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(71) Applicant(s)

John Hugh Docherty
41 York Avenue, Finchfield, WOLVERHAMPTON,
WV3 9BX, United Kingdom

(72) Inventor(s)

John Hugh Docherty

(74) Agent and/or Address for Service

D W & S W Gee
Farmhouse Court, Marston, SUTTON COLDFIELD,
West Midlands, B76 0DW, United Kingdom

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(54) Abstract Title

Refuse receptacle with sensing and reward means

(57) A refuse receptacle 10 adapted to detect and reward the introduction of refuse comprises: a container 12 for receiving deposited items of refuse, sensing means 22 for sensing the introduction of an object into the receptacle and rewarding means for issuing a reward to the depositor of said refuse. Said sensing means comprises; two light emitters 24, 26, which cooperate with two mirrors 34, 36 in order to reflect the emitted light back and forth, thus creating upper and lower webs of radiation, the obstruction of which may be determined by light detectors 30 and 32. The direction of travel of an object may be determined from the order in which the two light webs are obstructed and therefore, the removal or improper insertion of an item into the receptacle may be detected.

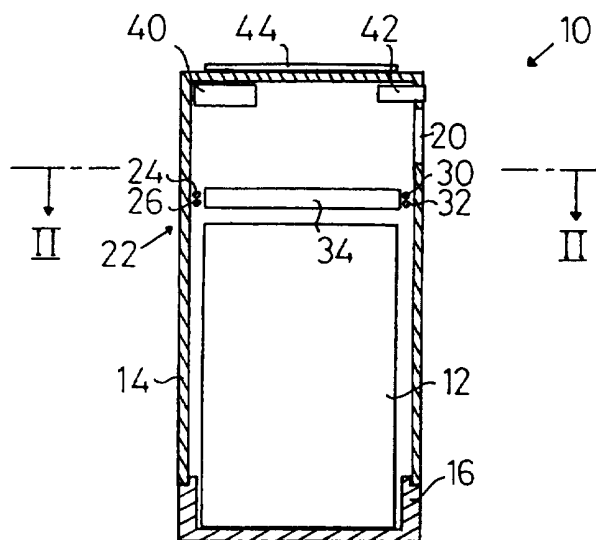
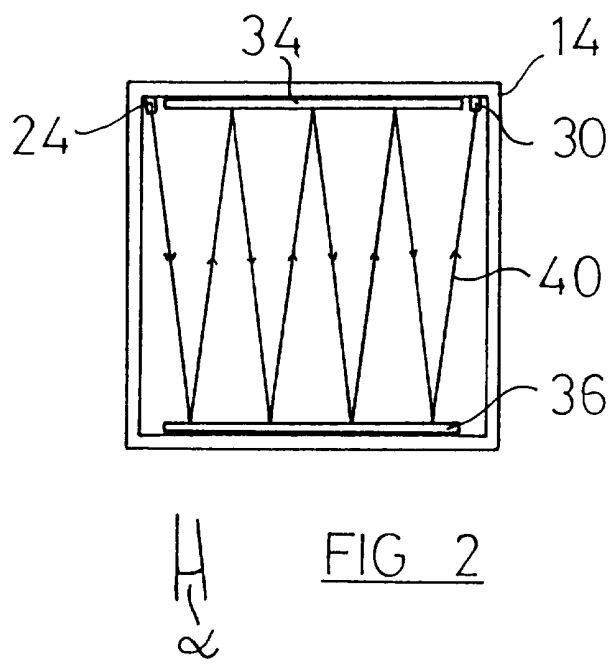
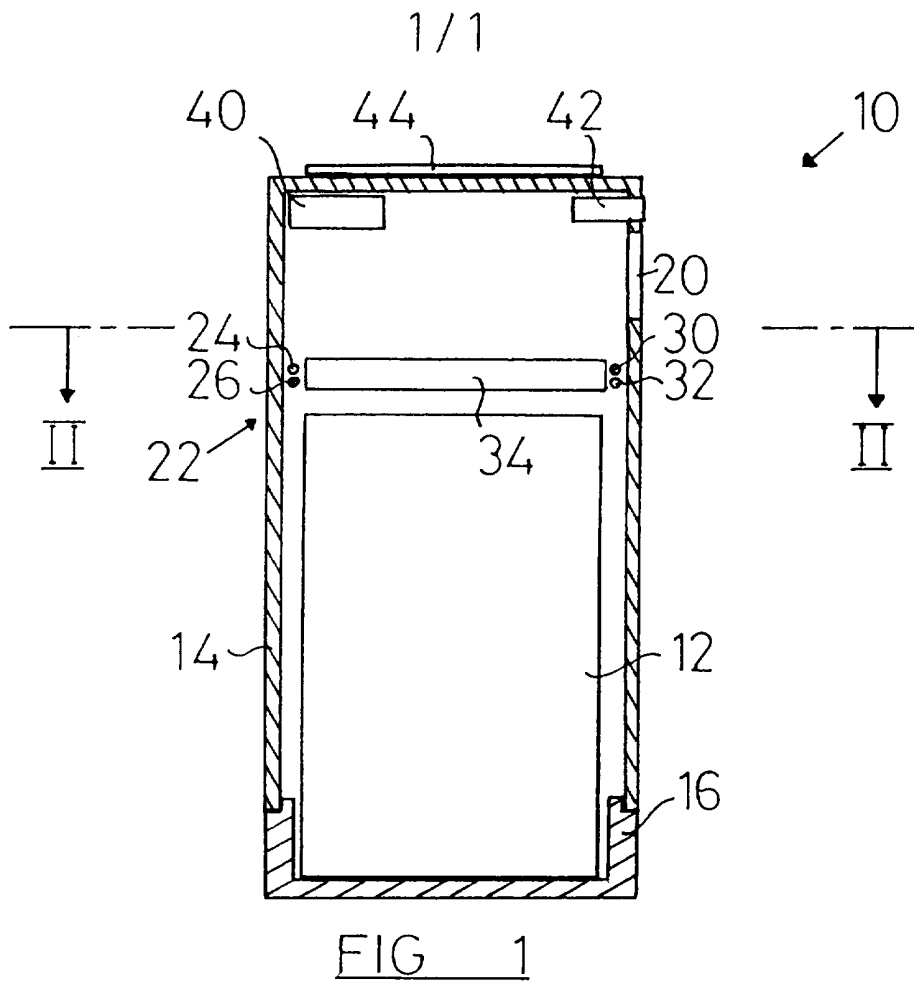


