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(56) Documents Cited:
GB 2503720 A
WO 2015/189825 A2
US 20140085089 A1
US 20070131005 A1
EP 2759975 A
WO 2015/121833 A1
US 20070205902 A1

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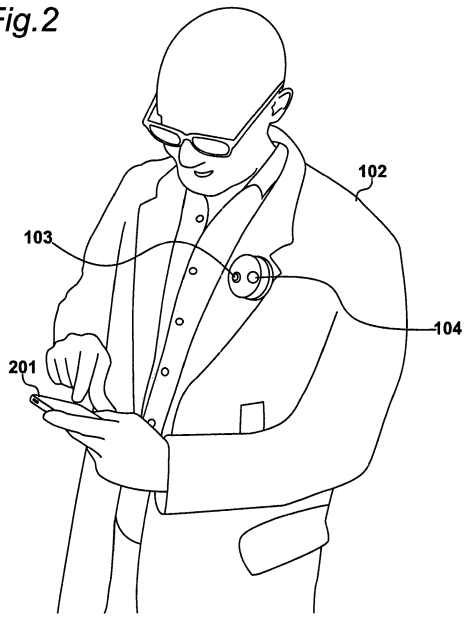
INT CL **E05B, G06Q, G08B**
Other: **EPODOC, TXTA, WPI**

(54) Title of the Invention: **Security tag**
Abstract Title: **A security tag and method of release**

(57) A security tag for an article which is released upon receiving authorisation, the tag comprising a transmitter for sending a signal to a mobile device (e.g. mobile phone 201) and a receiver (preferably with an internal processor (303 Fig 5)) for receiving an input signal from an administration system indicating the tag can be released. The mobile device interacts directly with the administration system directly to purchase the item prior to issuing of the input signal. The user may have to interact with the tag to transmit the signal, e.g. a physical switch 103 and/or to release the tag after reception of the input release signal. The output signal and the signal between the portable device and administrative system may be a unique tag identification signal. There may be a visual indicator, e.g. lights, on the tag indicating that the signal has been sent/received. A method of removing a tag is also disclosed.

Fig.2



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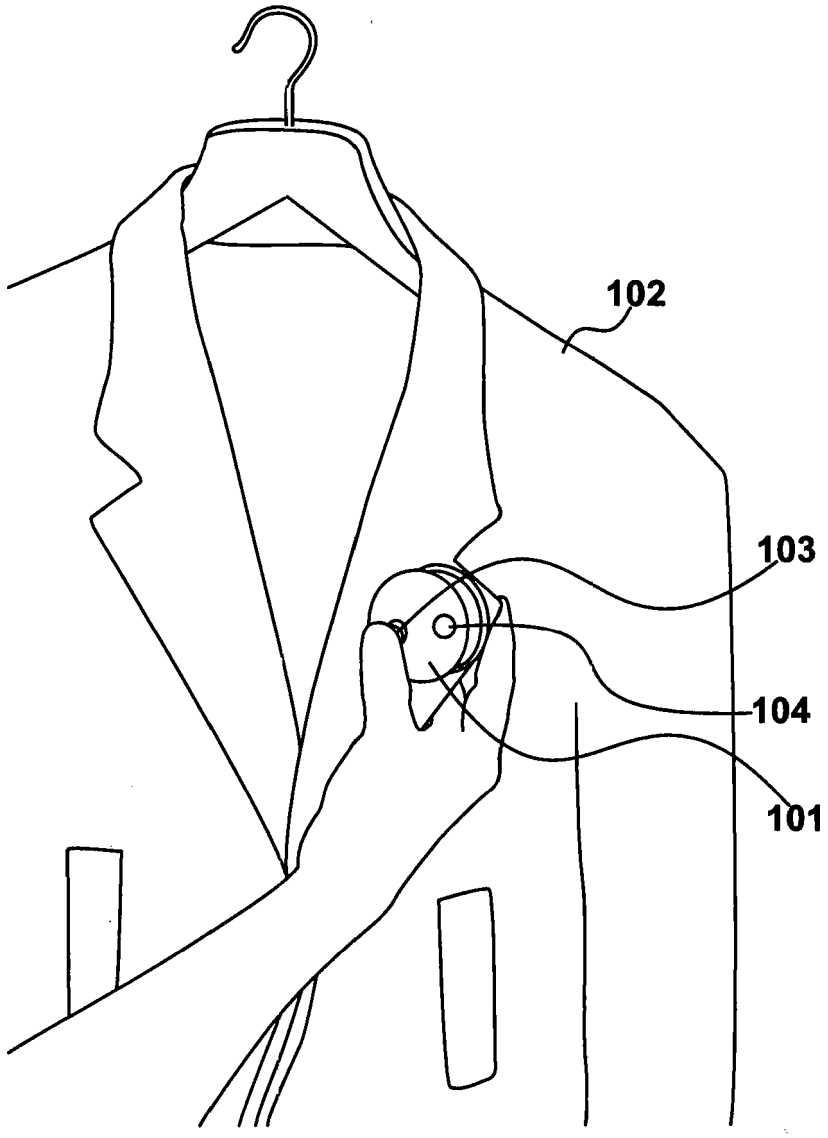

