(19) DANMARK

(10) **DK/EP 3459878 T3**

Patent- og
Varemærkestyrelsen

(12) Oversættelse af
europæisk patentskrift

(51) Int.Cl.: ***B 65 F 1/06 (2006.01)*** ***G 06 Q 10/06 (2012.01)*** ***G 06 Q 10/08 (2012.01)***
G 06 Q 50/26 (2012.01)

(45) Oversættelsen bekendtgjort den: **2021-05-17**

(80) Dato for Den Europæiske Patentmyndigheds
bekendtgørelse om meddelelse af patentet: **2021-03-03**

(86) Europæisk ansøgning nr.: **18195904.0**

(86) Europæisk indleveringsdag: **2018-09-21**

(87) Den europæiske ansøgnings publiceringsdag: **2019-03-27**

(30) Prioritet: **2017-09-21 FR 1771002**

(84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

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(54) Benævnelse: **SYSTEM OG FREMGANGSMÅDE TIL SPORING AF FYLDNING AF ET SÆT AF AFFALDSBEHOLDERE**

(56) Fremdragne publikationer:
EP-A1- 0 626 569
EP-A1- 1 482 285
WO-A1-2017/074521
FR-A1- 2 902 876
Ferran Adelantado ET AL: "Understanding the Limits of LoRaWAN", IEEE Communications Magazine, 13 février 2017 (2017-02-13), pages 34-40, XP055534686, DOI: 10.1109/MCOM.2017.1600613 Extrait de l'Internet: URL:https://arxiv.org/pdf/1607.08011.pdf [extrait le 2018-12-14]
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DESCRIPTION

[0001] The present invention belongs to the field of waste collection, and more particularly waste collection in a site with a high density of passers-by, i.e. a defined site through which more than 50,000 people might pass every day, for example.

[0002] A site with a high density of passers-by could be a railway station, an airport, a bus station, a business center, a shopping center, an exhibition space, a live entertainment space, a sports venue, a zoo, a theme park, etc.

[0003] Generally, a site with a high density of passers-by consists of several spaces of different sizes such as a hall, with the spaces being interconnected by corridors or passages, which can also be of different sizes.

[0004] In a site of this kind, collecting and picking up waste is a major issue when it comes to maintaining good hygiene and cleanliness conditions. A set of waste containers is therefore distributed more or less uniformly in the different spaces and corridors so as to provide users of the site with a large number of options for disposing of their waste in a waste container.

[0005] The goal of the maintenance service is to avoid a waste container remaining too full for too long. When a waste container is full, the users may be tempted to throw their waste on the ground, which can quickly mar the cleanliness of a site. Aside from the negative impression this can give to users of the site, it can also generate significant additional costs with regard to the cleaning and maintenance of the site.

[0006] In this context, so as to facilitate the collection of waste, each waste container can be provided with a removable receptacle such as a collection bag. However, the main difficulty in managing such a set of waste containers has to do with the frequency of emptying or collecting each waste container.

[0007] The filling speed of a waste container is completely random and depends on several factors such as the position of a container, the frequency and density of users passing by, and the likelihood that they have waste to throw away.

[0008] To respond to this problem, maintenance services typically send operators on patrol with the task of touring the various spaces and corridors on the site and emptying each waste container when they are full.

[0009] However, owing to the aforementioned uncertainties of the filling speed of a waste container, it is not uncommon for a waste container to remain full for a prolonged period of time, depending on how the operator's tour is progressing, thus producing more waste around the full waste container.

[0010] WO 2014/063184 suggests a solution using a system for monitoring the filling of a set of waste containers comprising a monitoring box with which each waste container is provided. Each monitoring box comprises a power source which supplies power to at least one fill sensor of the waste container that is preferably an ultrasonic sensor, to a processor suitable for calculating the fill level of the waste container at two or three levels: empty, full and/or half-full, to a memory which stores the fill level of the waste container until said container is full, and to a transmitter suitable for transmitting data to a remote processing terminal. The transmitter here is a transmitter which uses a telecommunications network such as a "GPRS" or "Wi-Fi" network. The transmitter only transmits information to the remote terminal when the waste container is detected to be full.

[0011] By design, a monitoring box of this kind has large power requirements. The processor and the memory must be continuously supplied with power, while "GPRS"- and "Wi-Fi"-type transmitters consume a lot of power. Therefore, to supply power to a monitoring box, it is necessary to connect it to a mains socket and/or to provide it with a high-capacity battery, which requires regular charging.

[0012] However, connecting the monitoring box to the mains or using a high-capacity battery that is likely to require very regular replacement are too restrictive and not suitable in the context of a system for monitoring the filling of a set of waste containers arranged in a site with a high density of passers-by.

[0013] EP 1 482 285 A1 discloses a monitoring system according to the preamble of claim 1.

[0014] With regard to these problems, the present invention offers an eco-friendly approach by suggesting an alternative solution which allows optimal monitoring of the fill level of a set of waste containers. With this in mind, the applicant has developed a system for monitoring filling comprising a discrete and energy-efficient monitoring box which constitutes the basis for information feedback.

[0015] As a result, a first aspect of the present invention relates to a system for monitoring the filling of a set of waste containers according to claim 1.

[0016] Advantageously, introducing the relay unit into the structure of the system allows the data processing operations executed in the monitoring box to be kept to a strict minimum. Reducing the tasks of the monitoring box allows its dimensions to be reduced and allows the box to be made invisible while increasing the battery life of its power source. According to a first embodiment of the first aspect of the invention, the transmitter is a radio frequency transmitter set up to operate according to a low-value spreading factor which is between 50 chips/symbol and 200 chips/symbol.

[0017] The transmitter is preferably controlled at an uncluttered transmission frequency band. In this configuration, the relay unit comprises a radio frequency receiver for receiving the data transmitted by each transmitter.

[0018] According to an embodiment of the first aspect of the invention, the relay unit comprises a telecommunications module suitable for transferring, to the remote processing terminal via a telecommunications network, the data transmitted by each transmitter.

