(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 959 402 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
20.08.2008 Bulletin 2008/34

(51) Int Cl.:
G07D 1/00 *(2006.01)* ***G07F 9/04*** *(2006.01)*

(21) Application number: **08075123.3**

(22) Date of filing: **19.02.2008**

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

(30) Priority: **19.02.2007 NL 1033426**
02.04.2007 NL 1033631

(71) Applicant: **Suzo International (NL) B.V.**
3261 LT Oud-Beijerland (NL)

(72) Inventor: **Suverein, Leonardus**
B-2920 Kalmthout (BE)

(74) Representative: **Van Gorkom, Lucas Marijn**
Exter Polak & Charlouis B.V.
P.O. Box 3241
2280 GE Rijswijk (NL)

(54) **Coin-detection station provided with a fraud-prevention facility**

(57) The present invention provides a coin-detection station comprising a frame in which a passage for coins is provided. In use, the coins roll on one side along an underside of the passage. The passage is provided with at least one radiation source arranged on a side thereof for emitting radiation across the width of the passage in the direction of at least one radiation sensor. The at least one radiation sensor is designed to emit a detection signal which indicates the passing of a coin. The passage is furthermore provided with a movable first closure element for closing off a first end of the passage. If desired, the passage is provided with a second closure element which can be moved synchronously with the first closure element and closes off a second end of the passage which is situated opposite the first end. Operating means provided on the frame serve to move the first closure element and the second closure element between the first and the second position.

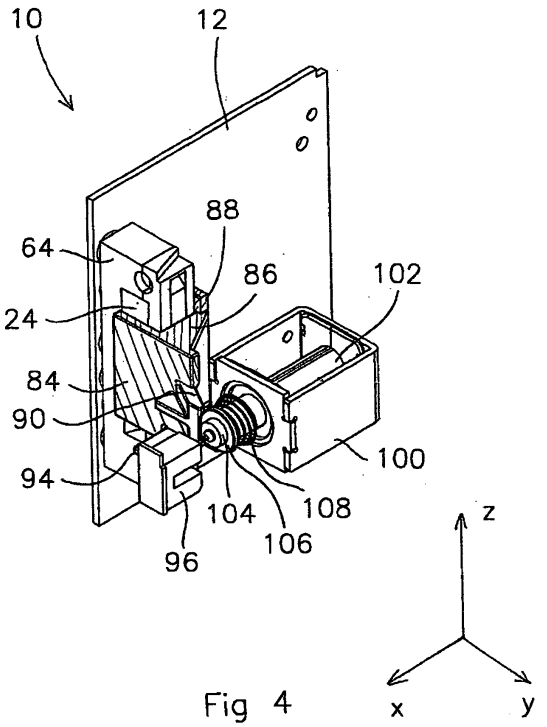

Fig 4

EP 1 959 402 A2

Description

[0001] The present invention relates to a coin-detection station provided with a fraud-prevention facility for preventing fraud when dispensing coins.

[0002] The device according to the invention is, for example, suitable for a coin-dispensing unit. The device can, for example, be added to a hopper, a money-changing apparatus, a gambling machine, automatic vending machine, transport ticket machine, parking ticket machine and the like. A hopper is a device for dispensing coins and may therefore form part of, for example, a money-changing apparatus or a gambling machine. A device for dispensing coins is, for example, described in WO-03/049049-A1. Reference is made to said patent application for a description of the construction, the specific parts and the operation of the known device.

[0003] US-5767506 discloses a coin-detection station provided with an optical sensor. The coin-detection station is intended to be fitted between a coin container in the interior of the coin-dispensing unit and a collecting tray for collecting coins to be dispensed. A user can then remove the coins which have collected in the collecting tray. The coin-detection station comprises a slotted passage for coins. The passage has a height such that it fits the diameter of the coins to be dispensed and a width such that it fits the thickness of the coins to be dispensed. In use, coins roll through the passage on their side in the direction of the collecting tray. Two LEDs are provided on one side of the passage, each of which can emit a ray of light. On the side of the passage opposite the LEDs, a number of reflective surfaces are provided in order to reflect the rays of light across the width of the passage in the direction of a number of light sensors. The LEDs and the light sensors are connected to a control unit which is provided with suitable control software. Each coin which is dispensed passes the passage and interrupts one or more of the rays of light for a specific period of time. The control unit is designed to register the passing of a coin from the interruption of a ray of light, so that the number of coins dispensed is counted.

[0004] In practice, it has been found to be possible to trick the known coin-detection station. To this end, fraudulent persons have apparatuses which ensure that a ray of light is not interrupted when a coin passes. The apparatuses comprise, for example, an elongate wire which is provided with a light source at one end. The light source is designed to shine light onto a light sensor. Thus, light will still fall onto the light sensor when a coin passes. As the ray of light which is incident on the light sensor appears not to have been interrupted, another coin will be dispensed and so on. Despite the introduction of time-out times, i.e. interrupting the dispensing of coins when the ray of light has not been interrupted for a certain amount of time, for example longer than five to ten seconds, it is in this way still possible for too many coins to be dispensed. The number of coins dispensed may, for example, become five or ten times the correct number of coins. It is obvious that this can result in a great financial loss for the operator of the (gambling) machine.

