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(54) **Device and method for counting and classifying coins**

(57)   Coins-classifier and counter, comprising a light source (4), an image linear sensor (7) for receiving a luminous radiation (r) reflected by a face of a passing coin illuminated by a radiation (1) emitted by said light source.
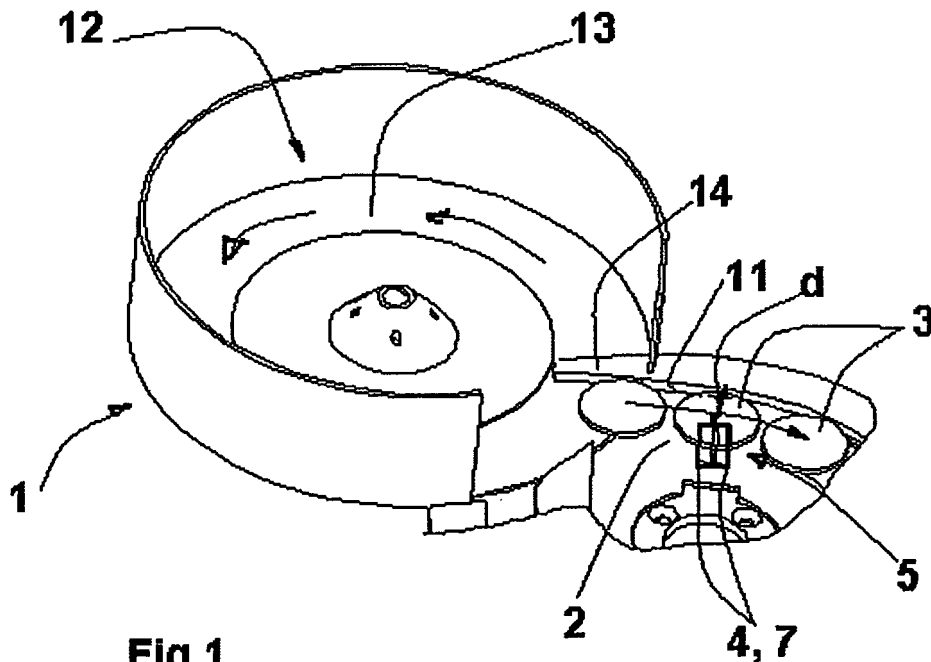
Fig.1

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Description

[0001]   The object of the present invention is a device and method for counting and classifying coins.

[0002]   More in particular, the invention relates to a device and method based on an optical detection corresponding to a coin's dimension such as the diameter, and able to assign a given class or value to the coin.

[0003]   At present, classification systems are known which are based on the reading, by means of a detection device, of a beam of light directed towards the region of transit of the coins.

[0004]   In these known systems, the coin, as it moves on, intercepts the beam of light and dims the sensor by an extent corresponding to the diameter of the coin.

[0005]   The detection of the sensor is processed by an electronic unit which provides for counting the coins in transit and classifying them on the basis of the detected diameter.

[0006]   The known systems exhibit some drawbacks as far as the reliability of detection is concerned, because of the normally illuminated state of the detection sensor, and of possible false readings due to the deviation of the light, emitted by the light source, that reaches the sensor. Moreover, such systems generally need a light opposite to the transit of coins and, consequently, of bulky mechanical parts on both sides of the path covered by the coin.

[0007]   A first object of the present invention is to propose a classifier device without the drawbacks of the known devices.

[0008]   The object of the invention is achieved by a device and method according to the attached independent claims.

[0009]   Further advantages are achieved by a device and method according to the attached dependent claims.

[0010]   The technical characteristics of the invention, according to said objects, are clearly set forth by the content of the following claims, and the advantages of same invention will result more clearly from a reading of the detailed description given herebelow, reference being made to the accompanying drawings which show but an exemplary and non-limiting embodiment thereof. In the drawings:

- Fig. 1 shows a first embodiment of a coin-counting device according to the invention;
- Fig. 2 shows a second embodiment of the invention;
- Fig. 3 shows a detail of a sensor unit according to the invention; and
- Fig. 4 shows a detail of the sensor unit.