[0019] The monitoring system comprises at least one mobile terminal suitable for receiving, in real time, the fill rate of each waste container provided with an autonomous monitoring box, allowing at least one operator patrolling a site and provided with a mobile terminal to receive, in real time, information regarding the fill rate of the waste containers on the site.

[0020] According to an embodiment of the first aspect of the invention, each autonomous monitoring box comprises means for managing the power source which are configured to periodically wake the fill sensor and the transmitter so as to measure the filling of the waste container and to transmit this data. Advantageously, managing the periodic waking of the fill sensor and the transmitter allows the energy consumption to be reduced, and thus allows the battery life of the monitoring box to be increased.

[0021] In this context, the monitoring system comprises, between each wake period, a sleep interval which is between 2 minutes and 15 minutes, the sleep interval preferably being between 5 and 10 minutes.

[0022] According to an embodiment of the first aspect of the invention, the transmitter is a short-range transmitter, preferably for transmitting over a range between 50 m and 500 m.

[0023] A second aspect of the invention relates to a monitoring method which implements the monitoring system of the first aspect of the invention.

[0024] The monitoring method comprises:

- a step of generating a wireless message MZ which includes data regarding the fill rate of a waste container corresponding to a monitoring box, and an identification signature SN of the monitoring box;
- a step of transmitting, by the transmitter, a wireless message MZ to a relay unit;
- a step of relaying the data transmitted by the transmitter, the relay unit receiving each wireless message MZ and transforming it into a digital message MN, before transmitting the digital message MN to the remote processing terminal via its communication module;
- a step of processing, by the remote terminal, each digital message MN, the processing step consisting in identifying the origin of the digital message MN using the signature

SN that said message comprises, and in implementing a database relating to the fill rate of the identified waste container; and

- an alert step being triggered when a waste container reaches a predefined threshold fill rate, the alert step consisting in alerting an operator on a tour of the site that the waste container corresponding to the identified monitoring box has reached the predefined threshold fill value.

[0025] A monitoring method of this kind has the advantage of allowing monitoring in real time of the fill rate of a set of waste containers of site with a high density of passers-by. The monitoring system allows the emptying tour of the waste containers to be adapted in real time using the alert step, and therefore allows a site with a high density of passers-by to be kept clean. At the same time, the various method steps are designed so that the monitoring box consumes a minimal amount of energy.

[0026] According to a first specific feature of the second aspect of the invention, each autonomous monitoring box observes a sleep interval between two wake periods, the fill sensor and the transmitter of each monitoring box being activated simultaneously during a wake period so as to generate a wireless message MZ and transmit said message to the relay unit.

[0027] The sleep interval is preferably between 2 minutes and 15 minutes, preferably between 5 and 10 minutes.

[0028] According to a second specific feature of the second aspect of the invention, the wireless message MZ can also include data regarding the remaining level of the power source. Other specific features and advantages will be set out in the following detailed description of a non-limiting embodiment of the invention, which is illustrated by the appended figures 1 to 4, in which:

- Fig. 1 is a schematic view of a system for monitoring the filling of a set of waste containers according to an embodiment of the invention;
- Fig. 2 shows waste containers provided with a monitoring box according to an embodiment of the invention;
- Fig. 3 is a schematic view of a monitoring box according to an embodiment of the invention; and
- Fig. 4 is a graph showing the life of a battery as a function of a frequency of measurement of a monitoring box from figure 3.

[0029] The present invention relates to a system 1 for monitoring the filling of a set of waste containers 2 which are distributed over a site with a high density of passers-by. A waste container 2 is typically formed by a garbage can.

[0030] In the example shown in Fig. 1, so as to monitor the fill level of a predetermined number of waste containers 2 which form a set of waste containers 2, each waste container 2 comprises an autonomous monitoring box 3.

[0031] As shown in Fig. 2, each waste container 2 is provided with a monitoring box 3 and preferably comprises a closure 2a which closes said waste container 2 at the top at least in part. In this example, the closure 2a can be formed by an integral or partial cover which can be movable between an open position and a closed position. The monitoring box 3 is preferably positioned so as to be hidden by the closure 2a.

[0032] As shown in Fig. 3, each autonomous monitoring box 3 comprises a power source 4 such as a battery, which can be rechargeable. In this example, the power source 3 supplies power to at least one fill sensor 5 of the waste container 2.

[0033] The fill sensor 5 is preferably a "time-of-flight" distance sensor. More particularly, the fill sensor 5 can be formed by an optical sensor such as a laser sensor. The fill sensor 5 is preferably oriented toward a bottom of the waste container 2.

[0034] In the example in Fig. 3, a power source 3 supplies power to at least one transmitter 6 suitable for transmitting data to a remote processing terminal 7. In this example, the transmitter 6 is a radio frequency transmitter. In this example, the transmitter 6 transmits data in the form of a wireless message MZ.

[0035] The transmitter 6 is preferably controlled at a transmission frequency band which is not normally used. Advantageously, a little-used frequency range allows the transmission power to be reduced and provides a faster data transmission rate, allowing the power consumption of the transmitter 6 to be reduced. Depending on the country in which the invention is implemented, and on the standards of this country and the congestion of the frequency bands in this country, the frequency band may vary.

[0036] In France, the transmitter 6 can use ultra-high frequencies which are propagated in direct view. The transmission frequency band can therefore be controlled at 868 MHz, which is a little-used frequency band. Transmitting in a frequency band that is used too much and/or is too cluttered such as the 433 MHz frequency band instead would require increasing the transmission power and thus increasing the power consumption of the transmitter 6.

[0037] As shown in Fig. 3, each autonomous monitoring box 3 comprises a means 8 for managing the power source 4. In practice, the managing means 8 are configured to periodically wake the fill sensor 5 so as to periodically measure the filling of the waste container 2.