[0005] It is an object of the present invention to prevent fraud during the dispensing of coins.

[0006] To this end, the present invention provides a coin-detection station comprising:

- a frame in which a passage for coins is provided, the passage having a height such that it fits the diameter of the coins and a width such that it fits the thickness of the coins, with the coins in use rolling on one side along an underside of the passage;
- at least one radiation source arranged on a side of the passage for emitting radiation across the width of the passage in the direction of at least one radiation sensor;
- in which the at least one radiation sensor is designed to emit a detection signal which indicates the passing of a coin,
- a movable first closure element for closing off a first end of the passage, the first closure element having a first position closing off the passage and a second position leaving the passage clear; and
- operating means provided on the frame for moving the first closure element between the first and the second position.

[0007] In the first position, the first closure element closes off the passage and thus prevents a fraudulent person from being able to sabotage the sensor arranged in the passage. The first position is preferably a starting or rest position, i.e. the closure element leaves the passage clear when dispensing coins and closes off the passage at all other times. As the purpose of the first closure element is to protect the sensor, the first closure element is preferably provided near the sensor. The distance of the first closure element to the sensor is in the order of magnitude of 1 cm.

[0008] In one embodiment, the coin-detection station comprises a second closure element which can be moved synchronously with the first closure element and closes off a second end of the passage which is situated opposite the first end, the second closure element having a first position closing off the passage and a second position leaving the passage clear. The second closure element in this case prevents a coin from the coin container inadvertently entering the passage. This could for example happen when the coin-dispensing unit into which the coin-detection station is fitted is switched off, such as during transportation. Thus, the second closure element prevents a coin from entering the passage, which would go unnoticed upon switching on of the coin-dispensing unit and would be dispensed. The first and/or the second closure element may, as desired, partially or completely overlap the height of the passage. The latter also depends on ducts of the device in which the coin-detection station is being used and to which the passage is connected.

[0009] In one embodiment, the first closure element and the second closure element are connected to one another and in combination form a U-shaped closure element for closing off opposite ends of the passage. This embodiment results in a compact, simple and strong protection of the sensor fitted in the passage against fraud.

[0010] The operating means for example comprise an electromagnetic coil. The electromagnetic coil can move the closure element into the first position in case there is no electrical power. This prevents fraud from being committed when the device is switched off.

[0011] Preferably, the operating means comprise spring means. The spring means operate without (electrical) power and can therefore be used to close off the opening when the device is switched off.

[0012] Preferably, the operating means comprise locking means for locking the closure element in the first position. The device is thus protected against undesirable opening of the closure element, for example from the outside.

[0013] Optionally, a closure sensor is arranged near the closure element in order to register the position the closure element is in. By thus preventing failures, savings can be achieved with regard to maintenance.

[0014] In one embodiment, the closure sensor comprises an optical sensor. This is a sturdy design which is relatively insensitive to vibrations and the like.

[0015] In another embodiment, the closure element and the frame are coupled by spring means.

[0016] Preferably, the device comprises a radiation source arranged on an inlet side of the opening with respect to the closure element for emitting radiation via a radiation path, and a radiation sensor which is arranged at a distance from the radiation source for registering the emitted radiation.

[0017] In one embodiment, radiation-deflecting means are arranged in the radiation path. The radiation-deflecting means comprise, for example, a mirror surface. This has proved to be a simple, inexpensive and strong part for the radiation-deflecting means.

[0018] In another preferred embodiment, the radiation-deflecting means comprise a prism. This has likewise proved to be a simple, inexpensive and strong part for the radiation-deflecting means. There is very little, if any, wear and the prism is sufficiently able to withstand damage during transportation.

[0019] In one embodiment, the radiation-deflecting means comprise an optical fibre. This has proved to be a suitable part to achieve deflection of radiation over relatively great distances, so that the radiation source and the radiation sensor can be arranged at a relatively large distance from one another. It is also possible to bypass obstacles. The use of the optical fibre thus increases the design options.

[0020] In another embodiment, the radiation-deflecting means comprise two prisms for deflecting the radiation over an angle of approximately 180 degrees. In practice, this has proved to be an effective and inexpensive design.

[0021] In yet another embodiment, the intermediate distance of the radiation sensor perpendicular to the axis of the radiation source which is formed by the radiation emitted by the radiation source is in the range of approximately 0.5 cm to 20 cm. The intermediate distance makes fraud relatively difficult to impossible. In combination with suitable warning means which are designed to generate an alarm if the radiation path is interrupted for a period of time which is longer than a predetermined period, fraud is essentially impossible.

[0022] The predetermined period is for example longer than 100 ms. As coins interrupt the radiation path in the order of magnitude of 50 ms +/- 10 ms and it is impossible for a human being to place a fraudulent device within 100 ms, this measure provides significant added security.