Fig. 1

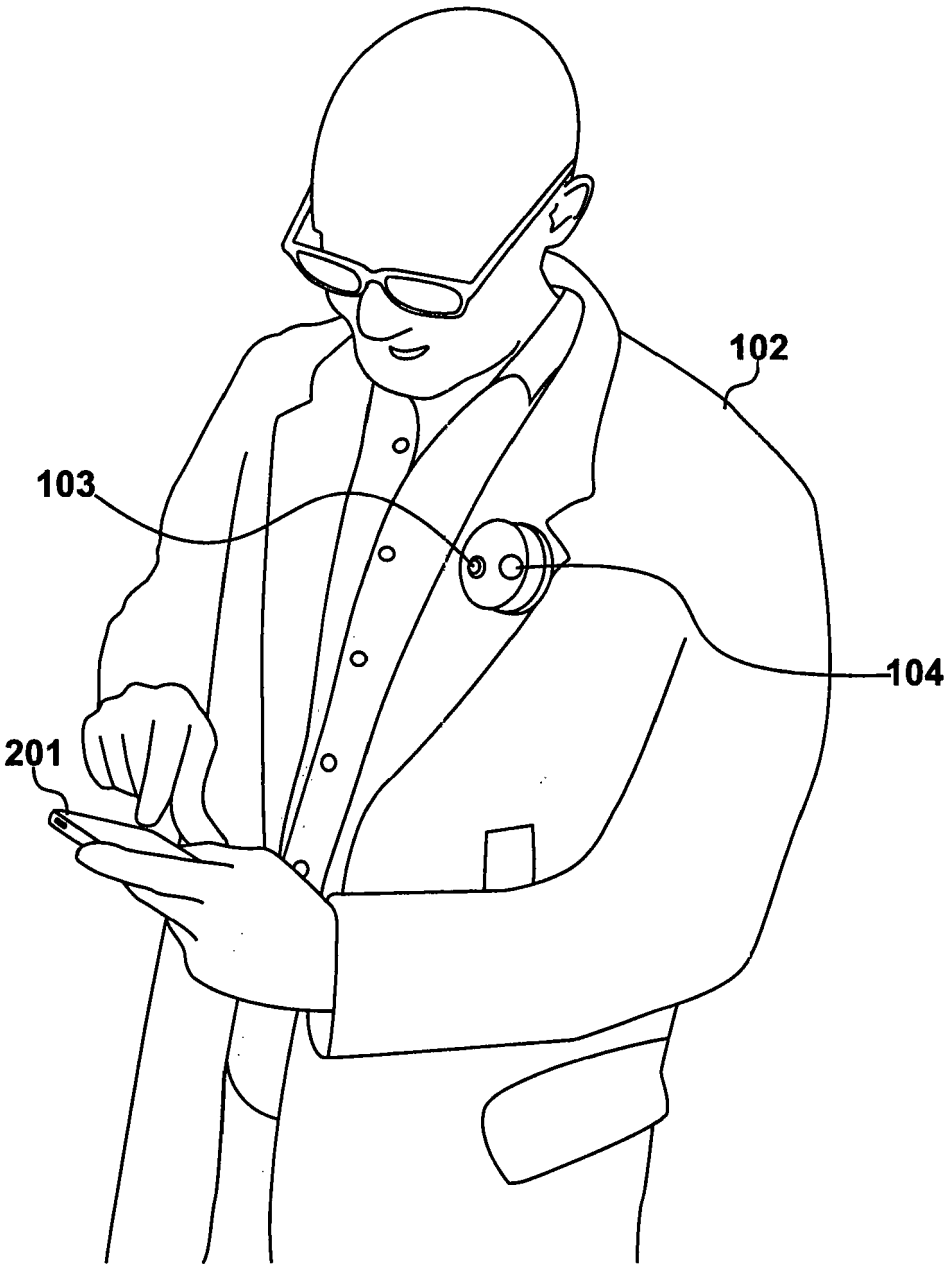

Fig.2

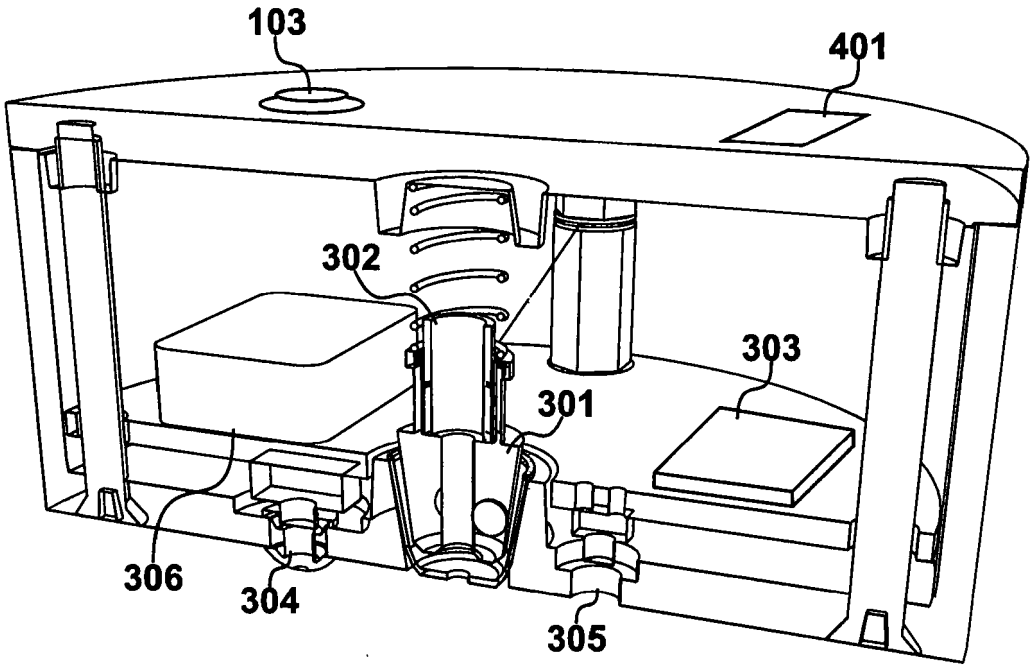

Fig. 3

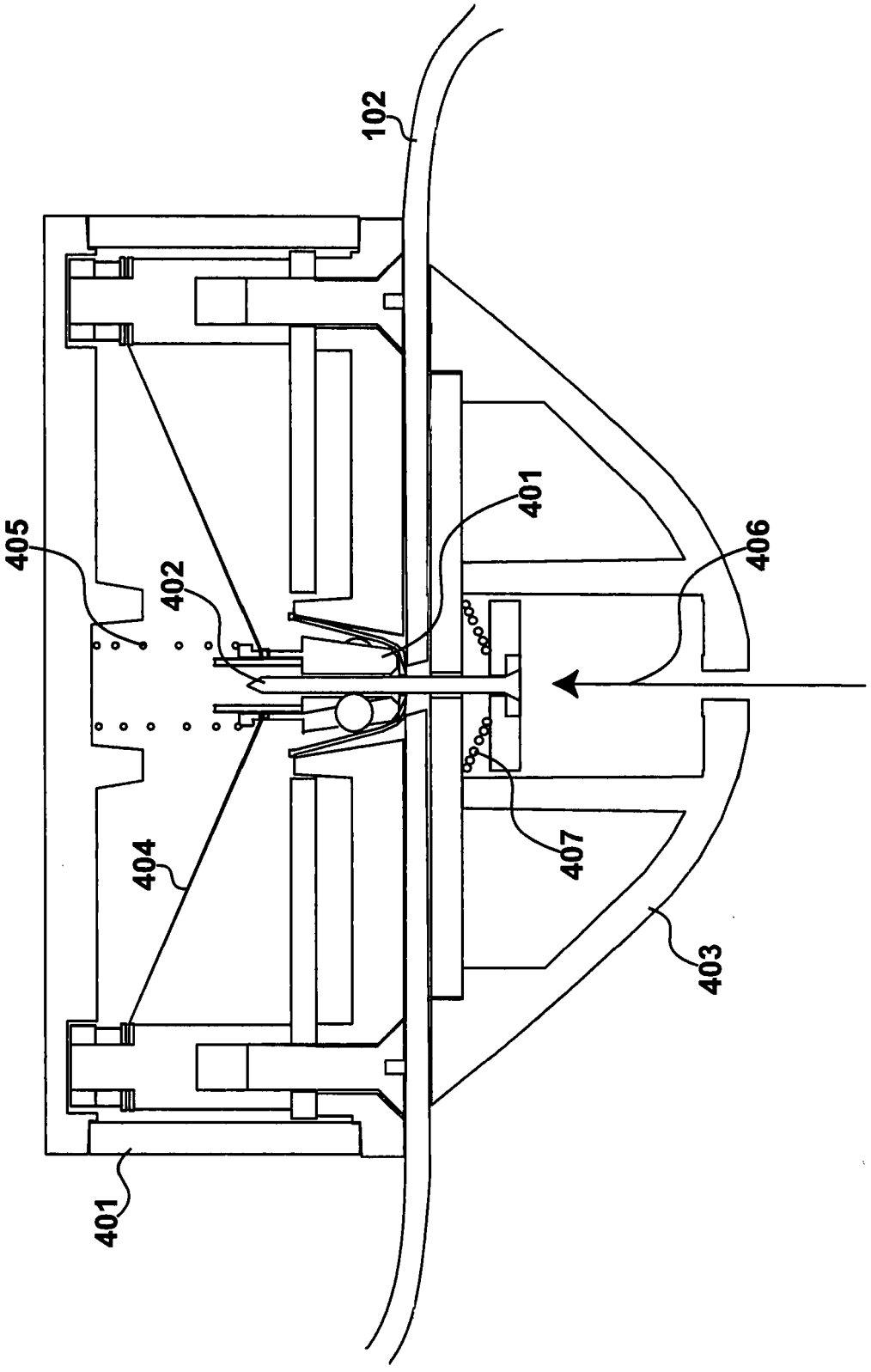