[0038] The managing means 8 preferably periodically wake the transmitter 6 which transmits the fill data immediately after they have been measured by the fill sensor 5.

[0039] Advantageously, this periodic waking of the fill sensor 5 and the transmitter 6 of each monitoring box 3 allows the energy consumption to be reduced, the power source 4 to be preserved, and the battery life of the autonomous monitoring box 3 to be increased.

[0040] In practice, the managing means 8 can be formed by an algorithmic program stored and executed by a microcontroller 9 with which the monitoring box 3 is provided. The microcontroller 9 here is formed by a processor and a memory.

[0041] The managing means 8 are parameterizable and interact with a temporal unit 10 with which the monitoring box 3 is provided so as to control the sleep intervals and the wake periods of the microcontroller 9, the fill sensor 5 and the transmitter 6.

[0042] The temporal unit 10 is a device which is supplied with power by the power source 4 and is used to beat and/or count a defined temporal measure such as a second. The temporal unit 10 here can be formed by a clock or a timer. It should be noted that a timer consumes less energy than a clock.

[0043] During each sleep interval, the fill sensor 5 is switched to a standby mode. Completely switching off the fill sensor 5 would require reinitialization at each restart. Reinitializing the fill sensor 5 consumes more energy than keeping the fill sensor 5 in standby mode. Advantageously, only the temporal unit 10, which consumes little energy, operates uninterrupted.

[0044] In this context, the monitoring system 1 comprises a sleep interval between each wake period of the microcontroller 9 and/or of the fill sensor 5 and/or of the transmitter 6. In this example, the sleep interval corresponds to a period in which the microcontroller 9 and/or the fill sensor 5 and/or the transmitter 6 do not operate. Each sleep interval is interposed between two wake periods of the microcontroller 9 and/or of the fill sensor 5 and/or of the transmitter 6 during which a fill measurement of the waste container 2 is carried out and transmitted to the remote processing terminal 7.

[0045] Furthermore, Fig. 4 shows the prolongation of the battery life of power source 4 such as a battery when the duration of a sleep interval is increased. Fig. 4 shows a curve of the longevity of a power source 4 on the y axis expressed in hours as a function of a sleep interval on the x axis expressed in milliseconds or ms.

[0046] Preferably, in this context, the sleep interval can be between 2 minutes and 15 minutes and is preferably between 5 and 10 minutes. For example, by using a 5000 mA battery, such a sleep interval results in a battery life of more than 8000 hours of effective operation, or approximately 12 months of battery life.

[0047] The managing means 8 allow other radio transmission parameters to be modulated so as to reduce the energy consumption of the transmitter 6.

[0048] The spreading factor of the spectrum, the transmission power and the transmission rate are the other main parameters which influence the energy consumption of the transmitter 6.

[0049] In this example, so as to reduce the energy consumption of the transmitter 6, the managing means 8 allow the spreading factor of the spectrum to be parameterized to a low value. Preferably, the transmitter 6 has a spreading factor of between 50 chips/symbol and 200 chips/symbol, preferably of between 100 chips/symbol and 150 chips/symbol, and preferably of between 125 chips/symbol and 135 chips/symbol.

[0050] A low spreading factor allows a fast transmission rate which can be between 1 kB/s and 5 kB/s, preferably between 1.5 kB/s and 3 kB/s, and preferably between 2 kB/s and 2.5 kB/s.

[0051] A fast transmission rate allows the transmission time of the transmitter 6 to be reduced, which reduces the energy consumption of the transmitter 6.

[0052] At the same time, the transmission power of the transmitter 6 can be parameterized by the managing means 8 to a low value. The transmission power is preferably between 5 dBm and 20 dBm, preferably between 10 dBm and 15 dBm, and is preferably 13 dBm.

[0053] The optimization of the transmission parameters as described therefore allows the energy consumption of the transmitter 6 to be reduced while defining a short-range transmission radius which is effective in the context of an uncluttered frequency band. The transmission radius of the transmitter is preferably between 50 m and 500 m, preferably between 100 m and 200 m.

[0054] As shown in Fig. 1, the monitoring system 1 comprises at least one relay unit 12 which is positioned within the transmission radius of the transmitter 6 of the monitoring boxes 3 of a sub-set of waste containers 2 delimiting a reception field of the relay unit 12 and consisting of a fleet 13 of waste containers 2.

[0055] Depending on the dimensions of the site on which the monitoring system 1 is installed and on the number of monitoring boxes 3 installed for monitoring the set of waste containers 2 of said site, the monitoring system 1 can comprise a plurality of relay units 12, each relay unit 12 being connected to a fleet 13 of waste containers 2 which are located in its reception field.

[0056] The relay unit 12 is suitable for relaying each wireless message MZ transmitted by each transmitter 6 of the fleet 13 which is located in its reception field. The relay unit 12 relays the data to the remote processing terminal 7.

[0057] To this end, each relay unit 12 comprises a radio frequency receiver which allows the wireless messages MZ to be received and a conventional algorithm executed by a processor which allows each wireless message MZ to be transformed into a digital message MN.

[0058] So as to transmit each generated digital message MN, the relay unit 12 comprises a telecommunications module suitable for transferring the digital messages MN via a telecommunications network such as a GSM or Internet network, or a Wi-Fi network.

[0059] In a conventional manner, the telecommunications module can be formed by a SIM card, a modem, a network card, etc.

[0060] The remote processing terminal 7 is suitable for receiving and processing the digital message MN relayed by the relay unit 12. In this example, the remote processing terminal 7 implements a database.

[0061] As shown in Fig. 1, the monitoring system 1 comprises a monitoring interface 14 which allows the progress of filling and emptying of each waste container 2 to be monitored. According to a possibility of the invention, the monitoring interface 14 can allow the managing means 8 of each monitoring box 3 constituting the fleet 13 of each relay unit 12 to be parameterized remotely.

[0062] Advantageously, the monitoring interface 14 is accessible via a computer terminal suitable for communicating with the remote processing terminal 7 via a telecommunications network of the Internet type, the GSM type, etc.

