(19) DANMARK

(10) DK/EP 1855964 T3

(12) Oversættelse af europæisk patentskrift

Patent- og Varemærkestyrelsen

(51) Int.Cl.: *B 65 F 1/06 (2006.01)* *B 07 C 5/34 (2006.01)* *G 01 V 15/00 (2006.01)*

(45) Oversættelsen bekendtgjort den: **2016-05-23**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2016-02-17**

(86) Europæisk ansøgning nr.: **05722200.2**

(86) Europæisk indleveringsdag: **2005-03-11**

(87) Den europæiske ansøgnings publiceringsdag: **2007-11-21**

(86) International ansøgning nr.: **SE2005000353**

(87) Internationalt publikationsnr.: **WO2006096101**

(84) Designerede stater: **AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU MC NL PL PT RO SE SI SK TR**

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(54) Benævnelse: **ANORDNING OG FREMGANGSMÅDE TIL SORTERING AF AFFALDSBEHOLDERE**

(56) Fremdragne publikationer:
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DATABASE WPI Week 200413, Derwent Publications Ltd., London, GB; Class P43, AN 2004-126761, XP003017548 & JP 2004 018201 A (TOKYO SHIBAURA ELECTRIC CO) 22 January 2004

DESCRIPTION

Field of the Invention

[0001] The present invention relates to an arrangement and a method for sorting of waste containers.

Background Art

[0002] Arrangements for sorting of waste containers in the form of bags are known from, for instance, SE8901046-6, WO93/06945A1 and EP0759816B1. Methods for sorting of waste are known from, for instance, WO03/039773A1 and WO2004/050264A1.

[0003] These prior-art arrangements sort waste containers into two or more fractions. In some of the documents, this is done based on the colours of the waste containers. For example, black waste containers can be sorted into a biodegradable fraction whereas white waste containers are sorted into a combustible fraction. Waste containers with different colours can be used for sorting into respective fractions for, for example, recyclable rigid plastic, metal, glass etc.

[0004] A drawback in prior-art arrangements for sorting of waste containers is that objects, such as newspapers, empty bags, sheets of plastic etc, can get onto the conveyor belt that transports the waste containers during sorting and, thus, wholly or partly block the sensor which records the colours of the waste containers. Also dirt on the waste containers can make it difficult for the sensor to identify them. This may result in incorrect sorting of the waste containers, with the ensuing manual correction work and/or reduced recyclability.

[0005] US2004/0133484A1 discloses a sorting arrangement according to the preamble of claim 1 for sorting of containers or other articles provided with RFID tags. This arrangement functions, however, only in situations where discrete containers, which are each provided with an RFID tag, are to be sorted, and is therefore not suited for sorting of domestic waste, which may contain disintegrated and/or sticky material.

[0006] WO2004/090799A1 discloses a system for sorting of recyclable products, which are each provided with an RFID tag. Also this system requires the articles that are to be sorted to be provided with an RFID tag each.

[0007] JP 2004018201 A discloses a system for discrimination of refuse, wherein an electronic information recording element is provided integrally at the refuse.

Summary of the Invention

[0008] An object thus is to provide a waste container as well as an arrangement and a method for sorting of such waste containers, which wholly or partly eliminate the drawbacks of prior-art technique and which allow an improved sorting quality, especially in sorting of domestic waste.

[0009] The invention is defined by the independent claims. Embodiments are evident from the dependent claims and from the following description and the accompanying drawings.

[0010] With a second sensor, the sorting quality can be improved by more information being made available before the decision about how each waste container is to be sorted. Moreover, the sensitivity to incorrect reading, or no reading, of a tag readable based on radio frequencies is reduced since also information about the colour or shade of the waste container can be used.

Brief Description of the Drawings

[0011] The waste container, the sorting arrangement and the method will now be described in more detail with reference to the accompanying schematic drawings.

Fig. 1 shows a waste container.

Fig. 2 shows a sorting arrangement according to one embodiment of the invention.

Fig. 3 shows part of a sorting method according to one embodiment of the invention.

Description of Embodiments

[0012] Fig. 1 shows a waste container 1, which consists of a thin-walled bag 6 of a flexible material, such as plastic, paper, metal or a combination thereof. The bag can have a closure 5 to prevent waste in the bag 6 from being spread outside the bag. Moreover, the bag is provided with means 2 which is readable based on radio frequencies, such as an RFID tag or the like. Such a tag may comprise a chip 4 and an aerial coil 3. The chip 4 may comprise a processor and a data memory (not shown). There are currently different types of RFID tags. Two main types are referred to as active and passive RFID tags, which differ from each other by the active RFID tag comprising a current source whereas the passive RFID tag receives its energy from a magnetic field inducing a current in the aerial coil.