Fig. 4

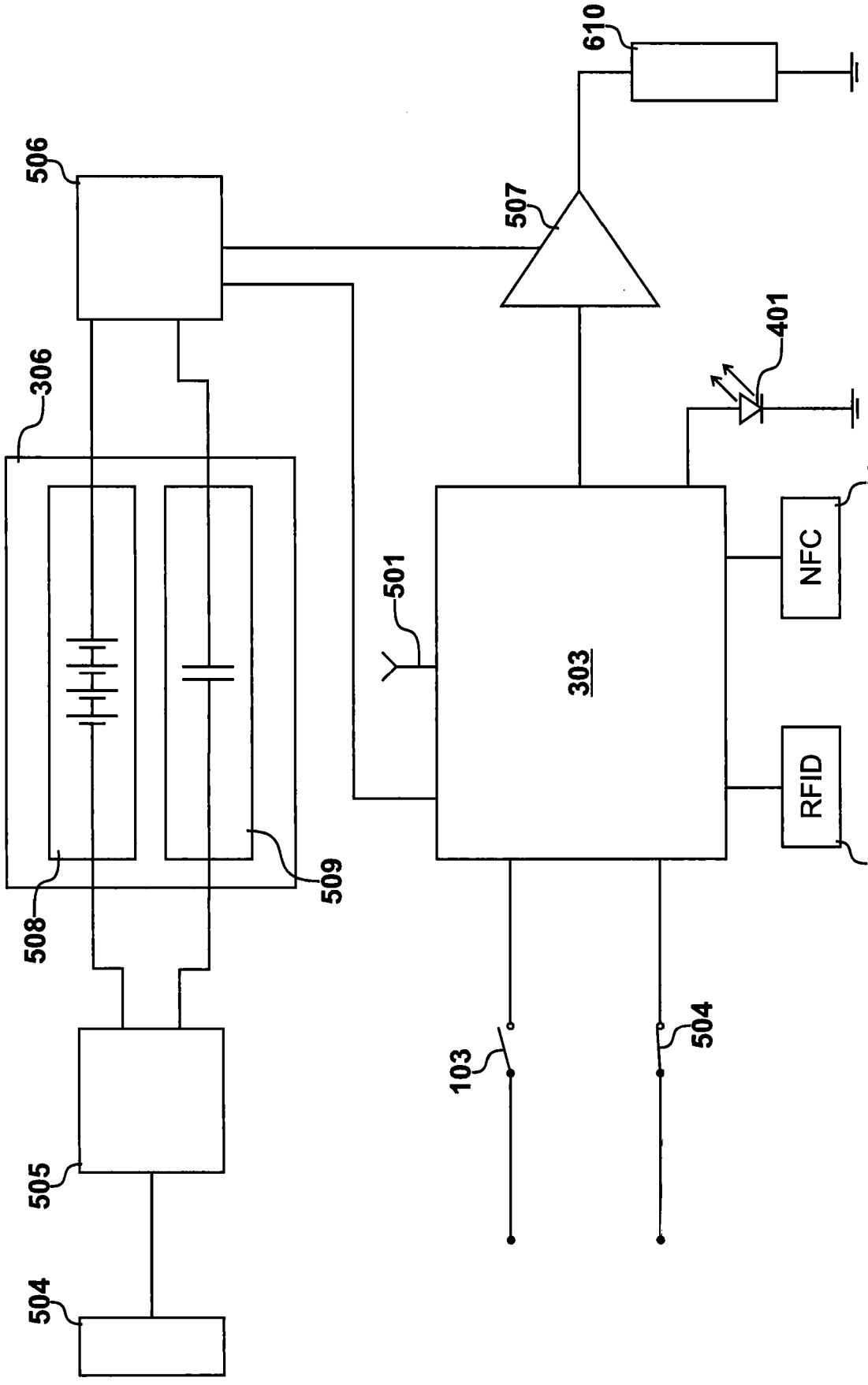
610
506
507
401
306
503
NFC
501
303
509
508
RFID
502
103
504
505
504