[0063] Moreover, as shown in Fig. 1, the monitoring system 1 comprises at least one mobile terminal 15 suitable for receiving, in real time, the fill rate of each waste container 2 provided with an autonomous monitoring box 3. In practice, at least one operator patrolling the site is provided with a mobile terminal 15 which allows him to receive, in real time, information regarding the fill rate of the waste containers 2 of one or more fleets 13. This information allows each operator to optimize his tour of emptying the waste containers 2.

[0064] The remote processing terminal 7 transmits an alert to the mobile terminal 15 when the fill level of a waste container 2 reaches a threshold predefined by the monitoring interface 14. For example, it is possible to fix a threshold when the fill rate of a waste container 2 reached 75% of its capacity. In this way, each operator on a tour will benefit from a time interval sufficient to empty/collect the waste containers 2 for which he has already received an alert before proceeding to the location of the last waste container 2 for which he has received a new alert.

[0065] Other thresholds can be parameterized from the monitoring interface 14 to facilitate the monitoring of the emptying of a waste container 2. For example, thresholds can be parameterized at 25%, 50%, or 100% of fill rate of a waste container 2. The thresholds at 25% and 50% can be displayed on the monitoring interface 14 without being transmitted to the mobile terminal 15, or they can be transmitted to the mobile terminal 15.

[0066] Moreover, the processing terminal 7 can transmit an alert via a telecommunications network in the form of an "SMS"-type message and/or via an application installed on the mobile terminal 15.

[0067] In this example, the database indexes each monitoring box 3 and the waste container 2 with which it is associated, their area-specific position within the site, the fill rate of the waste container 2, the remaining level of the power source 4, and the attribution of each mobile terminal 15 to an area of the site.

[0068] The invention also relates to a method for monitoring a set of waste containers 2 distributed in a defined site. The monitoring method according to the invention uses a monitoring system 1 as described above.

[0069] The monitoring method comprises a step of fill measurement of each waste container 2 provided with an autonomous monitoring box 3. Preferably, the measuring step is carried out during the wake period of the fill sensor 5 of each monitoring box 3. During the measuring step, the fill sensor 5 measures the fill rate of the waste container 2.

[0070] The monitoring method comprises a step of generating a wireless message MZ. The wireless message MZ comprises the data of the fill rate of the waste container 2. The wireless message MZ can also include data regarding the remaining level of the power source 4. Preferably, the wireless message MZ comprises an identification signature SN of the monitoring box 3. Here, the step of generating the wireless message MZ is carried out by the microcontroller 9 of the monitoring box 3.

[0071] The monitoring method comprises a step of transmitting the wireless message MZ. Preferably, the step of transmitting the wireless message MZ during the wake period of the transmitter 6 and/or of the fill sensor 5 and/or of the microcontroller 9 of each monitoring box 3.

[0072] The steps of measuring, generating a wireless message MZ, and transmitting are preferably successive and quasi-simultaneous. This feature allows the energy consumption of the monitoring box 3 to be reduced and the power source 4 to be preserved.

[0073] In this example, the transmitter 6 simultaneously transmits three types of data to the remote processing terminal 7. The transmitter 6 transmits the data of the fill rate of the waste container 2. The transmitter 6 can also transmit data regarding the level of the power source 4. The signature data which allow the waste container 2 from which the wireless message MZ originates to be identified are also transmitted by the transmitter 6 to the remote processing terminal 7.

[0074] According to a particular embodiment of the invention, the steps of measuring, generating a wireless message MZ, and transmission of a monitoring box 3 follow one another at regular

intervals. Each interval corresponds to a sleep interval of the microcontroller 9, the fill sensor 5 and the transmitter 6 of each monitoring box 3. The sequence of sleep intervals and wake periods is managed by the managing means 8. The sequence of sleep intervals can be parameterized during the installation of the monitoring box 3, or optionally remotely from the monitoring interface 14.

[0075] Preferably, within a single fleet 13 of waste containers 2, each monitoring box 3 operates in a manner unsynchronized with the other monitoring boxes 3. In particular, each monitoring box carries out the steps of measuring, generating a wireless message MZ, and transmission in a manner unsynchronized with the other monitoring boxes 3 of the same fleet 13. In practice, the transmissions of the wireless messages MZ of each monitoring box 3 are staggered with respect to one another. Advantageously, this feature of the monitoring method 1 allows a collision between two wireless messages MZ at the relay unit 12 to be avoided.

[0076] The monitoring method comprises a step of relaying the data transmitted by each transmitter 6. The relaying step is carried out by a relay unit 12 which receives each wireless message MZ via its radio frequency receiver. In a second stage, the relay unit transforms the wireless message MZ into a digital message MN. The relay unit transmits the digital message MN to the remote processing terminal 7 via its communication module.

[0077] The monitoring method comprises a step of processing each digital message MN relayed by the relay unit 12 to the remote processing terminal 7.

[0078] The processing step comprises an implementation operation of a database with the new data contained in the last digital message MN received by the remote processing terminal 7. During the implementation operation, the origin of the digital message MN is identified using the signature SN which it comprises. Moreover, the digital message MN allows the data regarding the fill rate and the identified remaining level of the power source 4 of the monitoring box 3 to be updated.

[0079] The processing step comprises an analysis operation of the data implemented in the database. During the analysis operation of the implemented data the remote processing terminal 7 checks that the fill rate of the waste container 2 identified by the monitoring box 3 does not reach a predefined threshold value. When the predefined threshold value of the fill rate of a waste container 2 is reached, the monitoring method comprises an alert step. The alert step consists in alerting an operator on a tour of the site that the waste container 2 corresponding to the identified monitoring box 3 has reached the predefined threshold fill value. The operator on a tour will therefore be able to proceed as a matter of priority to the location of the waste container 2 in order to empty it. In practice, the remote processing terminal 7 transmits a message to the mobile

terminal 15 which is in charge of the area to which the waste container 2 of the identified monitoring box 3 belongs. The operator in possession of said mobile terminal 15 can therefore proceed as a matter of priority to the location of the waste container 2 in order to empty it.