[0013] When such a passive RFID tag 2 is subjected to a predetermined magnetic field, a current is induced in the aerial coil 3, which current is sufficient to drive the chip 4. As the chip 4 is driven, the processor retrieves information from the data memory and sends via the aerial coil 3 a response signal that corresponds to said information. According to the invention, the information comprises at least information about the type of waste for which the waste container 1 is intended. The emitted response signal may be perceived by a sensor 12 (Fig. 2) for reading based on radio frequencies. The sensor 12 can also be arranged to generate the magnetic field.

[0014] The tag 2 can be provided in the form of a very thin unit, in which the aerial coil 3 and the chip 4 are arranged on a carrier in the form of a film of plastic or paper, which can be provided with an adhesive. Tags of this type are known and disclosed, for example, in US-6,265,977 and US-6,107,920. The tag can then by means of the adhesive be applied to the waste container.

[0015] It will be appreciated that the vital parts of the tag, i.e. the aerial loop and the chip, can be arranged directly on or in the waste container or the material of which it is made, an additional carrier. The term "tag" is thus only to be understood to comprise the parts that are required for the identification of the waste container based on radio frequencies to be possible.

[0016] According to one embodiment, the RFID circuit can wholly or partly be printed directly on the waste container by means of polymer electronics/paper electronics, for instance of the type discussed in US-2004/0256644.

[0017] According to one embodiment, a set of waste containers comprising at least two different waste containers is provided, which are intended for different types of waste and, thus, differ from each other with regard to the information that is available in the data memory of the tag. In one variant of this embodiment, the two different waste containers differ from each other also with regard to the colour or shade of the waste containers. The colour or the shade can thus represent the type of waste for which the respective containers are intended. This colour coding of the waste containers can be used by the users as well as by the sorting arrangement in order to distinguish different types of waste.

[0018] Fig. 2 is a simplified view of a sorting arrangement 10 for waste containers 1. The sorting arrangement comprises a conveyor 11, in this case a conveyor belt, on which waste containers 1 to be sorted are transported at the left end of the conveyor shown in the Figure. A first sensor 12 is arranged for reading, based on radio frequencies, of tags 2 arranged on the waste containers 1 and readable based on radio frequencies, as described above. When reading the tag 2 of a waste container, the sensor 12 receives a signal corresponding to at least part of the information available in the data memory of the tag 2. The signal is sent to a control unit 14.

[0019] The waste container can also pass a second sensor 13, which can be a sensor of the type which is disclosed in SE8901046-6, WO9306945A1 and EP0759816B1 and which identifies a colour or a shade of the passing waste container, a second signal representing said colour or shade being sent to the control unit 14. The first and second sensors 12, 13 can be arranged in any relative order. Thus it need not be important which sensor records the waste container 1 first.

[0020] Sorting means 15a, 15b are arranged to selectively strike or push a waste container 1 away from the conveyor 11, so that

the waste container gets into a collecting vessel 16a, 16b. The control unit 14 can be arranged to produce control signals to the sorting means 15a, 15b. based on the time of arrival of the signals from the sensors 12, 13 and knowledge of the transport speed of the conveyor. This results in sorting of the waste container in two collecting vessels 16a, 16b, which, for example, can be intended to contain biodegradable and combustible waste respectively.

[0021] It will be appreciated that the sorting arrangement, the conveyor and the sorting means can be designed in various ways. Conveyors of different types can be used, such as belt conveyors, screw conveyors, overhead conveyors, chain conveyors etc. Also pipes in which the waste containers are made to be transported under the action of excess pressure, negative pressure and/or gravity may constitute conveyors. Also the number of collecting vessels can be varied according to the number of sorting fractions that are desired.

[0022] Also the sorting means can be arbitrarily designed.

[0023] Fig. 3 illustrates a method in sorting of waste containers. The method comprises recording 101, by reading, based on radio frequencies, of a tag 2 arranged on a waste container 1 and readable based on radio frequencies. The method further comprises, optionally, recording 102 of a colour or a shade of the waste container 1. Subsequently the signals received from the first and second recordings are compared 103, 104. If the signals correspond with each other, i.e. indicate the same type of waste, it is determined 105 to which fraction the waste container 1 is to be sorted. Then a control signal is sent 106 to the sorting means 15a, 15b.