[0011]   With reference to the accompanying drawings, a coins-classifier and counter 1 according to the invention comprises a supply 12 for feeding coins to be classified and counted, in the described case said supply consisting of a hopper with a rotating bottom 13 for driving a succession of coins 3 towards a deflector 14 which directs the coins to a flat path 2 for the coins to slide therealong.

[0012]   Associated with the path 1 is at least one light source 4 to illuminate at least one reading region of said path which the coin 3 is to be passed through for the detection thereof.

[0013]   In the described examples, the region 5 comprises a transparent window formed in the plane of transit of the coins.

[0014]   In the illustrated embodiment, the source 4 is also made up of an array of LEDs 6 disposed on the side of region 5 opposite to the sliding surface of coins 3 along the path 2.

[0015]   Associatred with the source 4 is a linear sensor 7 for optical detection, comprising a number of detection pixels 8 located along the path 1 and lined up transversally to the direction of transit of the coins 3.

[0016]   Advantageously, according to the invention, the ligth source 4 and the detection sensor 7 are both disposed on the side opposite to that of transit of the coin 3 and make up an illumination and detection unit 8 associable with a reading region 5.

[0017]   Connected to the sensor 7 is a processing unit 9 which, upon using the device, receives from the sensor a signal representative of the number of illuminated pixels and which, in turn, is associable with the diameter of the coin in transit.

[0018]   According to the invention, the sensor 7 and the source 4 are so disposed as to have the sensor resulting normally in black-out conditions and receiving a luminous radiation only when a coin transits through the region 5.

[0019]   To this end, provision may be made for a shield 10 preventing the ambient light from reaching the sensor 7 thus altering and disturbing the detection of transit of the coins.

[0020]   In the embodiment shown in Fig. 1, the path 1 of transit comprises a side abutment 11 along which the coins slide in contact therewith as they move through the reading region 5.

[0021]   In this embodiment, the sensor 7 is transversally offset by a distance "d" with respect to the abutment 11 so as to receive only part of the light hitting the coin's face illuminated by the light source and reflected towards the sensor. This disposition of the sensor 7 allows illuminating a plurality of pixels which corresponds to a value of the coin's diameter save for the extent "d".

[0022]   In the embodiment shown in Fig. 2, the region 5 extends completely across the path 2, so as to illuminate the coins 3 throughout their diameter, and the processing unit 9 acquires a signal corresponding to the maximum M number of pixels illuminated by the light reflected by the transiting coin and associates univocally the same signal to the diameter of the coin.

[0023]   Figs. 3 and 4 show schematically an illumination and detection unit 15, according to the invention, consisting of a source for irradiating a luminous radiation "T", and a sensor 7 for receiving the reflected radiation "r", which are respectively oriented with an angle (alfa) and an angle (beta) with respect to the sliding surface 2 of

the coin 3.

[0024] Preferably, the unit 15 is a CIS (Contact Image Sensor) module consisting of a linear array of elementary MOS image sensors, preferably with a density in the range of 200-400 dpi, which defines the sensors 7 and respective detection pixels 8, and of an array of LEDs 6 which make up the light source 4.

[0025] In operation, the coins 3 are fed to the sliding surface 2 along which they meet the reading region 5.

[0026] In the absence of coins within the region 5, the sensor 7 is fully dimmed, whereas, when the coin starts interferring with the luminous radiation emitted by the source 4, the illuminated face of the coin reflects the light and irradiates a number of pixels 8 of sensor 7 corresponding to the portion covered by the sensor.

[0027] In this stage, the processing unit carries out a repeated acquisition of images of the illuminated pixels, preferably each one millisecond-reading frequency.

[0028] Upon completion of transit of the coin, the processing unit 9 will have acquired a plurality of signals among which a signal corresponding to the highest number M of pixels illuminated from the point of maximun dimensional extension of the coin, coinciding with the diameter, and with wich the diameter of the just passed coin 3 can be associated.

[0029] As above mentioned, in the case shown in Fig. 1, there is obtained a partial reading of the diameter to which the deviation value "d" must be added, whereas in case of Fig. 2, there is acquired a complete reading of the coin's diameter, the technique of signal acquisition being the same in both cases.