[0023] Optionally, the radiation source is designed for emitting the radiation in a modulated manner. By modulating the radiation, a fraudulent person is forced to emit an identical pattern of radiation pulses to the sensor. By emitting the radiation in the form of a pattern, fraud by means of a single radiation source is made impossible. The pattern may, for example, be pulsed, random, have a specific pattern and/or a specific frequency. The pattern may, for example, differ for each unit time, be secret and/or have a frequency which is invisible to the human eye.

[0024] In one embodiment:

- the radiation source comprises a first and a second radiation source for emitting a first and a second radiation, respectively, via a first and a second radiation path; and
- the radiation sensor comprises a first and a second radiation sensor for registering the first and the second radiation, respectively.

[0025] By using two radiation paths, the device is suitable for substantially all types of coins, including coins which are provided with openings and the like. It is also possible to arrange the radiation sensor further from the opening, so that the radiation path only has to pass the opening once.

[0026] Optionally, the radiation source and the radiation sensor are coupled by means of a synchronization unit.

[0027] According to another aspect, the invention provides a coin-dispensing unit which is provided with a device as described above.

[0028] According to another aspect, the invention provides a method for preventing fraud when dispensing coins, comprising the steps of:

- providing a frame having an opening through which coins can pass;
- movably connecting a closure element to the frame, with the closure element having a first position closing off the opening and a second position leaving the

opening clear; and

- moving the closure element into the second position when dispensing the coins and subsequently moving the closure element into the first position.

[0029] As the opening is blocked by the closure element, it will be impossible for a fraudulent person to access the interior of a money-dispensing unit. Other embodiments of the method result from the use of a device as described above.

[0030] Additional advantages and features of the present invention will be explained by means of the following description of preferred embodiments illustrated in the drawings, in which:

Fig. 1 shows a perspective view of a device according to the present invention;
Fig. 2 shows a partially cut-away and diagrammatic side view of the device from Fig. 1;
Fig. 3 shows a perspective view of a part of the device from Fig. 1 in a first position of use;
Fig. 4 shows a perspective view of a part of the device from Fig. 1 in a second position of use;
Fig. 5 shows a diagrammatic side view of a coin-dispensing opening according to the invention in which an attempt at fraud has been committed;
Fig. 6 shows a diagrammatic side view of a coin-dispensing unit which is provided with a coin-detection station according to the invention; and
Fig. 7 shows a diagrammatic top view of a coin-dispensing unit which is provided with a coin-detection station according to the invention.

[0031] As illustrated in Fig. 1, a device 10 for dispensing coins according to the present invention comprises a circuit board 12 which is provided along an edge with a finishing part 14. The circuit board contains a number of electronic components 16 which are not shown in detail. The electronic components inter alia comprise components for driving the device 10. The control components comprise, for example, hardware and/or software. The hardware comprises for example a control unit, a memory, transistors, capacitors and/or resistors. The software comprises a suitable control program. The control program controls the operation of the device which is described below.

[0032] An edge 18 of the circuit board situated opposite the edge which is connected to the finishing part 14 is provided with a coin-outlet part 20. The coin-outlet part 20 comprises a frame 22 provided with a slotted opening 24. The opening 24 is a coin-outlet opening and forms the end of a coin-dispensing duct which is not shown in the figure in any more detail.

[0033] In one embodiment, the coin-outlet opening 24 together with the entire device 10 can be connected to a coin-dispensing duct of a coin-dispensing unit, such as a hopper.

[0034] The frame 22 furthermore comprises a casing 26 in which the parts illustrated in the following figures are housed.

[0035] As illustrated in Fig. 2, the circuit board 12 contains, for example, two radiation sources 40, 42 and two radiation sensors 44, 46. In the illustrated embodiment, two detectors comprising a combination of a radiation source and a radiation sensor are shown, but any number of one or more detectors is possible. The radiation sources and radiation sensors are attached to the circuit board by means of respective protuberances 48, 50, 52, 54, preferably by soldering.

[0036] The radiation sources 48, 50 are arranged in such a manner that they can emit radiation via radiation paths 56, 58. To this end, the radiation sources 48, 50 project from the circuit board 12 into apertures 60, 62 in framework 64. From the sources, the radiation paths first pass the opening 24. On the other side of the opening 24, passages 66, 68 are provided in the framework 64.

[0037] Deflecting elements are arranged in the passages 66, 68 to deflect the radiation in the desired direction, i.e. in the direction of the radiation sensors 52, 54. In the illustrated embodiment, the deflecting elements comprise two prisms 70, 72 and 74, 76, respectively. The prisms are designed to deflect the respective radiation path in each case approximately 90 degrees. Thus, the radiation sources and the radiation sensors can be arranged on the same circuit board. This makes maintenance of the device 10 more efficient and less expensive, since only the circuit board 12 is replaced, for example in the case of failure. The radiation paths 56, 58 pass the opening 24 only once. For the remainder, their course to the radiation sensors 52, 54 runs internally inside the framework 64.

[0038] Other variants are conceivable in addition to the illustrated embodiment. Thus, the radiation sensors may be arranged opposite the respective radiation sources in the framework 64. Furthermore, the deflecting means may comprise other parts, such as an optical fibre and/or a mirror.

[0039] Inside casing 26, a closure element 80 and operating means 82 which are coupled thereto are arranged. For the sake of clarity, the closure element 80 is hatched.