Fig. 5

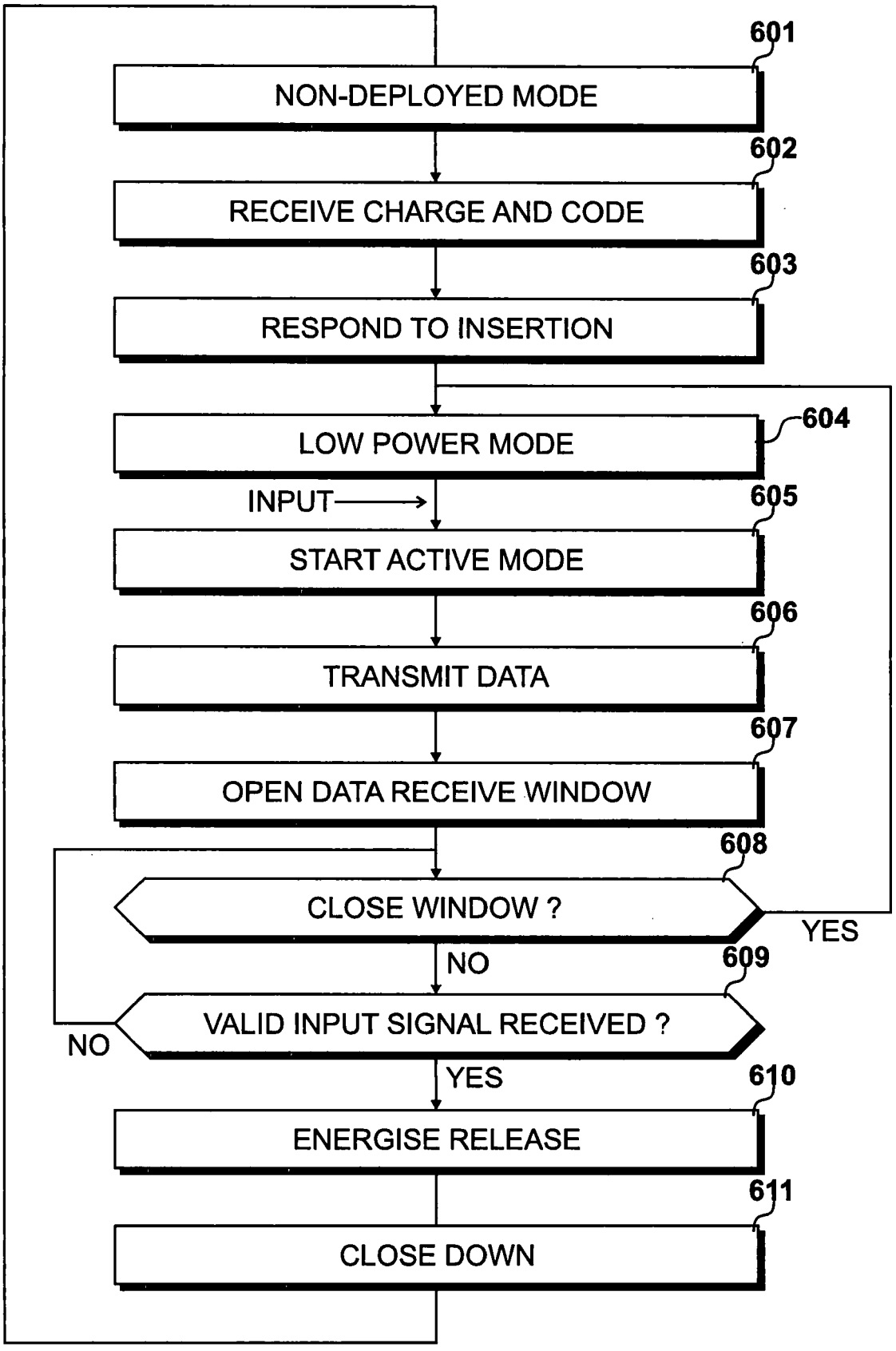
601
NON-DEPLOYED MODE
602
RECEIVE CHARGE AND CODE
603
RESPOND TO INSERTION
604
LOW POWER MODE
INPUT
605
START ACTIVE MODE
606
TRANSMIT DATA
607
OPEN DATA RECEIVE WINDOW
608
CLOSE WINDOW ?
YES
NO
609
VALID INPUT SIGNAL RECEIVED ?
NO
YES
610
ENERGISE RELEASE
611
CLOSE DOWN

Fig. 6

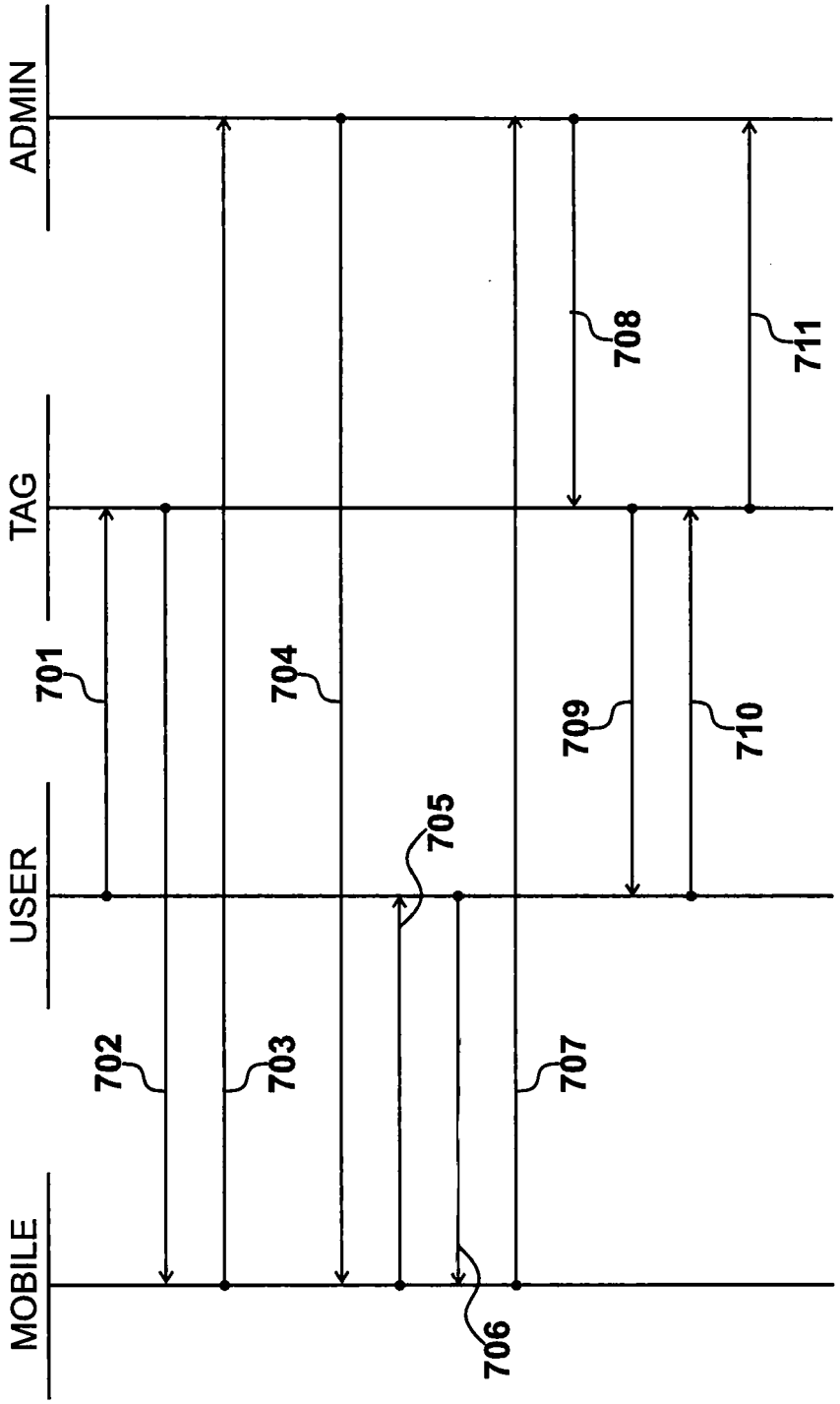
ADMIN
TAG
USER
MOBILE
701
702
703
704
705
706
707
708
709
710
711