FIG 1



REFUSE RECEPTACLE

FIELD OF THE INVENTION

This invention relates to refuse receptacle, and in particular to a refuse receptacle adapted to detect and reward the introduction of refuse.

BACKGROUND TO THE INVENTION

In order to prevent refuse or waste such as paper and the like being dumped, local authorities and building occupiers often provide receptacles into which the refuse can be placed. Once placed in the receptacle, the items of refuse are conveniently stored pending their subsequent disposal.

However, notwithstanding the availability of receptacles, less considerate people are known to discard their refuse items away from the receptacle, the discarded refuse often being unsightly and perhaps being hazardous.

DESCRIPTION OF THE PRIOR ART

Refuse receptacles in the form of waste bins and the like are known, comprising a box-like container into which the refuse can be deposited. The receptacle can be open-topped,

or it can have an opening in one of its sides adjacent its top. The opening can be provided with a movable flap or the like, so that once the refuse has been placed inside the receptacle the flap swings back substantially to occupy the opening and so obscure the refuse inside the receptacle.

Gambling or fruit machines are also known which can detect the introduction of money into the machine. One such device is disclosed in GB patent 1,562,502.

Refuse receptacles which can detect and reward the introduction of specific items of refuse are also known, for example US patents 4,316,533 and 4,440,284 which detect and reward the introduction of certain types of aluminium can. Also, GB patent application 2,102,174 discloses a refuse receptacle which can detect predetermined items of refuse, and reward each deposit or a specified number of deposits of such refuse items.

However, the prior art devices discussed in the preceding paragraph accept and/or reward only predetermined waste items, so that there is no encouragement to the less considerate not to discard waste items for which there will be no reward.

STATEMENT OF THE INVENTION

The inventor has realised that to avoid or reduce the instances of discarded refuse, it is desirable to provide a refuse receptacle which can detect and reward the introduction of many or all different types of solid waste material, i.e. the refuse receptacle should preferably not be item specific as in the prior art disclosures discussed above.