[0040] As is illustrated in Fig. 3 and Fig. 4, the closure element 80 comprises a first closure element 84. The first closure element 84 is connected to one or more arms 86, which in turn are connected to the second closure element 88. In one embodiment, the first closure element 84 and the second closure element 88 are approximately panel-shaped and formed as a single part. Together, the first and the second closure element form a U-shaped closure element 80. The closure element 80 is movable with respect to the passage 24 in order to close it off or leave it clear (Figs. 3 and 4, respectively).

[0041] On the opposite side, the closure element 80 comprises an operating part 90 which extends obliquely from the first closure element 84 having an approximately flat edge 92 at one end. A spring (not shown in the figures)

is arranged between the arms 86 and the framework 64. The spring pushes the closure element 80 away from the framework 64 when the operating part is clear from plunger 104, i.e. when the plunger 104 has been pulled in (Fig. 3).

[0042] On the cover 84, a second upright wall 94 is provided on the same side as the operating part. The second upright wall 94 is movably arranged inside U-shaped housing 96 which contains a location detector. The location detector comprises, for example, an optical sensor which is provided with a radiation source (not shown in any more detail) and an associated radiation detector for detecting the location of the upright wall 94. The housing 96 is connected to the frame 22 (see Fig. 1).

[0043] The operating means 82 comprise a frame 100 which is connected to casing 26. Inside the frame 100, an actuator 102 is provided which, in a practical embodiment, comprises an electromagnet. The electromagnet comprises an electrical coil, in which a plunger 104 is movably arranged. At one end, the plunger 104 is provided with a circular flange 106. A spring 108 is arranged between the flange 106 and a casing of the electromagnet.

[0044] In the open position of use of the closure element 80 illustrated in Fig. 3, the plunger 104 is pulled into the electromagnet. The cover 84 is pushed in the direction of the operating means 82 by the abovementioned spring which acts on the arm 86. The open position of use of the closure element 80 (Fig. 3) is delimited by the edge of the flange 106 and/or by the plunger 104.

[0045] In the closed position of use of the closure element 80 illustrated in Fig. 4, the edge 92 of the operating part 90 rests against the edge of the flange 106 provided on the operating means.

[0046] The device 10 operates as follows. As mentioned above, the device has an open and a closed position of use. Figures 1, 2 and 3 show the open position of use and Fig. 4 shows the closed position of use.

[0047] When the device 10 has to dispense coins, i.e. has to allow coins through the opening 24, the actuator 102 is activated. The actuator 102 pulls the plunger against the spring action of the spring 108, so that the closure element 80 is pushed from the opening 24 by a spring which is not shown. The closure element 80 then leaves the opening 24 clear in order to allow coins to pass.

[0048] The operation of actuator 102 is stopped before the coins are dispensed or after the coins have been dispensed. In practice, the electrical power of an electromagnet will be stopped, following which the spring 108 pushes the plunger against the operating part 90. As the operating part runs obliquely, the plunger 104 pushes the cover 84 as far as into the opening 24, so that the latter is closed off. The edge of the flange 106 in this case locks the edge 92, and thus the closure element 80, against manual operation of the cover 84 from outside.

[0049] When the cover 84 leaves the opening 24 clear, coins are able to pass through the opening. Each of the radiation sources 48, 50 creates a radiation path which is interrupted for a period of time by a passing coin. The period of time is, for example, between 30 ms and 70 ms. Each interruption of the radiation path is registered by a control unit coupled to the radiation sensors 52, 54 as the passing of a single coin.

[0050] As described above, the radiation is preferably emitted in a modulated manner. That is to say that the radiation is emitted in a pattern, with the result that fraud by means of a light source emitting light continuously is impossible.

[0051] In an embodiment which is not shown in any more detail, the device 10 comprises a second closure element. The second closure element can, for example, be operated simultaneously with the abovementioned closure element. If desired, the closure element is shaped as a U-shaped part, so that the cover 84 and the second closure element form a single entity. The second closure element prevents coins from entering the opening 24 during for example transportation or at other times when the device is switched off. This prevents possible malfunction after transportation. The cover 84 can close off the outlet side of the opening 24, while the second closure element can close off an inlet side, i.e. the side to which coins are supplied.

[0052] In Figs. 1-4, the length is indicated by the direction x, the width by the direction y and the height by the direction z.

[0053] In a practical embodiment, the opening 24 has a height in the order of magnitude of 25 to 50 mm, preferably approximately 30 to 35 mm. The opening has a width in the order of magnitude of 3 to 10 mm, preferably approximately 5 to 6 mm. The underside 120 of the opening 24 is provided with or connected to a coin-dispensing duct having an angle of inclination with respect to a floor in the order of magnitude of 15 to 30 degrees, preferably approximately 15 to 20 degrees. The radiation sources 40, 42 comprise, for example, LEDs. The radiation emitted by the LEDs has, for example, a frequency which is in the range of infrared light.

[0054] The closure element 80 comprises, for example, metal and/or a plastic reinforced with fibreglass.

