Julyan Elbro  
Date of search: 18 May 1999

**Patents Act 1977  
Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:  
UK CI (Ed.Q): G1A (AMG, AMK, AMQX, AMRP, AMU)  
Int CI (Ed.6): G01P 13/04; G05D 1/03; G07F 7/06; G08B 13/14, 13/18, 13/181, 13/183, 13/184  
Other: ONLINE: EPODOC JAPIO WPI

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2302174 A SNAP-ON TECHNOLOGIES see abstract and figs. 1 and 2.	1, 5, 10-13
X	GB 2233084 A PA CONSULTING SERVICES see abstract and page 7 line 18.	1, 5, 10, 11, 13
X, Y	GB 2028647 A PETERSEN et al. see abstract and figs. 1 and 2.	X: 1-3, 5, 9, 11-13 Y: 4
X, Y	EP 0629370 A1 SOLAR WIDE INDUSTRIAL see abstract, column 3 lines 41, 42, and 53 to 58.	X: 1-3, 5, 7, 9, 11-13 Y: 4
Y	US 5767765 SHOUP see abstract.	4
Y	US 4549182 GILLET see column 1 line 63 to column 2 line 8 and column 4 lines 8 to 13.	4
X, Y	US 4327819 COUTTA see abstract, fig. 1, and column 3 lines 65-66.	X: 1-3, 9, 11-13 Y: 4

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.



Application No: GB 9904767.2  
Claims searched: 1 to 14

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Date of search: 18 May 1999

Category	Identity of document and relevant passage	Relevant to claims
X, Y	US 3882982 SMITH see abstract, fig. 1, and column 4 lines 33-39.	x: 1-3, 5, 9-13 Y: 4

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
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