Fig. 7

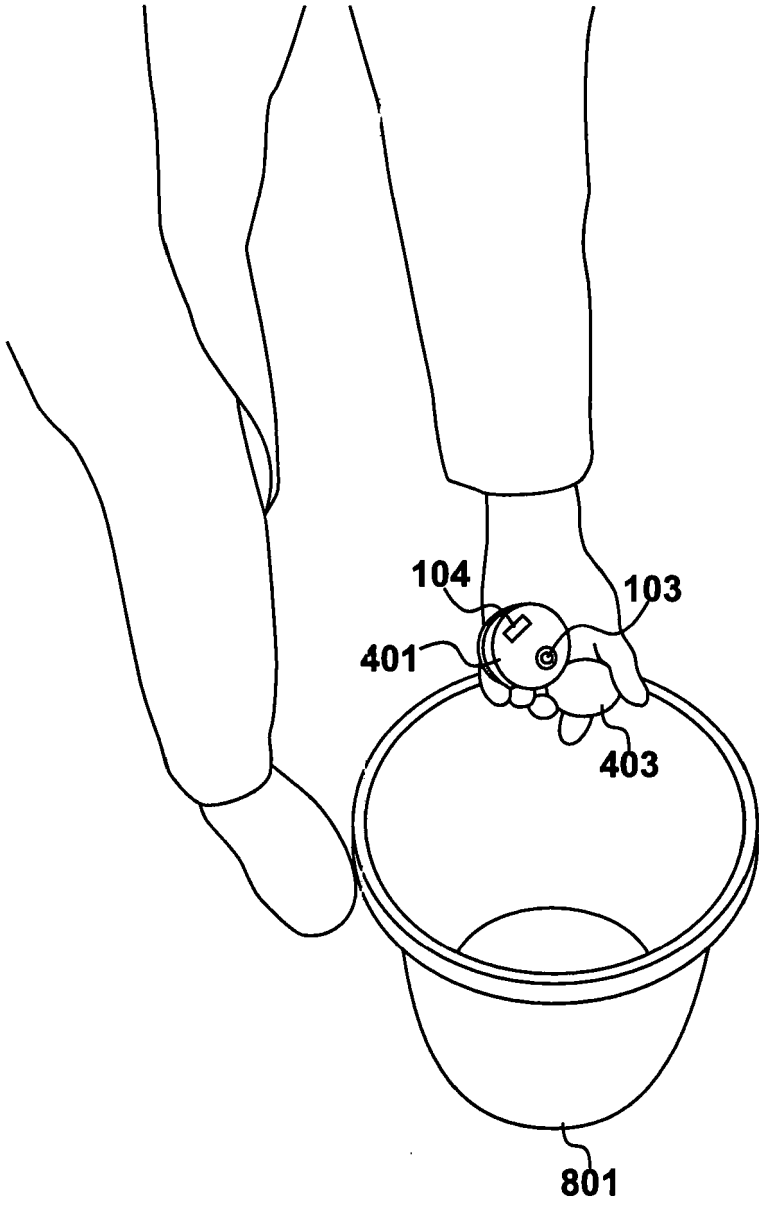

Fig. 8

The following terms are registered trade marks and should be read as such wherever they occur in this document:

Texas Instruments (Page 8)

Security Tag

The present invention relates to a security tag for location upon an article and removal from said article upon authorisation.

It is known to attach security tags to articles of merchandise which are then released when the merchandise is purchased by a customer. The tags may include a locking mechanism with a releasing device for attaching the tag to the article. In addition, it is known to provide a release signal detection circuit with an electro-mechanical actuator that releases the locking mechanism when the release signal detection circuit receives a release signal.

Although operatives may be trained to effect the required release procedure, the requirement for procedures of this type do not facilitate the releasing of tags by customers themselves when they have successfully purchased an article. Furthermore, in many known systems, the continual monitoring of the presence of an external signal consumes significant electrical power, therefore measures must be adopted to maintain the availability of electrical power so that the tag remains active during an operational period.

According to a first aspect of the present invention, there is provided a security tag for location upon an article and removal from said article upon authorisation, comprising: a transmitter for transmitting an output signal to a mobile device; and a receiver for receiving an input signal from an administration system indicating that the tag can be released, wherein: said mobile device interacts with said administration system directly to effect a purchase of the item prior to the administration system issuing said input signal.

In an embodiment the transmitter is activated after the tag has experienced an interaction with a user. A first visual indication may be presented to said user in response to said interaction. The output signal may represent a unique tag identification. The interaction may include sending said unique tag identification and a mobile identification to the administration

system. The tag may provide a second visual indication when said input signal has been received. The tag may be released only after experiencing a further physical action performed by a user.

According to a second aspect of the present invention, there is provided a method of removing a security tag from am article after said tag has been located on an article, comprising the steps of: transmitting an output signal from a tag to a mobile device; adapting an administration system to communicate directly with said mobile device to effect a purchase of the article; and receiving an input signal at the tag from the administration system to authorise the release of the tag.