Thus, according to the invention there is provided a refuse receptacle comprising a container for deposited items of refuse, sensing means for sensing the introduction of an item of refuse into the receptacle, and rewarding means for issuing a reward to the depositor of refuse, characterised in that the sensing means comprises first and second electromagnetic radiation emitters and respective first and second electromagnetic radiation detectors arranged adjacent the container.

Preferably, the first and second emitters are adapted to provide a substantially collimated (i.e. substantially non-divergent) beam of radiation incident upon the respective detectors, the first detector being arranged above the second detector in the path of the item of refuse so that the sequential interruption of the respective beams of radiation indicate the passage of an article of waste.

Suitably, control means are provided to sense the sequential interruption of the respective beams of radiation, the control means being connected to the rewarding means. The control means can be set to issue a signal to the rewarding means so that a reward is generated for every deposit which is sensed; preferably, however, the control means can be set to issue a signal to the rewarding means after a number of deposits have been sensed.

The provision of a first and second emitter and detector adjacent the container (perhaps above the container if the refuse falls downwardly into the container) permits the receptacle to sense the reverse passage of an article of waste (i.e. when the second detector is interrupted prior to the first detector), as may occur when an article of waste is being withdrawn for subsequent re-introduction into the receptacle. In such circumstances, the control means can be set so that {i} a signal to the rewarding means is not issued for a given period of time, {ii} a signal to the rewarding means is not issued in response to the subsequent deposit of refuse into the receptacle, or {iii} in the embodiment in which a number of deposits are required to effect a reward, the control means can subtract one or more deposits from the existing count.

Preferably, the electromagnetic radiation emitters and detectors operate in the infra-red part of the spectrum; preferably also the emitters are solid-state laser devices, and the detectors are photoelectric cells.

Usefully, the emitters cooperate with at least one mirror to reflect the respective beams of emitted radiation and create a "web" or webs of radiation above the container, so that only very small articles of refuse can pass through the web without being sensed. The density of the web can be chosen to determine the minimum size of refuse item which can pass without being sensed, so that the receptacle can for example be set up to reward only the deposit of relatively large refuse items.

Preferably, the web created by the second emitter and the mirror(s) closely matches that created by the first emitter and the mirror(s).

The receptacle may include an audio or visual signalling means, so that the sensing of an item of refuse is signalled by the emission of an audible or visual signal.

The rewarding means may issue money, tickets or tokens, which tickets or tokens may be redeemed for goods, services, or other forms of gain.

The energy required to power the emitters, detectors, control means and associated parts of the receptacle may be derived from mains electricity suitably adapted through a transformer and/or rectifier, or from batteries or solar power cells.

BRIEF DESCRIPTION OF THE DRAWINGS

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

Fig.1 is a side-sectional view of a refuse receptacle according to the invention; and

Fig.2 is a sectional view along the lines II-II of Fig.1.

DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

The refuse receptacle 10 shown in Fig.1 has a removable container 12, which is located within a housing 14 mounted on base 16. When it is desired to empty the receptacle the housing 14 may be lifted off the base 16, exposing the container 12, which may then be replaced with an empty container, or else the contents of the container can be removed for subsequent disposal, in known fashion.

The housing 14 is secured to the base 16 by fixing means (not shown) to prevent its unauthorised removal.

As is also known in this art, the housing 14 has an opening 20, the opening being above the container 12 and being adapted to receive the items of refuse being deposited. In

an alternative embodiment the aperture 20 is normally closed by a hinged flap or the like.

Between the aperture 20 and the top of the container 12 is the sensing means 22. The sensing means 22 comprises a first emitter 24, a second emitter 26, and corresponding first and second detectors 30 and 32 respectively. Between the emitters 24,26 and the detectors 30,32 is a mirror 34, which cooperates with another mirror 36 (Fig.2) to reflect the radiation from emitters 24,26 to the respective detectors 30,32. Thus, the emitter 24 and the mirrors 34,36 act to create a web of radiation 40 (and the emitter 26 and the mirrors 34,36 act to create a corresponding web (not shown) below the web 40), between the opening 20 and the container 12.

When an item of refuse is deposited into the receptacle, it passes between the mirrors 34,36. If the item of waste is of a sufficient size, the passage of radiation from the first emitter 24 to the first detector 30 is temporarily interrupted, and shortly thereafter the passage of radiation from the second emitter 26 to the second detector 32 is interrupted. The detectors 30,32 are connected to a control unit 40 which is responsive to the sequential interruption of the radiation beams, and so senses the introduction of an item of waste.