[0055] As is illustrated in Fig. 5, a fraudulent person would have to fit one receiver 122, 124 for each radiation source 40, 42 in order to determine the pattern and/or the frequency of the emitted radiation. On the other side of the opening 24, a radiation source 126, 128 would have to be fitted for emitting radiation with the same pattern and the same frequency. The receivers 122, 124 and the radiation sources 126, 128 would have to be coupled by means of a control unit (not shown in any more detail). Fraud is prevented due to the fact that the width of the opening 24 is largely taken up by the receivers and the radiation sources, so that too little room is left to allow coins to pass. Radiation sources and receivers have a thickness in the order of magnitude 2 mm, while coins have a minimum thickness of approximately 1.5 mm. If a transmitter and a receiver have been fitted, the remaining width of the opening 24 is too small to allow

a coin to pass. The opening 24 has a width d1 and a height d2.

[0056] As a result of the closure element 80, fitting fraudulent transmitters and receivers is impossible when the device 10 is switched off.

[0057] Figs. 6 and 7 show an example of an application of the coin-detection station 10 in a coin-dispensing unit of a (gambling) machine. The coin-dispensing unit comprises a coin container 200, which is arranged in the interior of the unit and which holds a number of coins 202. The coins 202 have a thickness d3 and a diameter d4. The passage 24 has dimensions such that the thickness d3 of the coins fits inside the width d1 and that the diameter d4 fits inside the height d2.

[0058] A duct 204 for dispensing coins extends from the coin container 200 in the direction of a coin-collecting tray 206. The duct 204 may have any suitable form and shape, depending on the unit in which the duct is located. The coin-collecting tray 206 is accessible via an opening 208 in the wall 210 of a housing of the (gambling) machine (not shown in any more detail). A user can remove coins from the collecting tray 206 via the opening.

[0059] In the illustrated embodiment, coins 202 roll on their side along the underside of the inclined duct 204 of the container 200 in the direction of the collecting tray 206. The direction is indicated by arrow 212. As described above, the duct 204 is provided with the coin-detection station 10 in a suitable location. The closure element 80 of the coin-detection station 10 can move in the direction of arrow 214 between the first position, shown in Fig. 7, and the second position. In the first position, the closure element blocks the duct 204. In the second position, coins 202 are able to pass the coin-detection station.

[0060] The coin-detection station 10 is coupled to a control unit (not shown in detail). When one or more coins are dispensed, the control unit emits a control signal to the operating means 82 in order to open the closure element 80. The control unit furthermore controls the radiation source(s) of the detection station and determines from a detection signal, originating from the radiation sensor(s), whether a coin has passed the detection station 10.

[0061] The present invention is not limited to the above-described embodiment, to which many modifications can be made without departing from the scope of the attached claims.

Claims

1. Coin-detection station (10) comprising:

- a frame in which a passage (24) for coins is provided, the passage having a height (d2) such that it fits the diameter of the coins and a width (d1) such that it fits the thickness of the coins, with the coins in use rolling on one side along an underside (120) of the passage;
- at least one radiation source (40, 42) arranged on a side of the passage for emitting radiation (56, 58) across the width of the passage in the direction of at least one radiation sensor (44, 46);
- in which the at least one radiation sensor is designed to emit a detection signal which indicates the passing of a coin,

characterized by

- a movable first closure element (84) for closing off a first end of the passage, the first closure element having a first position closing off the passage and a second position leaving the passage clear; and
- operating means (82) provided on the frame for moving the first closure element between the first and the second position.

2. Coin-detection station according to claim 1, also comprising a second closure element (88) which can be moved synchronously with the first closure element and closes off a second end of the passage which is situated opposite the first end, the second closure element having a first position closing off the passage and a second position leaving the passage clear.

3. Coin-detection station according to claim 2, in which the first closure element and the second closure element are connected to one another and in combination form a U-shaped closure element (80) for closing off opposite ends of the passage.

4. Coin-detection station according to claim 1, 2 or 3, in which the operating means comprise locking means for locking the first closure element in the first position.

5. Coin-detection station according to claim 4, in which the locking means are coupled to warning means for generating an alarm if the locking of the first closure element is unintentionally ended.

6. Coin-detection station according to one of the preceding claims, in which the operating means comprise:

- an operating part (90) which extends obliquely from the first closure element; and
- a plunger (104) which cooperates with the operating part.

7. Coin-detection station according to claim 6, in which the operating means comprise a spring (108) which is designed to push the plunger against the operating part.

8. Coin-detection station according to claim 4 and 6, in which the locking means comprise a flange (106) provided on the plunger and having an edge which, in the first position, rests against an edge (92) of the operating part.

9. Coin-detection station according to one of the preceding claims, comprising a location sensor (96) which is designed to register in which position the first closure element is.

10. Coin-dispensing unit, comprising:

- a container (200) for coins (202);
- a collecting tray (206) for collecting coins to be dispensed; and
- a coin-detection station (10) according to one of claims 1-9 provided between the container and the collecting tray.