[0024] If the signals do not correspond with each other, a measure is initiated 107 in response thereto. Such a measure can be to return 108 the waste container to be sorted once more. Another measure may involve transporting the waste container to a separate vessel 109 for, for instance, manual sorting, controlled deposition or the like.

[0025] It will be appreciated that the sorting arrangement 10 can be programmed so that output data from one of the sensors 12, 13 have greater weight, allowing these data to be decisive, should the signals in the comparison 103 not correspond with each other.

[0026] It will also be appreciated that the relative order in which the sensors 12, 13 record the waste container 1 is optional, and that the reading can take place sequentially or simultaneously.

[0027] The memory of the tag 2 may also contain further information, such as information as basic data for debiting (optionally in combination with a weighing function in the conveyor 11 or in the collecting vessels 16a, 16b) of waste handling costs or information making it possible to trace the contents of the waste container to a given household or a given retailer of waste containers.

[0028] According to an alternative embodiment, a first sorting into at least two different fractions can be carried out based on colour or RFID. Subsequently a second sorting of at least one of the two fractions based on colour or RFID takes place. According to a first example, the first sorting can take place based on colour or shade of colour, after which one of the two fractions is sorted based on RFID. According to a second example, the first sorting takes place based on RFID and the second sorting based on colour or shade of colour.

[0029] According to one embodiment, use is made of "positive separation" as disclosed in WO2004/050264A1, i.e. sensors 12, 13 record a colour and/or an RFID, waste containers 1 with a predetermined colour and/or RFID being separated from the conveyor 11 by the sorting means 15a, 15b, and waste containers 1 which do not have said pre-determined colour and/or RFID coming along to the end of the belt and getting into a mixed fraction or being returned for new sorting.

[0030] According to an alternative embodiment, "negative separation", as disclosed in WO03/039773A1, is used, i.e. sensors 12, 13 record a colour and/or an RFID, waste containers 1 which do not have a predetermined colour and/or a predetermined RFID being separated from the conveyor 11 by the sorting means 15a, 15b, and waste containers 1 which have said predetermined colour and/or RFID coming along to the end of the belt and getting into a mixed fraction or being returned for new sorting.

[0031] It will be appreciated that the here shown use of tags readable based on radio frequencies can be used independently or in combination with reading of colour-coded waste containers.

[0032] According to an alternative embodiment, the waste containers 1 are provided with an optically machine-readable code, which indicates the type of waste for which the respective waste containers are intended. Examples of such codes are characters (letters, numerals or the like) or patterns, such as a bar code or a position-coding pattern of the type disclosed in US-5,852,434,

EP-0 578 692, EP-0 171 284 and US-2004113898. In this embodiment, the same, or a third, sensor 13 can be arranged to read the code and send this to the control unit 14 for controlling the sorting means 15a, 15b in accordance with that described regarding the second sensor.

[0033] As another embodiment, it may be mentioned that the waste container, as a second property, has a fluorescent or luminescent capacity, which is recordable by the second sensor, possibly combined with a source of energy for excitation.

[0034] It will further be appreciated that even if the above embodiments are shown with reference to a sorting arrangement with two sorting means 15a, 15b, the principles described above are applicable to sorting arrangements of any size, with any number of sorting means and with sorting into any number of collecting vessels.

[0035] It will also be appreciated that it is possible to provide an arrangement and a method for sorting of waste containers using the RFID sensor only, i.e. without the second sensor for colour or shade.

[0036] According to another embodiment, it is possible to use RFID tags that are also printable. In such an embodiment, it is possible to print, at a weighing station comprising a first sensor/printer, information in the RFID tag, for instance regarding the weight of the waste container, and at a subsequent station, possibly in connection with sorting, i.e. in reading by means of the first sensor 12, read this information and control the sorting means 15a, 15b based also on this information. Such weighing can take place when supplying the waste container to a waste handling system, for instance adjacent to a refuse chute; when collecting the waste container to be transported to a sorting plant, when the waste container arrives at the sorting plant and/or in direct connection with sorting.