The control unit 40 is connected to the rewarding unit 42, which in this embodiment is located above the aperture 20 and is adapted to issue printed tokens.

In the embodiment shown the first emitter and the first detector are arranged directly above, and at the same angle, as the second emitter and detector respectively, so that the beam of radiation from the second emitter follows a similar path to the beam of radiation from the first emitter, the beams being (vertically) spaced apart. In an alternative but less desirable embodiment the beams follow differing paths.

It will be understood that the density of the web 40, i.e. the number of times each beam is reflected between the emitter and detector, is dependent upon the angle α of the emitter 24. The smaller the angle α (for a given size of receptacle) the greater the density of the web and the smaller the items of refuse which will be sensed. However, it may be desirable to have a relatively large angle α , perhaps up to 20° , resulting in a web which is relatively open, and so that for example the temptation to tear a large item of waste paper into many smaller pieces, and so gain a greater reward, is discouraged.

It will be understood that the density of the web is also dependent upon the distance between the mirrors 34,36, so that the angle α can be varied in accordance with this

distance to create the web density required (a larger distance between the mirrors requiring a smaller angle α to create a similar density web).

The control unit 40 issues a signal to an audio transmitter (not shown) to signal the sensing of an item of refuse; alternatively, a visual indicator may be provided adjacent the rewarding unit 42 for a similar purpose.

In this embodiment, the control unit is able to sense the reverse passage of an item of refuse, i.e. when the radiation from emitter 26 is interrupted prior to the radiation from emitter 24. The control unit 40 includes a timer so that in the event of the sensing of the reverse passage of an item of refuse a signal to the rewarding unit will not be issued for a given period of time, perhaps 300 seconds for example. Alternatively, in an embodiment in which the control unit includes a counter to count successive deposits, and is set to issue a signal to the rewarding unit only after a predetermined number of deposits have been made, the control unit can subtract one or more deposits from the counter total when the reverse passage of an item of refuse is sensed.

In addition, if both beams of radiation are interrupted for an extended period of time, for example one second or more (as may occur if for example a person places his or her arm into the receptacle to remove several items of refuse for

subsequent reintroduction), the control unit can be set so as not to issue a rewarding signal for a given period of time, or to issue an audible alarm signal. Such alarm signal would also be issued if the radiation beams were interrupted by refuse overflowing the container, indicating that the container required emptying.

The emitters 24,26 in this embodiment are spaced apart by a vertical distance of 2cm; the emitters are parallel, and the collimated beams of radiation maintain this separation substantially unchanged, so that the detectors 30,32 are similarly spaced. The spacing of the beams of radiation permits an additional method of rewarding only larger items of waste, in that the control unit can be set to issue a signal to the rewarding unit (or to add to the count) only if both radiation beams are interrupted together (i.e. the item of refuse is still interrupting the radiation from the first emitter when it also interrupts the radiation from the second emitter). Accordingly, the sequence of events needing to be detected by the control unit in order for a signal to be issued to the rewarding unit (or to increase the count) is: (i) the beam to the first detector is interrupted; (ii) the beams to both the first and second detectors are interrupted together, and (iii) the beam to the second detector is interrupted.

In such an embodiment only items of refuse with a vertical dimension greater than 2cm could receive a reward or

increase the count. Clearly, larger or smaller vertical spacings (perhaps in combination with some lateral spacing) between the radiation beams can be used to increase or decrease the size of refuse items liable to a reward.

In the embodiment shown, the control unit 40, rewarding unit 42 and sensing unit 22 are above the top of the container 12, and so are not liable to damage during removal and subsequent replacement of the housing 14. Electrical energy for this embodiment is provided by solar cells 44 on the top of the housing 14, which cooperate with rechargeable batteries (not shown) which provide power during the hours of darkness. In an alternative embodiment electrical power is provided from the mains via a suitable connection between the base and the housing, the base carrying a transformer and/or rectifier to provide electrical power of the required form.

The electrical connections between the various components are by way of wires, which are not shown since they will be readily apparent to one skilled in the art.