The invention will now be described by way of example only, with reference to the accompanying drawings, of which:

Figure 1 shows a security tag attached to an article;

Figure 2 illustrates an interaction with a mobile device;

Figure 3 details a primary portion of a security tag;

Figure 4 shows the primary portion of the security tag identified in Figure 3 in cross-section, cooperating with a secondary portion of a security tag;

Figure 5 shows a diagrammatic representation of the primary portion identified in Figure 3 and including an internal processor;

Figure 6 details operations performed by the internal processor identified in Figure 5;

Figure 7 shows a protocol diagram representing communications performed within the environment illustrated in Figure 1; and

Figure 8 shows the collection of disengaged tags.

Figure 1

A security tag **101** is shown in Figure 1, attached to an article **102**. The security tag **101** can be removed from the article **102** upon receiving an authorisation. The tag includes an internal processor arranged to transmit an output signal to an external processor indicating that a customer has identified an interest in the article. The security tag **101** is provided with physical switching means **103**, wherein an activation of the physical switching means **103** initiates a procedure for the internal processor to transmit the output signal.

In the embodiment of Figure 1, the security tag has a housing and the physical switching means **103** is a manually operable switch extending from this housing.

In an embodiment, the internal processor remains in a minimal power consumption state when not required to interact. Procedures are initiated, possibly by operation of button **103**, by interrupting the internal processor out of this minimal power consumption state.

In the embodiment of Figure 1, there is also provided a visual indicator **104**, that could be in the form of an LED or in the form of a passive indicator that experiences a change of state. The visual indicator **104** is activated in response to an initiation of the procedure; that is to say, in response to the operation of button **103** in this embodiment.

As described herein, a procedure is performed in order to obtain an authorisation, possibly after a user has purchased the article to which the tag has been attached. In an embodiment, the visual indicator **104** (or an alternative indicator) or a display elsewhere in the store, is activated again so as to invite further manual operation. Thus, in an embodiment, after authorisation, the tag is removed but only after further manual operation, possibly in the form of a further manual operation of button **104**.

Thus, in an embodiment, a user activates switching means **103** in order to identify their interest in the article. Illumination device **104** is

illuminated, indicating that the tag has become aware of the user's interest and as such it transmits an output signal to an external processor. This initiates a procedure during which the customer-user can complete the transaction. Confirmation to the effect that the transaction has been completed is provided by the tag **101** activating illumination device **104** again. Thus, upon this second illumination (or illumination in an alternative form), the user can remove the tag. For example, when implemented as an LED, different colours could be selected for the first and second illuminations, such as a red illumination followed by a green illumination.

In this embodiment, this tag removal is only achieved after the user has activated the physical switching means again. In this way, the user has control over the removal of the tag to assist with the disposal of the tag in an appropriate receiving receptacle.

In the embodiment shown, the physical switching means extends from the housing. However, it should be appreciated that in alternative embodiments the switching means could be contained within the housing. In the embodiment, the physical switching means takes the form of a manually operable switch. However, as an alternative, and when enclosed within the housing, the physical switching means could take another form activated by physical movement of the security tag. Thus, for example, use could be made of accelerometers, either specifically added to the circuitry of the tag or already present within a selected internal processor. Similarly, other devices such as peizo-electric devices could be deployed in order to provide the physical switching means.

Figure 2

In a retail shopping environment, a customer may be encouraged to try on an article **102** without assistance possibly in a changing room environment. Furthermore, it is possible for the customer to complete the financial transaction without assistance.

In Accordance with an aspect of the present invention, the release procedure involves a communication with a mobile device **201**, such as a mobile cellular telephone. Thus, the security tag is provided for location upon an article and removal from the article upon authorisation. A transmitter transmits an output signal to a mobile device **201**. Furthermore, the tag includes a receiver for receiving an input signal from an administration system indicating that the tag can be released. From a user's perspective, it appears as if communication continues between their mobile device **201** and the tag **101** in order to achieve a release of the tag. However, in accordance with this aspect of the present invention, the mobile device interacts with the administration system directly to effect a purchase of the item prior to the administration system issuing the input signal.

As previously described, the transmitter is activated after the tag has experienced an interaction with the user, such as, but not exclusively, the user activating button **104**. This results in a first visual indication being presented to the user immediately before or immediately after the tag transmits the output signal. Furthermore, in an embodiment, the output signal represents a unique tag identification. Thus, when the output signal is transmitted to the mobile device, in an embodiment, this results in the mobile device receiving the unique tag identification. Furthermore, in an embodiment, the interaction further includes the sending of the unique tag identification and a mobile identification to the administration system from the mobile device.

Thus, according to this aspect of the invention, further communication now occurs directly between the mobile device and the administration system; not the tag. If the transaction is successful, the tag then receives the input signal. In an embodiment, a second visual indication is provided when the input signal has been received, possibly by activating visual display device **104**. Thereafter, in an embodiment, the tag is released only after experiencing a further physical action performed by the user; possibly the operation of button **103**.

Figure 3

A primary portion of a security tag for attachment to an article is shown in Figure 3. The primary portion includes a locking mechanism **301** for locking a locking part of a secondary portion of the security tag, so as to secure the security tag to an article.

In an embodiment, a releasing mechanism **302** releases the locking mechanism **301**, so as to release a locking part of the secondary portion.

An internal processor **303** is configured to activate the releasing mechanism **302** in response to receiving an input signal. As previously described, the physical switching means **103** is configured to instruct the internal processor **303** to initiate a release procedure.

In the embodiment of Figure 3, the locking mechanism is arranged to hold the locking parts securely in place, such that it is not possible to physically separate the primary portion from the secondary portion of the tag. In this embodiment, the housing of the secondary portion is shaped so as to make it difficult to mechanically grip this portion. Furthermore, the locking part may take the form of a pin that itself may rotate in its housing, such that rotation does not result in a relative movement between the pin and a clutch of the locking mechanism **301**.

In the embodiment of Figure 3, there is provided a first detection device **304** and a second detection device **305**, each configured to activate if the primary portion is removed from being in contact with the article. In this way, it is not necessary to achieve a secure attachment of the primary portion to the secondary portion.

In an alternative embodiment, a mechanism may be provided for holding the primary portion in contact with the article but this mechanism would not prevent manual removal. However, the detection device will then activate, so as to generate a local alarm signal and so as to notify the administration system, if the tag is removed.

In an embodiment, the first detection device **304** is in the form of a mechanical switch that remains closed when the primary portion is in contact

the article but will open when the primary portion is removed from the article. In an embodiment, the second detection device **305** is an optical device. Thus, optical device **305** does not receive light when the primary portion is against the article **102** but will receive ambient light when the primary portion is removed; thus activating the alarm. In an embodiment, the local alarm may be an audible alarm device, possible taking the form of a peizo-electric device.