REFERENCES CITED IN THE DESCRIPTION

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P A T E N T K R A V

1. Anordning (10) til sortering af en flerhed af affaldsbeholdere (1) designet til at modtage en mængde affald og som er forsynet med midler (2), der er læsbare på baggrund af radiofrekvenser, omfattende:

et transportbånd (11) anbragt for at transportere affaldsbeholderne (1),

en første sensor (12), til at aflæse på baggrund af radiofrekvenser, der er anbragt til at kunne udsende et signal, når en affaldsbeholder (1), der transporteres på transportbåndet (11) er aflæst af den første sensor (12), og

midler (15a, 15b) til sortering af affaldsbeholderne (1) på baggrund af signalet fra den første sensor (12),

hvor den første sensor (12) er anbragt for at aflæse midlerne (2), der er læsbare på baggrund af radiofrekvenser og anbragt er på affaldsbeholderen (1),

k e n d e t e g n e t ved, at

anordningen omfatter en anden sensor (13) til detektering af en anden egenskab af affaldsbeholderen (1) og til at udsende et andet signal som svar på, at den anden sensor (13) aflæser en affaldsbeholder (1), med den anden egenskab, der transporteres på transportbåndet (11), og

sorteringsmidlerne (15a, 15b) er anbragt for også at sortere affaldsbeholderne (1) på baggrund af det andet signal.

2. Anordning ifølge krav 1, hvor den første sensor (12) er en RFID-sensor.

3. Anordning ifølge krav 1 eller 2, hvor den anden egenskab er en farve, en farvenuance, et eller flere tegn, et mønster og/eller et taktilt mærke.

4. System til sortering af affald, hvor systemet omfatter

en anordning ifølge et hvilket som helst af krav 1-3; og

mindst to affaldsbeholdere (1),

der er designet til engangsbrug og til at modtage en mængde affald,

der hver er forsynet med midlerne (2), der er læsbare på baggrund af radiofrekvenser, og

der er forskellige fra hinanden med henblik på en egenskab, der kan aflæses af en sensor (12, 13) og af en bruger, hvor egenskaben i det mindste delvist repræsenterer information som kan afledes fra midlerne (2), der er læsbare på baggrund af radiofrekvenser.

5. System ifølge krav 4, hvor midlerne (2), der er læsbare på baggrund af radiofrekvenser omfatter et RFID-middel.

6. System ifølge krav 4 eller 5, hvor midlerne (2) er fastgjort til affaldsbeholderen (1) ved hjælp af et klæbemiddel, såsom lim eller dobbeltklæbende tape.

7. System ifølge krav 1 eller 2, hvor midlerne (2) er i det mindste delvist fastgjort til affaldsbeholderen i form af polymer elektronik.

8. System ifølge et hvilket som helst af krav 4-7, hvor affaldsbeholderen (1) i det

væstenlige består af en pose (6) eller boks af polymermateriale, papir, metal, plastikbelagt papir, metalbelagt plastik eller metalbelagt papir.

9. System ifølge et hvilket som helst af krav 4-8, hvor affaldsbeholderen i det væsentlige består af en tyndvægget pose (6) af fleksibelt materiale.

10. Fremgangsmåde til sortering af affald, omfattende, at:

forsyne en flerhed af affaldsbeholdere (1) som er designede til at modtage en mængde affald, og er forsynet med midler (2), der er læsbare på baggrund af radiofrekvenser, hvor hver af affaldsbeholderne indeholder affald,

aflæse (101), ved hjælp af en første sensor (12), affaldsbeholderne (1), når de transporteres på et transportbånd, hvor aflæsningen opnås ved læsning, på baggrund af radiofrekvenser, af midlerne (2), der er læsbare på baggrund af radiofrekvenser,

aflæse (102), ved hjælp af en anden sensor (13), en anden egenskab af affaldsbeholderne (1), der transporteres på transportbåndet,

styre (106) midler (15a, 15b) til sortering af affaldsbeholderne (1), baseret på aflæsningen på baggrund af radiofrekvenser og på aflæsningen af den anden egenskab.

11. Fremgangsmåde ifølge krav 10, hvor den anden sensor optager en farve eller en farvenuance i det synlige spektrum, et eller flere tegn, et mønster og/eller et taktilt mærke.

12. Fremgangsmåde ifølge krav 10 eller 11, hvor én af affaldsbeholderne (1) vendes mod en sorteringsbeholder (16a, 16b) udelukkende på baggrund af signalet fra den første sensor (12) eller udelukkende på baggrund af signalet fra den anden sensor (13).

13. Fremgangsmåde ifølge krav 10 eller 11, hvor én af affaldsbeholderne (1) rettes mod en sorteringsbeholder (16a, 16b) hvis, og kun hvis, signalerne fra den første sensor (12) og fra den anden sensor (13) svarer til hinanden med hensyn til hvilken sorteringsbeholder (16a, 16b) affaldsbeholderen (1) skal rettes mod.