[0080] The processing step can comprise an operation of filtering the data implemented for an identified monitoring box 3.

[0081] The filtering operation consists in checking whether the predefined threshold value had already been reached during the previous implementation operation. In this example, two successive implementations of the predefined threshold value, or of a value greater than the predefined threshold value, triggers the alert step.

[0082] Moreover, during the processing step, the remote processing terminal 7 can also check that the remaining level of the power source 4 does not reach a critical threshold value. When the remaining level of the power source 4 reaches the critical threshold value, the monitoring method comprises a special alert step in the same manner as the alert step, the remote processing terminal 7 transmitting a special alert message indicating to the operator in charge of the area that the level of the power source 4 of the identified monitoring box 3 requires intervention, for example replacement of the power source 4.

[0083] A special alert of this kind can also be transmitted to the monitoring interface 14, where it will be highlighted.

[0084] The special alert allows an unintentional interruption of the operation of each monitoring box 3 due to exhaustion of the power source 4 to be anticipated.

[0085] Furthermore, the monitoring method can comprise a security alert step when abnormal filling of a waste container 2 is detected or when the fill sensor 5 is blocked. Abnormal filling of a waste container 2 can consist in a low fill state at the predefined threshold value for the same waste container 2 during two successive implementations. In this case, the remote processing terminal 7 can be configured to transmit an alert message to the security service of the site indicating the waste container 2 for which abnormal filling has been detected.

[0086] The processing step can also allow detection of the absence of the closure 2a, and/or, if said closure is movable, detection of when said closure is locked in the open position. When the fill sensor 5 is not oriented toward the bottom of the waste container 2, it can transmit incorrect values which can be infinite. Under these conditions, the method can comprise a malfunction alert step which consists in sending a malfunction alert message to the monitoring interface 14 and/or the mobile terminal 15.

[0087] Furthermore, according to another embodiment of the invention, it is possible to provide the monitoring box 3 with additional sensors such as a smoke sensor, a metal sensor, a movement

sensor, etc. A combination of different sensors allows the information feedback to the remote processing server 7 to be diversified.

PATENTKRAV

1. System til overvågning (1) af fyldning af et sæt af affaldsbeholdere (2), der er fordelt over et sted med mange forbipasserende, hvilket overvågningssystem (1) omfatter:

- en selvstændig overvågningsboks (3), der er tilvejebragt på hver affaldsbeholder (2), hvor hver selvstændig overvågningsboks (3) omfatter en energikilde (4), der forsyner mindst én fyldningssensor (5) for affaldsbeholderen (2) og en sender (6), der er tilpasset til at sende data til en fjernbehandlingsterminal (7);
- en relæenhed (12), der er placeret i en senderadius for senderen (6) af en underenhed af affaldsbeholdere (2), hvilken relæenhed (12) er tilpasset til at videresende data, der er sendt af senderen (6) fra hver overvågningsboks (3) til fjernbehandlingsterminalen (7);

kendetegnet ved, at overvågningssystemet (1) omfatter:

- mindst én mobil terminal (15), der er tilpasset til i realtid at modtage fyldningsgraden af hver affaldsbeholder (2), der er udstyret med en selvstændig overvågningsboks (3), som gør det muligt for mindst én operatør, der kører i et område, og som er udstyret med en mobil terminal (15) i realtid at modtage informationer om fyldningsgraden af områdets affaldsbeholdere (2), og
- en opfølgningsgrænseflade (14), der gør det muligt at overvåge udvikling af fyldning og tømning af hver affaldsbeholder (2),

hvor behandlingsterminalen (7) er konfigureret til at sende en advarsel til den mobile terminal (15), når en affaldsbeholders (2) fyldningsgrad når en tærskel, der er foruddefineret af opfølgningsgrænsefladen (14).

2. Overvågningssystem (1) ifølge krav 1, **kendetegnet ved, at** senderen (6) er en radiofrekvenssender, der er indstillet til at fungere ifølge en spredningsfaktor med lav værdi, som ligger mellem 50 chips/symbol og 200 chips/symbol.

3. Overvågningssystem (1) ifølge krav 2, **kendetegnet ved, at** relæenheden (12) omfatter en radiofrekvensmodtager, der gør det muligt at modtage data sendt af hver sender (6).

4. Overvågningssystem (1) ifølge et af kravene 1 til 3, **kendetegnet ved, at** relæenheden (12) omfatter et telekommunikationsmodul, der er tilpasset til at overføre data sendt af hver sender (6), via et kommunikationsnetværk, til en fjernbehandlingsterminal (7).

5. Overvågningssystem (1) ifølge et af kravene 1 til 4, **kendetegnet ved, at** senderen (6) anvender ultrahøje frekvenser, der spredes i direkte synsvidde.

6. Overvågningssystem (1) ifølge krav 5, **kendetegnet ved, at** senderens (6) frekvensbånd er indstillet på 868 MHz.

7. Overvågningssystem (1) ifølge et af kravene 1 til 6, **kendetegnet ved, at** hver selvstændig overvågningsboks (3) omfatter midler til forvaltning (8) af energikilden (4), som er konfigureret til periodisk overvågning af fyldningssensoren (5) og senderen (6) for således at måle affaldsbeholderens (2) fyldning og sende disse data.

8. Overvågningssystem (1) ifølge krav 7, **kendetegnet ved, at** det omfatter et hvileinterval mellem hver aktiveringsperiode, som ligger mellem 2 minutter og 15 minutter, fortrinsvis ligger hvileintervallet mellem 5 og 10 minutter.

9. Overvågningssystem (1) ifølge et af kravene 1 til 8, **kendetegnet ved, at** senderen (6) er en kortdistancesender, der fortrinsvis gør det muligt at sende over en afstand på mellem 50 m og 500 m.