In an alternative embodiment, the detection device includes a lever configured to extend from the primary portion when the primary portion is removed from the article.

In an embodiment, the primary portion includes a socket for receiving electrical charge. Charge is supplied to a power supply unit **306**.

In an embodiment, before receiving a command to initiate the release procedure, the internal processor is in a minimal power consumption (sleep) state. Thus, the power supply unit **306** may contain sufficient charge to maintain the internal processor in this sleep state for several months without requiring an additional charge.

Figure 4

The primary portion of the tag identified in Figure 3 is shown in Figure 4 in cross-section; cooperating with a secondary portion so as to secure the tag to article **102**. The primary potion **401** has a locking mechanism **301** for locking a locking part **402** of a secondary portion **403** of the security tag, so as to secure the security tag to an article, such as article **102**.

The primary portion **401** incudes a metal portion in the form of a metal wire **404**, configured to perform a contraction when energised, so as to effect a release of the locking mechanism **301** as a result of this contraction. In an embodiment, the metal wire is a shape-memory-alloy wire.

In an embodiment, the shape-memory-alloy wire is resistance heated when energised which, in this embodiment, requires the wire to be heated to a temperature of seventy degree Celsius for approximately 0.2 seconds. In

an embodiment, the energy for achieving this degree of heating is supplied by a super capacitor which, in this example, has a capacitance of 3.3 farads.

The combination of a voltage regulator and an amplifier maintains an applied electro motive force of 5 volts on the wire. The wire typically has a resistance of 3.1 ohms, resulting in a heating current of approximately 1.6 amps.

The locking mechanism includes a spring **405** and the release is effected by compressing this spring in response to a contraction of the shape-memory-alloy wire **404**.

In the embodiment of Figure 4, the locking part, in the form of pin **402**, extends from the secondary portion **403** and into the primary portion **401** by the application of an appropriate tool in the direction of arrow **406**.

The secondary portion **403** includes a spring **407** that is usually in compression and thereby applies force to pin **402**. In this way, the locking part undergoes a retraction when a release is effected. Thus, in an embodiment, the shape-memory-alloy wire **404** is energised for an interval that is long enough to allow the locking part **402** to undergo this retraction. Thus, after the spring **407** has caused the pin **402** to retract, the shape-memory-alloy wire **404** cools down, resulting in the expansion of spring **405**; such that the locking mechanism is returned to a condition suitable for receiving a locking part again, without requiring further mechanical intervention.

Figure 5

A diagrammatic representation of the primary portion identified in Figure 3 is detailed in Figure 5. Processor **303** may be a Texas Instruments TRF**7970**A and facilitates wireless communication via an antenna **501**. To facilitate operation within conventional security environments, the primary portion is also provided with an RFID (Radio Frequency Identification Device) **502**. This also provides the primary portion with a unique identification and

this identification may be read by processor **303**. Processor **303** also communicates with a near-field communication (NFC) device **503**. Other known types of security technology could be used, such as the technology known as electronic article surveillance.

A charging socket **504** allows charge to be supplied to the power supply unit **306** via a voltage regulation circuit **505**. Similarly, output current from the power supply unit **306** is controlled by an output voltage regulator **506**, before being supplied to the processor **303** and a power amplifier **507**.

In an embodiment, the power supply unit **306** includes a rechargeable lithium battery **508** and circuits **505** and **506** are responsible for controlling the charging and discharging of the lithium battery **508**, so as to maintain the integrity of the battery. The battery **508** is responsible for maintaining power to the processor **303** but batteries of this type are not suitable for supplying relatively large currents, as required for the removal of the article upon authorisation.

In addition to battery **608**, the power supply unit **306** also includes a capacitor **509** having a capacitance of several farads and being of a construction generally referred to as a super capacitor or electric—layer capacitor. Initially, the capacitor **509** receives charge via the input socket **504** and the regulator **505**. Regulator **506**, under the control of the processor **303**, is then responsible for providing power to the power amplifier **507** during tag removal.

It is also appreciated that, over time, the capacitor **509** may lose charge, therefore charge is maintained on the capacitor **509** by receiving a trickle charge from the battery **508**. In an alternative embodiment, the capacitor could be allowed to fully discharge and is then charged, over a period of seconds, when the internal processor is interrupted from its low power consumption state.

Thus, in this configuration, the capacitor **509** is responsible for delivering high current levels when a release is required, whereas the battery

508 is responsible for maintaining power to the processor **303** when the processor is in a low power consumption state.

Figure 6

Operations performed by the internal processor **303** are illustrated in Figure 7. In an embodiment, the processor **303** is an RFID and NFC transceiver integrated circuit, although other implementations are possible.

Step **601** identifies a non-deployed mode, that is followed by step **602** where the primary portion receives charge via socket **504**. In an embodiment, each device is hardcoded with a unique code and this code may be derived from RFID device **502**. Alternatively, it is possible for the device to receive a code when being charged at step **602**.

After receiving charge at step 62, deployment occurs which, in an embodiment, results in the primary portion receiving a locking part in the form of a pin. This operation may activate devices which in turn inform an administration system to the effect that the primary portion is now in use at step **603**. At step **604**, the processor enters a passive mode, during which it is configured to achieve minimal power consumption, so as to remain operational for as long as possible without requiring additional charging.

An active mode starts at step **605** in response to receiving the input signal instructing the internal processor to initiate a release procedure. At step **606**, the internal processor transmits data and opens a data-receive window at step **607**, during which it is responsive to receiving the input signal from the administration system.

In an embodiment, if an input signal is not received from the administration system within this window, a time-out occurs and the internal processor returns to its minimal power consumption state.

In this embodiment, a question is asked at step **608** as to whether the window is to close. If this is answered in the negative, a question is asked at step **609** as to whether a valid input signal has been received. If answered in the negative, the process repeats until the question asked at step **608** is

answered in the affirmative, whereupon the processor returns to its low power consumption mode at step **604**.

If a valid input signal is received, the question asked at step **609** is answered in the affirmative and the release mechanism is energised at step **610**. Thereafter, a close down process occurs at step **611**, returning the processor to its non-deployed mode at step **601**.

Figure 7

In an embodiment, the administration system is implemented on hardware supporting a web application and communications systems for effecting wireless communication to the tags in order to transmit input signals. The web application also includes access to a web sales site, as is well known in the art.