[0030] The above described invention brings about consideable advantages, in particular, the reliability of the obtained readings, the compactness of the reading device and the versatility of its use in different applications either as coin-counter and classifier or token dispensers (in particular in the case of Fig. 2), that is, as machines with also non-guided insertion of coins to be classified for the verification of their amount.

[0031] The invention thus conceived is clearly suited for industrial application; it can however be subjected to several modifications and changes all falling within the scope of the inventive idea; moreover, all the details may be replaced by technically equivalent elements.

Claims

1. Coins-classifier and counter, comprising:

   - a flat slide path (2) for one or more coins to be counted and classified on the base at least of their diameter;
   - a light source (4) for illuminating at least one region (5) of said path;
   - a linear optical sensor (7) comprising a plurality of detection pixels (8) located along said path transversally to a direction of transit of the coins,

the sensor being normally under dim conditions and positioned so as to receive a luminous radiation (r) reflected by a face of a transiting coin illuminated by a radiation (T) emitted by said light source;

   - a processing unit (9) connected to the sensor (7) in order to acquire at least one signal corresponding to the number of pixels of sensor (7) which are illuminated for the reflection of the coin in transit and to univocally associate a number of illuminated pixels with a diameter of the coin.

2. Device according to claim 1, wherein said processing unit carries out consecutive acquisitions as the coin moves on and associates the signal, corresponding to the acquisition of the maximum number of illuminated pixels, with the diameter of the coin in transit.

3. Device according to claim 1 or 2, wherein said illumination region is a path's transparent window and said sensor is disposed on the window's side opposite to the side of transit of the coin.

4. Device according to any of the preceding claims, wherein said light source irradiates said illumination region with an angle (alfa) to the sliding plane of the coins, and said sensor is so disposed as to receive a reflected radiation at an angle (beta) from the illuminated face of the coin.

5. Device according to claim 4, wherein said light source and said sensor make up an illumination and detection unit (15).

6. Device according to any of the preceding claims, wherein said sensor is a module consisting of an array of elementary linear MOS-image sensors.

7. Device according to any of the preceding claims, wherein said light source is an array of LEDs (6).

8. Device according to any of the preceding claims, wherein said coin slides by abutting against a side guide (11) longitutinally of said path, and said sensor detects a light reflected by a fraction of the diameter of the illuminated coin.

9. Device according to any of claims 1-7, wherein said sensor detects a light reflected by the whole diameter of the illuminated coin.

10. Method for classifying and counting coins, comprising the steps of:

   - illuminating a face of the coin;
   - detecting a light reflected by said coin transiting across an illumination region by means of a sensor which is normally non-illuminated;

- associating a measure of said reflected light being detected with a dimension of the coin.

11. Method according to claim 10, wherein said detection comprises a succession of acquisitions made during the transit of the coin, and said association is established between the acquisition of the maximum measure of reflected light and the dimension of the coin.