10. Opfølgningsfremgangsmåde ved hjælp af et overvågningssystem (1) ifølge et af kravene 1 til 9, hvilken fremgangsmåde omfatter

- et trin med generering af en trådløs meddelelse MZ, der omfatter data om fyldningsgraden af en affaldsbeholder (2) svarende til en overvågningsboks (3) og en identifikationssignatur SN for overvågningsboksen (3);
- et trin med senderens (6) afsendelse af den trådløse meddelelse MZ til en relæenhed (12); et trin med videresendelse af data sendt af senderen (6), relæenheden (12) modtager hver trådløs meddelelse MZ og omdanner den til en digital meddelelse MN, inden den sender den digitale meddelelse MN til fjernbehandlingsterminalen (7) via sit kommunikationsmodul;
- et trin med fjernterminalens (7) behandling af hver digital meddelelse MN, behandlingstrinnet består i at identificere oprindelsen af den digitale meddelelse MN via den signatur SN, som den omfatter, i at implementere en database for den identificerede affaldsbeholders (2) fyldningsgrad; og

- et advarselstrin udløses, når en affaldsbeholder (2) når en foruddefineret fyldningsgrad, advarselstrinnet består i at advare en operatør, der kører i området, om, at den affaldsbeholder (2), der svarer til den identificerede overvågningsboks (3), har nået den foruddefinerede tærskelværdi for fyldning.

11. Opfølgningsfremgangsmåde ifølge krav 10, **kendetegnet ved, at** hver selvstændig overvågningsboks (3) observerer et hvileinterval mellem to aktiveringsperioder, under en aktiveringsperiode, fyldningssensoren (5) og senderen (6) for hver overvågningsboks (3) aktiveres samtidigt for således at generere og sende en trådløs meddelelse MZ til relæenheden (12).

12. Opfølgningsfremgangsmåde ifølge et af kravene 10 og 11, **kendetegnet ved, at** behandlingstrinnet omfatter en filtrering af implementerede data for en identificeret overvågningsboks (3), filtreringen består i at kontrollere, om den foruddefinerede tærskelværdi allerede var nået ved den foregående implementering,

13. Opfølgningsfremgangsmåde ifølge krav 12, **kendetegnet ved, at** to efter hinanden følgende implementeringer af den foruddefinerede tærskelværdi eller af en værdi over den foruddefinerede tærskelværdi udlæser advarselstrinnet.

14. Opfølgningsfremgangsmåde ifølge et af kravene 10 til 13, **kendetegnet ved, at** fjernbehandlingsterminalen (7) kontrollerer, at energikildens (4) resterende niveau ikke når en kritisk tærskel, når energikildens (4) resterende niveau når den kritiske værdi, sender fjernbehandlingsterminalen (7) en særlig advarselsbesked, der oplyser den operatør, der har ansvaret for sektoren, om, at niveauet for energikilden (4) for den identificerede overvågningsboks (3) kræver et indgreb, for eksempel en udskiftning af energikilden (4).

15. Opfølgningsfremgangsmåde ifølge et af kravene 10 til 14, **kendetegnet ved, at** opfølgningsfremgangsmåden omfatter et trin med en sikkerhedsadvarsel, når der detekteres en unormal fyldning af en affaldsbeholder (2), eller når fyldningssensoren (5) er blokeret.