14. Fremgangsmåde ifølge krav 10 eller 11, hvor affaldsbeholderen (1) returneres til ny læsning af i det mindste én af nævnte første og anden sensorer (12, 13), hvis signalerne fra den første sensor (12) og fra den anden sensor (13) ikke svarer til hinanden.

15. Fremgangsmåde ifølge krav 10 eller 11, hvor affaldsbeholderen rettes mod en sorteringsbeholder til usorteret affald, hvis signalerne fra den første sensor (12) og fra den anden sensor (13) ikke svarer til hinanden.

16. Fremgangsmåde ifølge et hvilket som helst af krav 10-15, hvor affaldsbeholdere som ikke giver anledning til et gyldigt signal fra den første sensor (12) fjernes fra transportbåndet (11).

17. Fremgangsmåde ifølge et hvilket som helst af krav 10-15, hvor affaldsbeholdere som ikke giver anledning til et gyldigt signal fra i det mindste en af nævnte første og anden sensorer (12, 13) fjernes fra transportbåndet (11).

DRAWINGS

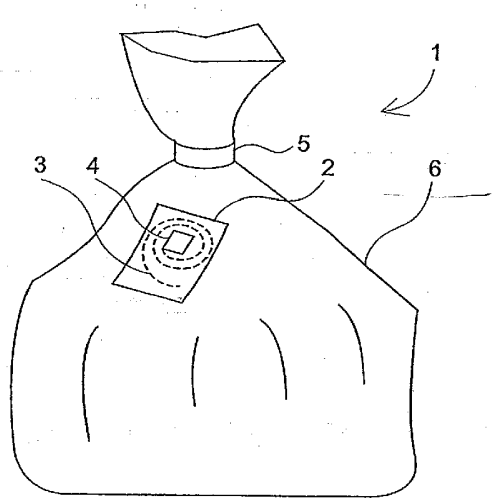

Fig 1

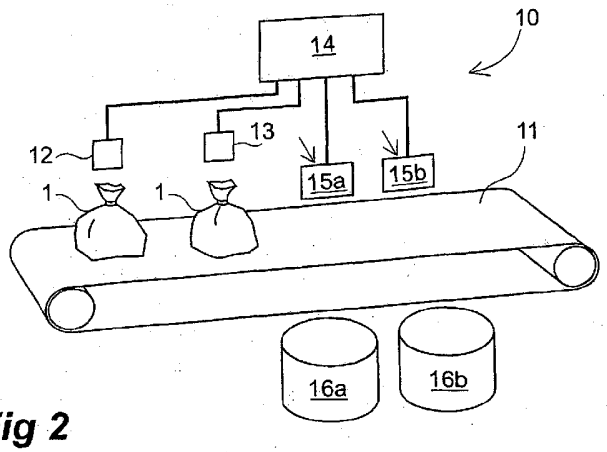
10
14
12
13
15a
15b
11
1
1
16a
16b

Fig 2

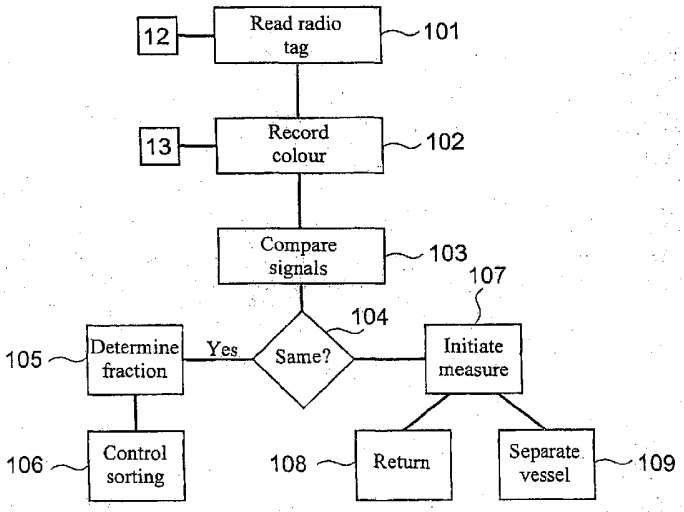
12
Read radio tag
101
13
Record colour
102
Compare signals
103
107
104
105
Determine fraction
Yes
Same?
Initiate measure
106
Control sorting
108
Return
Separate vessel
109

Fig 3