11. Method for using a device according to one of claims 1-9.

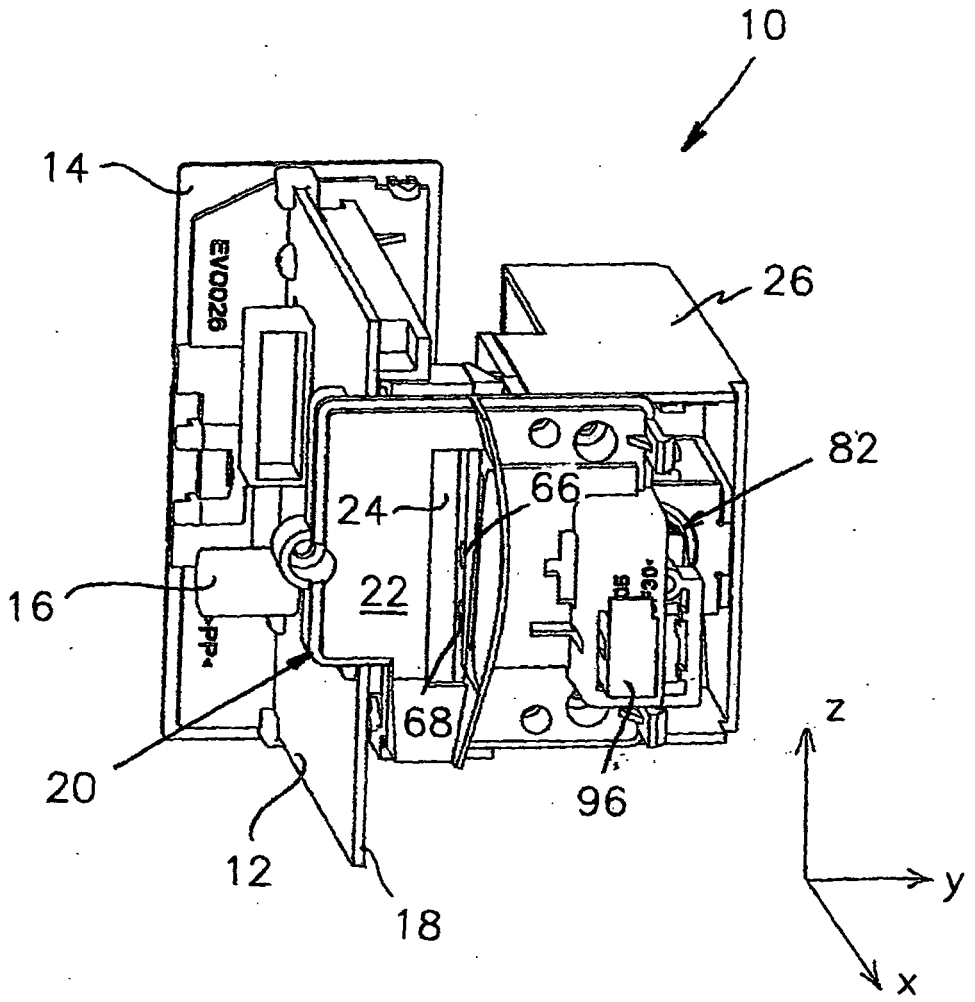

Fig 1

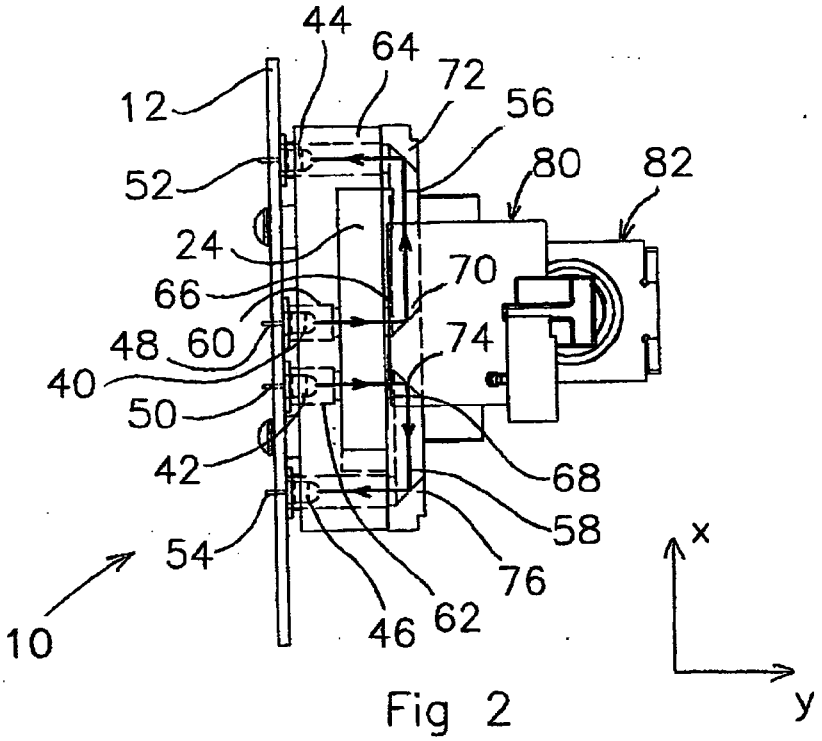
44
64
72
56
12
52
80
82
24
70
66
48
60
74
40
50
68
42
58
54
76
46
62
10
x
y