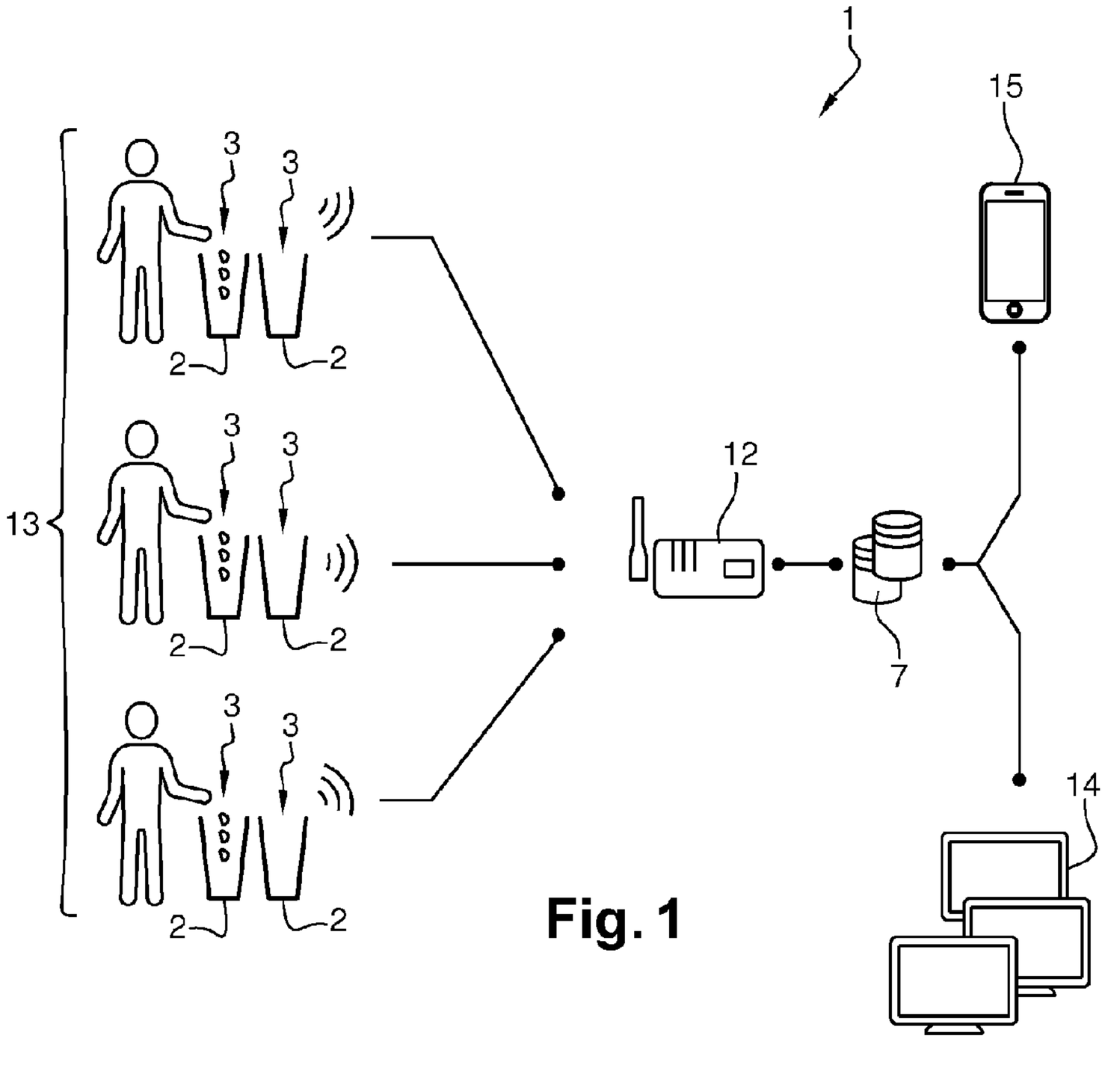

Fig. 1

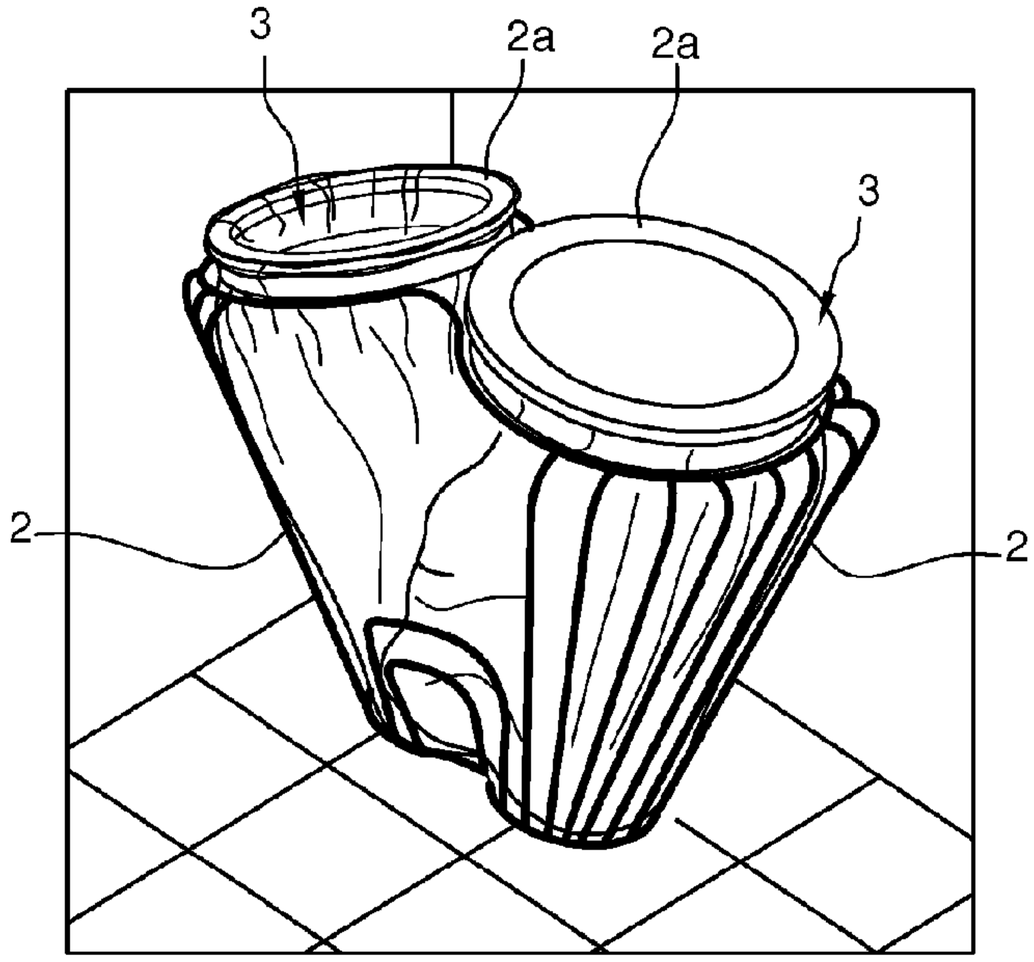

Fig. 2

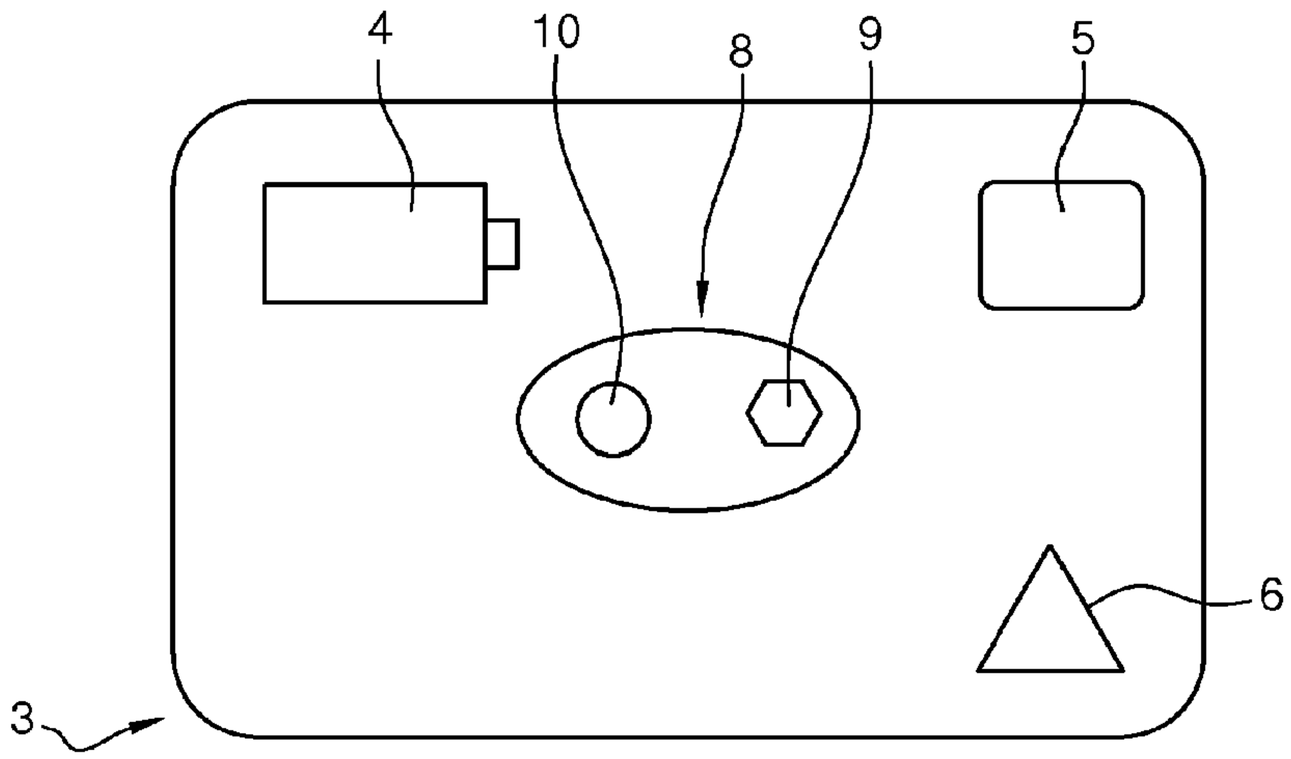