Fig.1

Fig.2

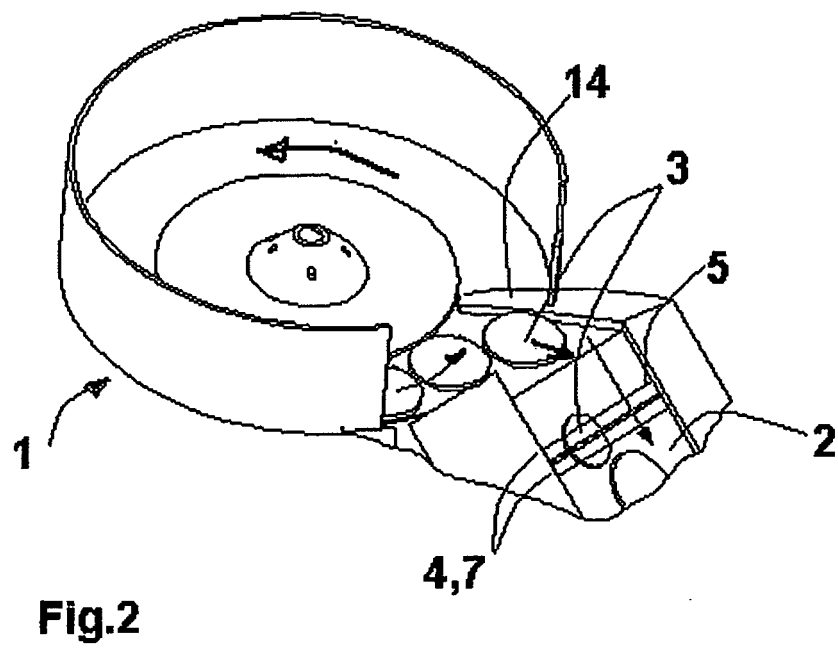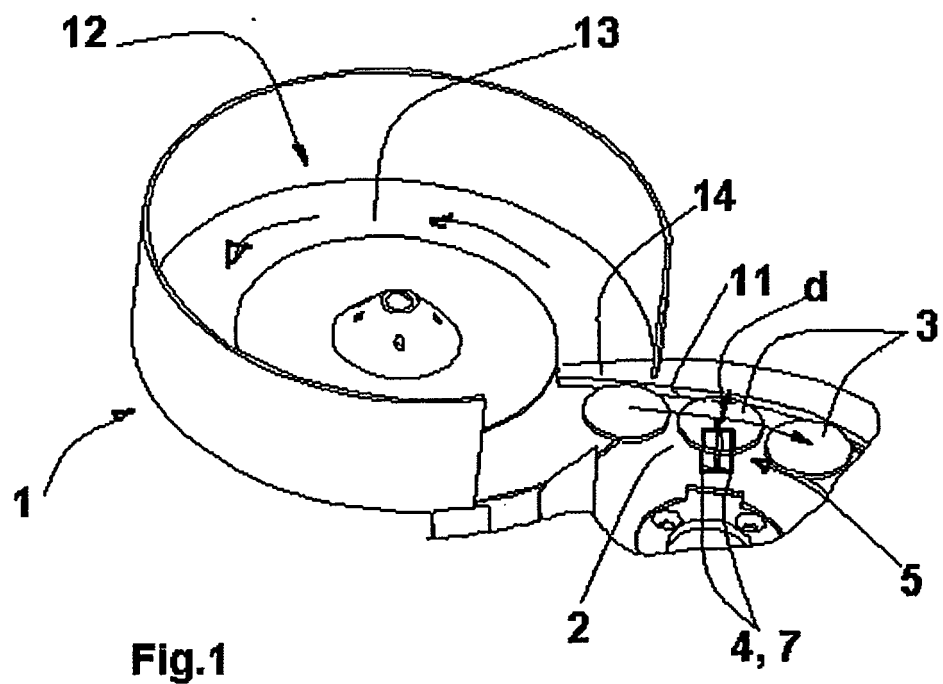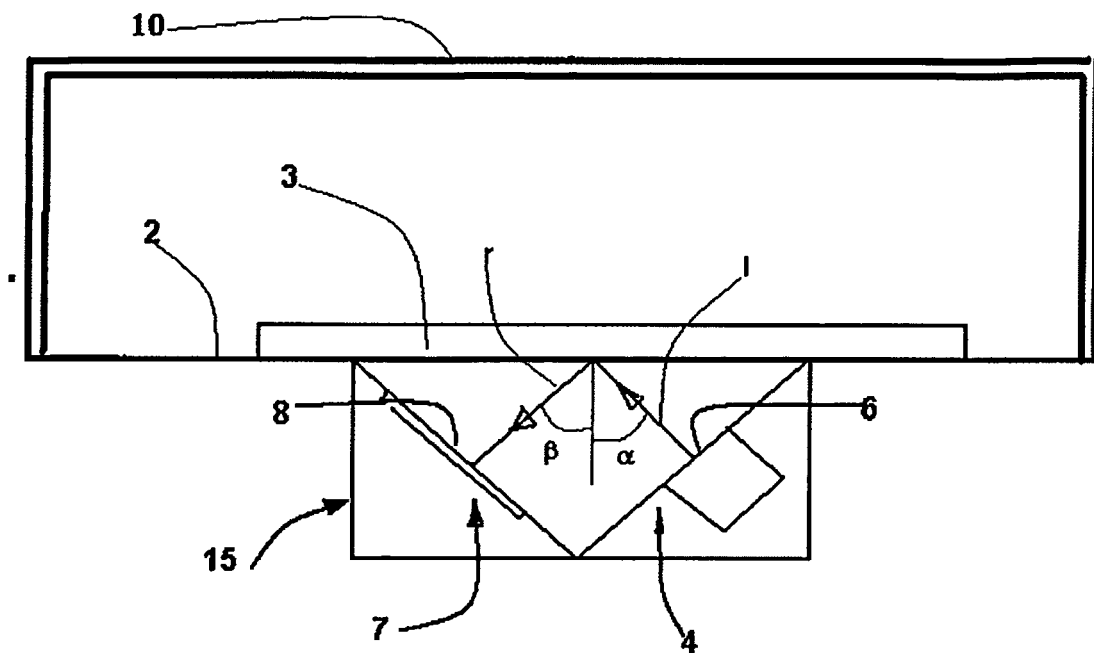**Fig.3**