Fig 2

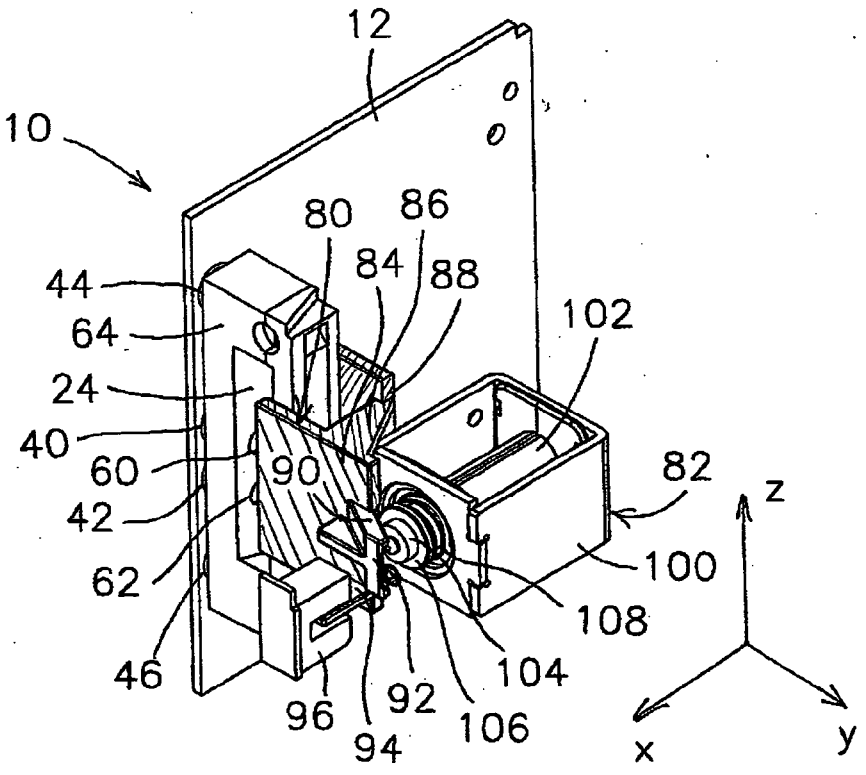
12
10
80
86
84
88
44
64
102
24
40
60
90
82
42
z
62
100
108
46
104
96
92
106
94
x
y