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Fig. 3

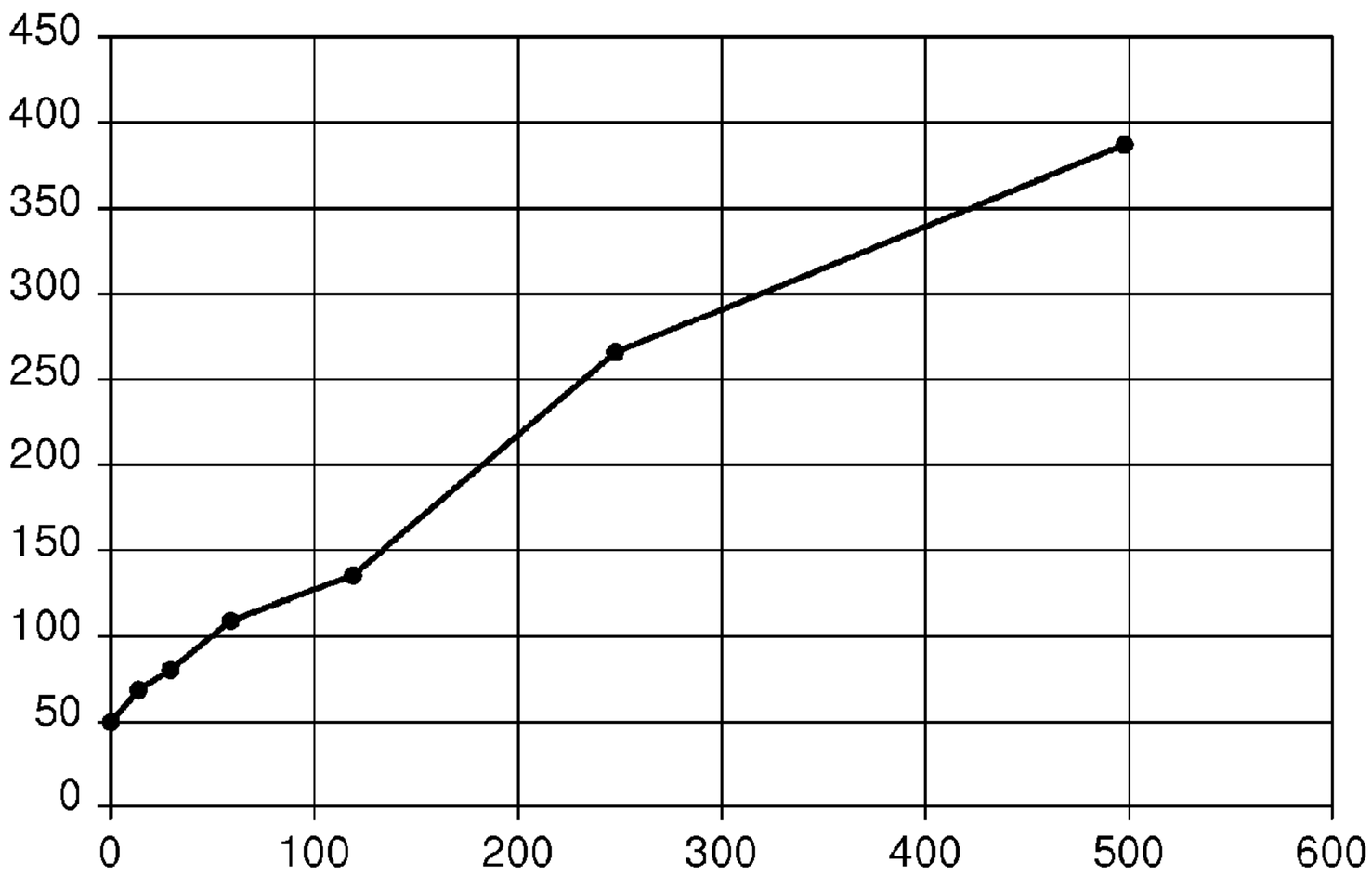
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Fig. 4