The refuse receptacle shown is square in plan view, so that the mirrors 34,36 are flat and parallel. In alternative embodiments the receptacle is elliptical or circular, having a single curved mirror around part or all of its periphery, the shaping of the mirror and the positioning and orientation of the emitters being arranged to cause multiple

reflections from the mirror prior to incidence upon the respective detector.

Also in the embodiment shown, the mirrors 34,36 are arranged to either side of the opening 20 where they are substantially protected from damage as the items of waste are introduced. In alternative embodiments the mirrors (and emitters and detectors) are located in respective recesses in the housing walls, further protecting them from damage.

In the embodiment in which the control unit includes a counter, so that the refuse receptacle issues a reward only after a predetermined number of deposits, the first item to be deposited will be recorded as one, the second as two and so on until the required count is reached whereupon a signal to the rewarding unit is issued and the counter is reset to zero. In such an embodiment, if the required number of deposits to achieve a reward is five, a person putting in four items of refuse might not receive a reward, and yet the next person to deposit even a single item of refuse would receive a reward. To avoid this, it may be arranged that the control unit includes a timer so that the counter is reset to zero after a given period of time. However, the use of a timer for this purpose is not preferred, since it is believed that the element of uncertainty and perhaps excitement created when depositing a small number of items of refuse into the receptacle will increase its appeal.

Furthermore, the number of items of refuse requiring to be deposited before a reward is gained may be random, perhaps varying from three to ten, so increasing the element of uncertainty involved.

CLAIMS

1. A refuse receptacle comprising a container for receiving deposited items of refuse, sensing means for sensing the introduction of an item of refuse into the receptacle, and rewarding means for issuing a reward to the depositor of refuse, in which the sensing means comprises first and second electromagnetic radiation emitters and respective first and second electromagnetic radiation detectors arranged adjacent the container.
2. A refuse receptacle according to claim 1 in which the first and second emitters are adapted to provide a substantially collimated beam of radiation incident upon the respective detectors.
3. A refuse receptacle according to claim 2 in which the first detector is arranged before the second detector in the path of the item of refuse.
4. A refuse receptacle according to claim 3 in which the sequential interruption of the respective beams of radiation indicate the passage of an item of refuse.
5. A refuse receptacle according to claim 4 in which control means are provided to sense the sequential interruption of the respective beams of radiation, the control means being connected to the rewarding means.

6. A refuse receptacle according to claim 5 in which the control means is set to issue a signal to the rewarding means so that a reward is generated for every deposit which is sensed.
7. A refuse receptacle according to claim 5 in which the control means is set to issue a signal to the rewarding means so that a reward is generated after a number of deposits have been sensed.
8. A refuse receptacle according to any of claims 5-7 in which the control means is responsive to the removal of refuse from the container.
9. A refuse receptacle according to any preceding claim in which the electromagnetic radiation emitters and detectors operate in the infra-red part of the spectrum.
10. A refuse receptacle according to claim 9 in which the emitters are solid-state laser devices, and the detectors are photoelectric cells.
11. A refuse receptacle according to any preceding claim in which the emitters cooperate with at least one mirror to reflect the respective beams of emitted radiation and create a web or webs of radiation adjacent the container.

12. A refuse receptacle according to claim 11 in which the web created by the second emitter and the mirror(s) closely matches that created by the first emitter and the mirror(s).
13. A refuse receptacle according to claim 11 or claim 12 in which the or each mirror is substantially planar.
14. A refuse receptacle according to claim 13 in which each emitter is angled relative to the or each mirror at between 70° and 89° .
15. A refuse receptacle according to any preceding claim in which there is included an audio or visual signalling means, so that the sensing of an item of refuse is signalled by the emission of an audible or visual signal.
16. A refuse receptacle constructed and arranged substantially as described in relation to Figs. 1 and 2 of the accompanying drawings.



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Claims searched: 1-16

Examiner: Robert MacDonald
Date of search: 20 May 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): A4A(AE); B8P(PAX); G1A(AMQM, AMQX); G4V(VBJ)

Int Cl (Ed.6): B65F(1/00, 1/14); G07F(7/06)

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
Y	GB2261096 A (PRIOR CONSULTING) See page 5, lines 15 to 22 and claims 10 and 15 especially.	Y(7)
X.Y	GB 2228400 A (PETER JOHN MORTIMER) See whole document.	X (1-6, 9-13,15) Y(7)

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