Fig 3

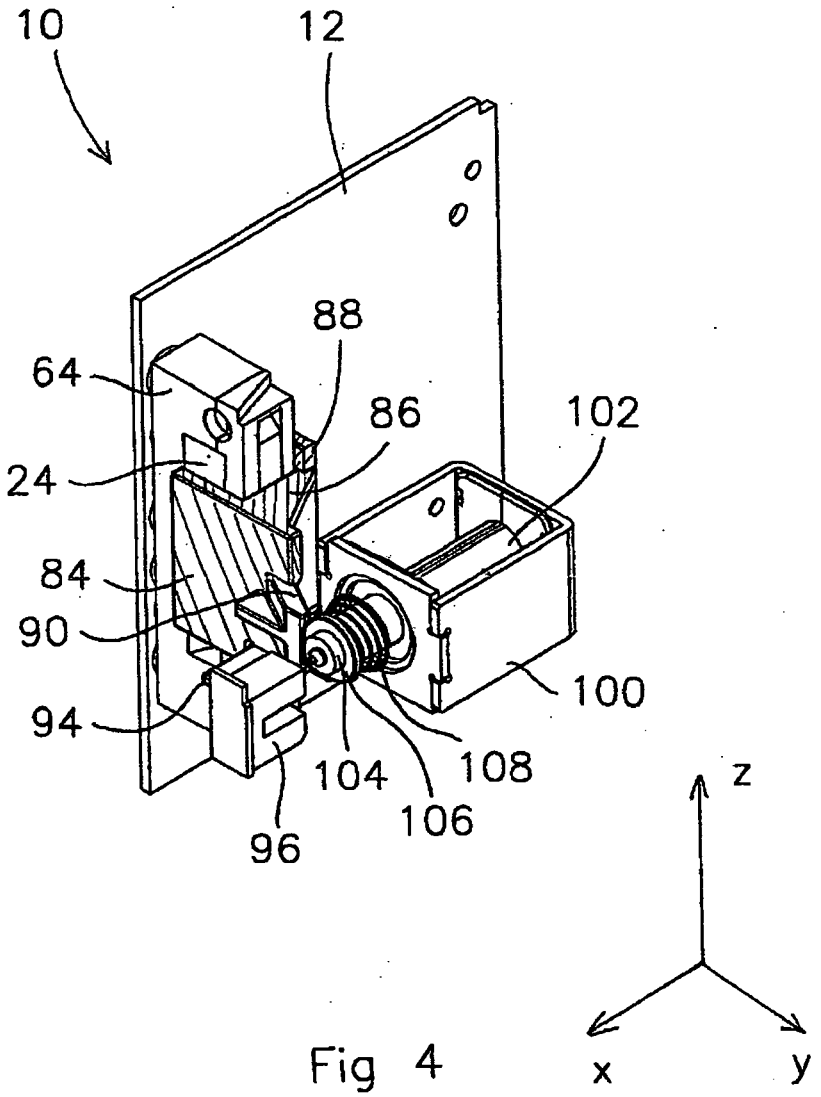

Fig 4

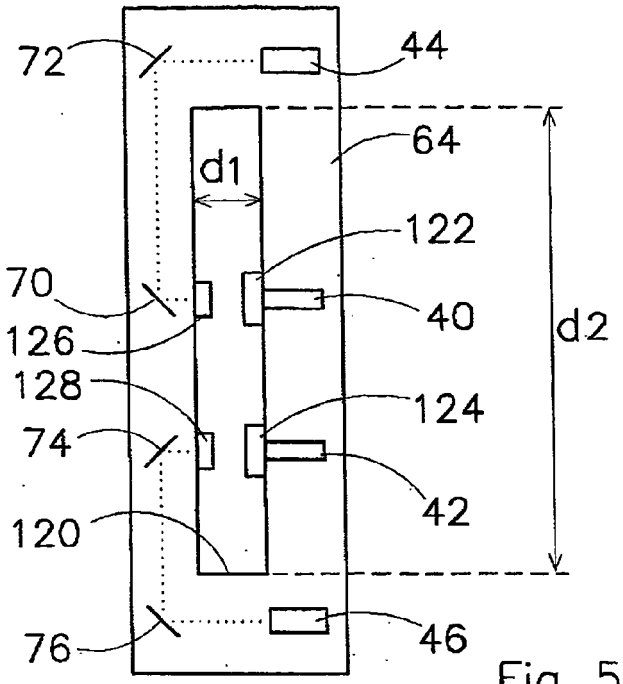

Fig 5

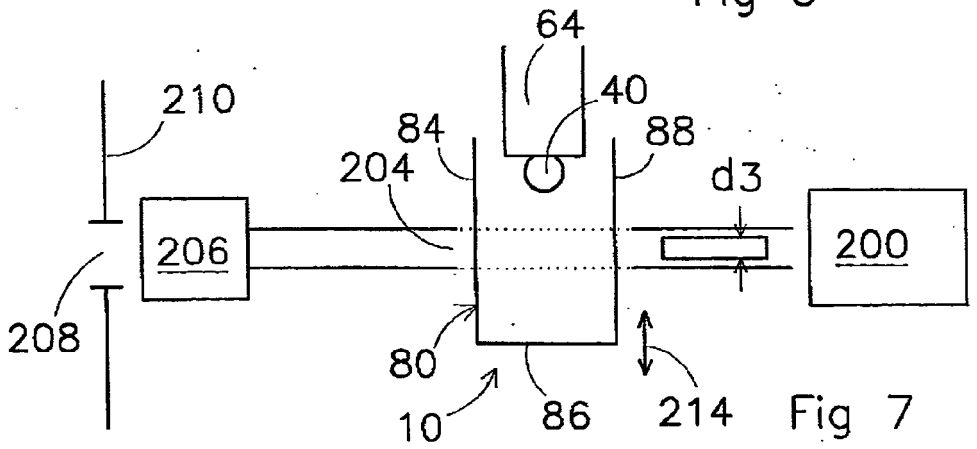

Fig 7

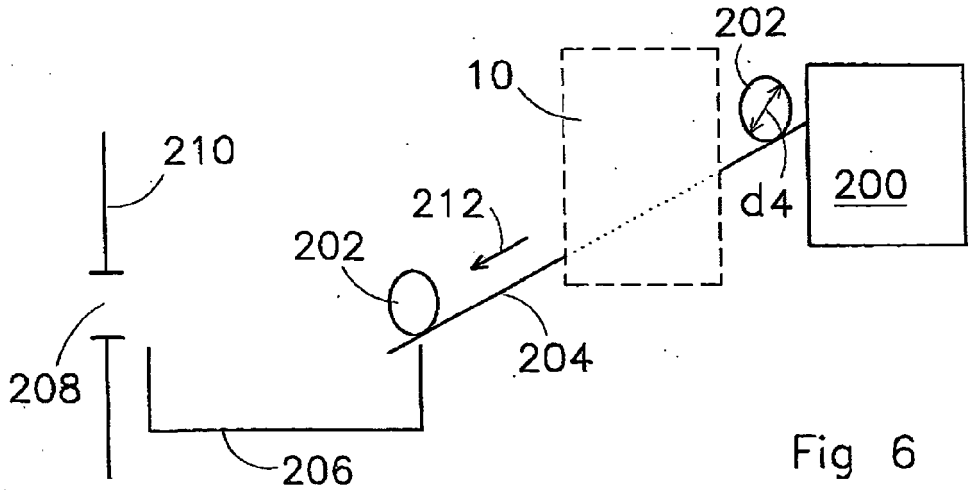

Fig 6

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 03049049 A1 **[0002]**
- US 5767506 A **[0003]**