A protocol diagram, representing communications performed within the environment illustrated in Figure 1, is shown in Figure 7. The protocol it depicts provides for the location of a security tag upon an article and removal from the article upon authorisation. The security tag has an internal processor and a release mechanism and the internal processor is arranged to receive an input signal indicating an authorisation to remove.

The internal processor is configured to facilitate a removal upon receiving the input signal. However, the internal processor will only allow a removal to be made upon also detecting a manual operation performed by the user.

Prior to receiving an input signal indicating an authorisation to remove, the tag receives an instruction from the physical switching means shown at **701**, in response to a manual activation made on the part of the user. This represents the first manual operation, indicating the user's interest, and a further manual operation will be required in order to effect final removal.

At **702**, the tag responds by making contact with mobile device **201**. In accordance with an aspect of the present invention, the mobile device **201**

interacts directly with the administration system as shown at **703**. The mobile device has received information from the tag at **702**, providing a unique identification. This unique tag identification, along with an identification of the mobile device, are conveyed together at **703**. The administration system now has information identifying the user who wishes to purchase the article and details of the article that they wish to purchase.

As illustrated at **704**, data is returned from the administration system to the mobile device to facilitate the purchasing exercise. This interaction may take the form of transmitting HTML encoded pages that are decoded within a browser application running on the mobile device. Thus, as shown at **705**, visual information is supplied to the user from the mobile device and at **706** the mobile device receives user input. Input data from the user is then transmitted from the mobile device to the administration system at **707**.

In embodiments, interactions **704** to **707** may be repeated a plurality of times until the sale has been concluded.

After completing the transaction, the input signal is transmitted to the tag from the administration system, as indicated at **708**. Thus, in accordance with an aspect of the invention, the internal processor receives an input signal indicating an authorisation to remove. At this point, it would be possible for the tag to disengage automatically. However, it has been appreciated that an automatic disengagement of this type can create problems therefore, in accordance with an aspect of the present invention, the disengagement is made under user control. Thus, according to this aspect of the invention, the tag indicates to the user that the tag is ready for removal by activating a visual display, such as display device **104**, as illustrated at **709**. The user is then required to perform a further manual operation **710**. In an embodiment, this may involve a further activation of button **103**.

Figure 8

It has been recognised that it is preferable, when in use, for

disengaged tags to be collected, to ensure that they are not lost and can be returned for redeployment. In an embodiment, significant advantages are gained from reducing the requirement for sales assistants to locate items, facilitate fitting and interact during the sale of the item. Much of this advantage is lost if tags become lost or damaged. Thus, procedures are adopted that nudge users towards disengaging tags such that they can be collected in a receptacle, such as receptacle **801** shown in Figure 8.

Thus, having completed the transaction and seeing visual display device **104** being activated again, a user is encouraged to activate button **103** again while the tag is held over the receptacle **801**. Furthermore, by controlling the deactivation of the tag, the user has control over the component parts and is less likely to misplace one of the parts after deactivation.

It is also appreciated that visual output displays other than those present to the tag itself could indicate to a user that a disengagement is now possible. Furthermore, in alternative embodiments, it is possible that disengagement may only occur within fixed specified geographical regions, such as a region where the tag is held over a receptacle, as shown in Figure 8 Thus, in this embodiment, disengagement will only occur when a receptacle is available to receive the component parts.

Claims

1. A security tag for location upon an article and removal from said article upon authorisation, comprising:

a transmitter for transmitting an output signal to a mobile device; and

a receiver for receiving an input signal from an administration system indicating that the tag can be released, wherein:

said mobile device interacts with said administration system directly to effect a purchase of the item prior to the administration system issuing said input signal.

2. The security tag of claim 1, wherein said transmitter is activated after the tag has experienced an interaction with a user.

3. The security tag of claim 2, wherein a first visual indication is presented to said user in response to said interaction.

4. The security tag of any of claims 1 to 3, wherein said output signal represents a unique tag identification.

5. The security tag of claim 4, wherein said interaction includes sending said unique tag identification and a mobile identification to the administration system.

6. The security tag of any of claims 1 to 5, wherein said tag provides a second visual indication when said input signal has been received.

7. The security tag of any of claims 1 to 6, wherein the tag is released only after experiencing a further physical action performed by a user.

8. A method of removing a security tag from am article after said tag has been located on an article, comprising the steps of:

transmitting an output signal from a tag to a mobile device;

adapting an administration system to communicate directly with said mobile device to effect a purchase of the article; and

receiving an input signal at the tag from the administration system to authorise the release of the tag.

9. The method of claim 8, wherein the transmitter is activated to produce an output signal after an operation has been performed upon the tag by a user.

10. The method of claim 9, wherein a visual indication is presented to a user in response to the tag detecting said operation.

11. The method of any of claims 8 to 10, wherein said output signal represents a unique tag identification.

12. The method of claim 11, wherein said communication includes sending said unique tag identification and a mobile identification to the administrative system.

13. The method of any of claims 8 to 12, wherein the tag provides a second visual indication when said inpt signal has been received.

14. The method of any of claims 8 to 13, wherein the tag is released only after experiencing a further physical action performed by the user.

15. A security tag substantially as herin described, with reference to

the accompanying drawings.

16. A method of removing a security tag substantially as herein described with reference to the accompanying drawings.

Application No:	GB1512792.1	**Examiner:**	Mr Philip Lawrence
Claims searched:	1-15	**Date of search:**	28 January 2016

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-14	US2014/0085089 A1 (TYCO FIRE & SECURITY), see Abstract, Figures and Paragraphs [0033], [0035]-[0040], [0043], [0059], [0070], [0071], [0101]-[0104] especially.
X	1-14	GB2503720 A (MESSULAM), see whole document.
X,E	1, 2, 4-7	WO2015/121833 A1 (VISA INTERNATIONAL), see Abstract, Figures and Paragraphs [0084]-[0091].
X,P	1, 2, 4-7	EP2759975 A (NXP), see Abstract, Figures and Paragraphs [001]-[0021]
X,E	1, 4	WO2015/189825 A2 (TREADIM), see Abstract, Figures and Page 9 lines 14-23
X	1	US2007/0205902 A1 (CHECKLIST SYSTEMS), see Abstract, Figures and Paragraphs [0030], [0034].
X	1	US2007/0131005 A1 (CLARE), see Abstract, Figure 2 and Paragraphs [0030], [0035]-[0037], [0042].

Categories:

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.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

E05B; G06Q; G08B

The following online and other databases have been used in the preparation of this search report

EPODOC, TXTA, WPI

International Classification:

Subclass	Subgroup	Valid From
G08B	0013/24	01/01/2006
E05B	0073/00	01/01/2006