Fig.4

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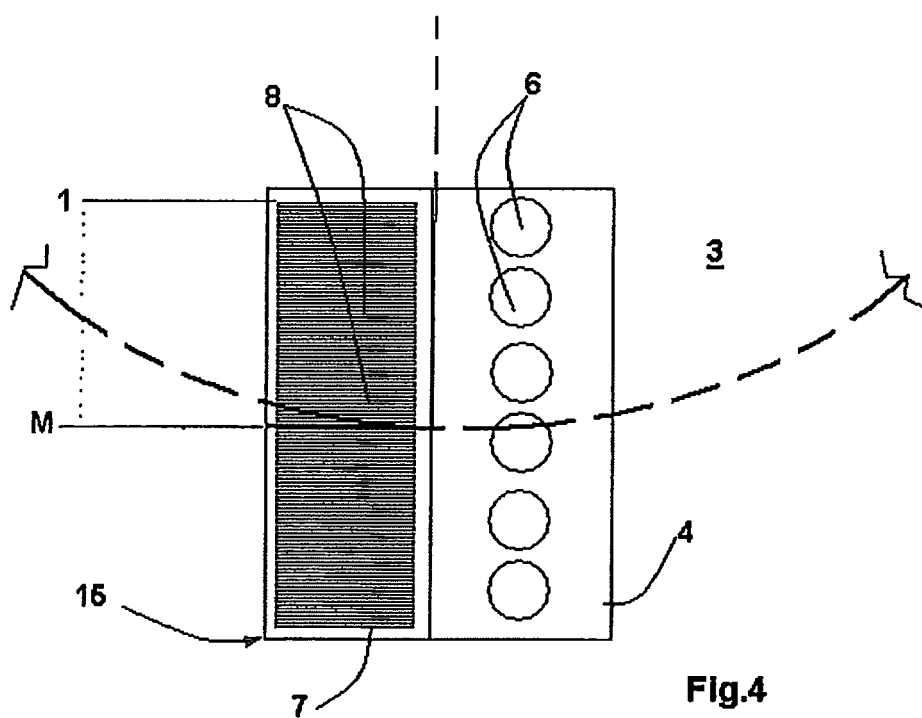
EUROPEAN SEARCH REPORT

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 6 609 604 B1 (JONES WILLIAM J [US] ET AL) 26 August 2003 (2003-08-26) * column 12, line 23 - line 51 * * column 15, line 38 - line 54 * -----	1-5,9-11	INV. G07D3/14 G07D9/00
X	US 2007/007723 A1 (OKADA KAZUO [JP] ET AL) 11 January 2007 (2007-01-11) * paragraphs [0076], [0095]; figures 2,13a,13b * * figure 14 * -----	1,10	
A	DE 20 2005 015342 U1 (NOVOMATIC GMBH [DE]) 9 November 2006 (2006-11-09) * the whole document * * abstract * * paragraphs [0008], [0009], [0018] - [0020]; figures 1,2 * -----	1,10	
A	GB 2 298 511 A (TETREL LTD [GB]) 4 September 1996 (1996-09-04) * the whole document * * page 26, line 4 - line 8 * * page 27, line 18 - line 25 * -----	1,10	TECHNICAL FIELDS SEARCHED (IPC) G07D G07F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	5 October 2009	Lindholm, Anna-Maria

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 09 00 5913

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05-10-2009

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82