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54 An arrangement for controlled transportation of sheet-like material, such as bank notes.

57 An arrangement for controlled transportation of sheet-like material (2), such as bank-notes, comprises transport means (10) for transporting sheets along a transport path and past optical detectors (111, 112) for detecting the presence/absence of sheets in the transport means. The detectors (111, 112) include a detector signal transmitter (111) and detector signal receiver (112) and are so disposed that the signal path (113) of the detector signal extends twice through the transport path and through a prism (1031). The transport means (10) include devices (101, 102) for transporting sheet-like materials (2) along the transport path, around a rotating guide roller (103), wherein the prism (1031) is circular and forms a peripheral part of the guide roller.

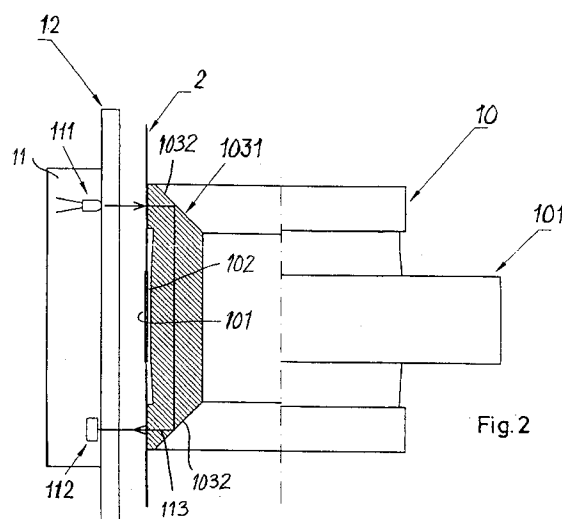


Fig. 2

The present invention relates to an arrangement for controlled transportation of sheet-like material, such as bank-notes. The arrangement includes means for transporting sheets along a transport path, past optical detectors which detect the presence/absence of sheets in the transport means. The detectors include a detector signal transmitter and a detector signal receiver and are so arranged that a detector signal path extends twice through the transport path.

It is known to use optical detectors adjacent bank-note transportation paths in, e.g., bank-note handling systems to count and detect bank-notes. In this regard, problems have occurred in transilluminating bank-notes of given currencies and denominations. In addition, problems have occurred in trimming the level of a light-emitting diode included in the detectors. Thus, when constructing an arrangement of the kind defined in the introduction, problems have occurred in achieving the requisite reliability in operation, particularly in combination with desired compact construction of the arrangement components.

An object of the present invention is to avoid these problems.

To this end, it is proposed in accordance with the invention that the transportation means of a transportation arrangement of the aforescribed kind have the form of transport bands, rollers or like devices for transporting sheets along the transportation path in the close proximity of a rotating guide roller which is provided with a circular prism in the region of its periphery; and that the detectors are disposed closely adjacent to the transport path but on the side thereof that lies opposite the circular prism.

According to one advantageous embodiment of the invention, the detectors with signal transmitter and receiver are so arranged in relation to the rotating guide roller that part of a signal path will have an extension through the peripheral region of the guide roller and parallel with the rotational axis of said roller.

The invention will now be described in more detail with reference to the accompanying drawings, in which Figure 1 illustrates schematically and in side view part of an arrangement for transporting sheet-like material constructed in accordance with the invention; and

Figure 2 illustrates the arrangement of Figure 1 from beneath, partly in section taken on the lines II-II in Figure 1.

Figure 1 illustrates that part of the transportation arrangement which is essential to the invention. The illustrated arrangement includes transport means 10 in the form of two coating transport bands 101, 102 which transport therebetween sheets (bank-notes) along a transport path and past detectors 111, 112. In the illustrated case, the detectors are mounted on a circuit board 11 and function to detect optically the presence/absence of sheets in the transport means, i.e. between the transport bands 101, 102, as they pass around a guide roller 103 forming part of the transportation arrangement. The detectors 111, 112 include a light transmitter 111 (Figure 2) and a light receiver 112, the light transmitter 111 being hidden by the light receiver 112 in the Figure 1 illustration. The roller 103 is provided with a circular prism 1031 which extends circumferentially around the roller at the periphery thereof, and the transport bands or belts 101, 102 pass around the periphery of said roller 103. The roller 103 is intended to be rotated anti-clockwise (see the two arrows in Figure 1).

The circuit board 11 is attached to an acrylic plate 12. Light from the transmitter 111 (suitably an IR-diode) follows a signal path through the plate 12 and through the sheet (the bank-note), when a sheet is located between the bands 101, 102 passing around the roller 103, and is reflected twice in the prism 1031, more specifically against its conical end surface parts 1032, and finally reaches the receiver 112. This is shown clearly in Figure 2, in which a transported sheet is referenced 2. The signal path 113 is shown in Figure 2 and marked with two arrows. The transmitter 111 and the receiver 112 are placed outside the edges of the transport bands 101, 102 on that side of the transport path which lies opposite to the guide roller 103. The signal path will thus pass twice through the transport path and in the region between the end surface parts 1032 passes parallel with the rotational axis of the guide roller 103 and the prism 1031, as shown in Figure 2.

In the case of the inventive arrangement, the signal path is broken twice by passing sheets 2. This minimizes the influence of semi-transparent sheets or bank-notes and also eliminates the risk of, e.g., a bank-note passing a sensor placed close to the centre of the bank-note path unnoticed. Furthermore, all electronics can be placed on one and the same side of the bank-note path, thereby minimizing the number of circuit boards and cables. When the receiver 112 incorporates a drive for the transmitter 111, the arrangement will be sensitive solely to its own light, i.e. will be insensitive to ambient light. In addition to achieving good reliability in operation, a saving in space can be achieved in accordance with the invention by fitting the requisite prism to an existing guide roller.

Claims

1. An arrangement for controlled transportation of sheet-like material, such as bank-notes, comprising

5 transport means (10) for transporting sheets along a transport path past detectors (111, 112) for detecting optically the presence/absence of sheets in the transport means (10), wherein the detectors (111, 112) include a detector signal transmitter (111) and detector signal receiver (112) and are so disposed that a detector signal path extends twice through the transport path, **characterized** in that the transport means (10) include transport bands, belts, rollers or like devices (101, 102, 103) for transporting sheets along the transport path in the close proximity of a rotating guide roller (103) which is provided with a circular prism (1031) in its peripheral region; and in that the detectors (111, 112) are disposed in the close proximity of the transport path but on the side thereof opposite to the circular prism (1031).

10 **2.** An arrangement according to Claim 1, **characterized** in that the detectors (111, 112) with signal transmitter (111) and receiver (112) are so arranged in relation to the rotating guide roller (103) that a part of the signal path has an extension through the peripheral region of the guide roller (103) and extends parallel with the rotational axis of the guide roller (103).

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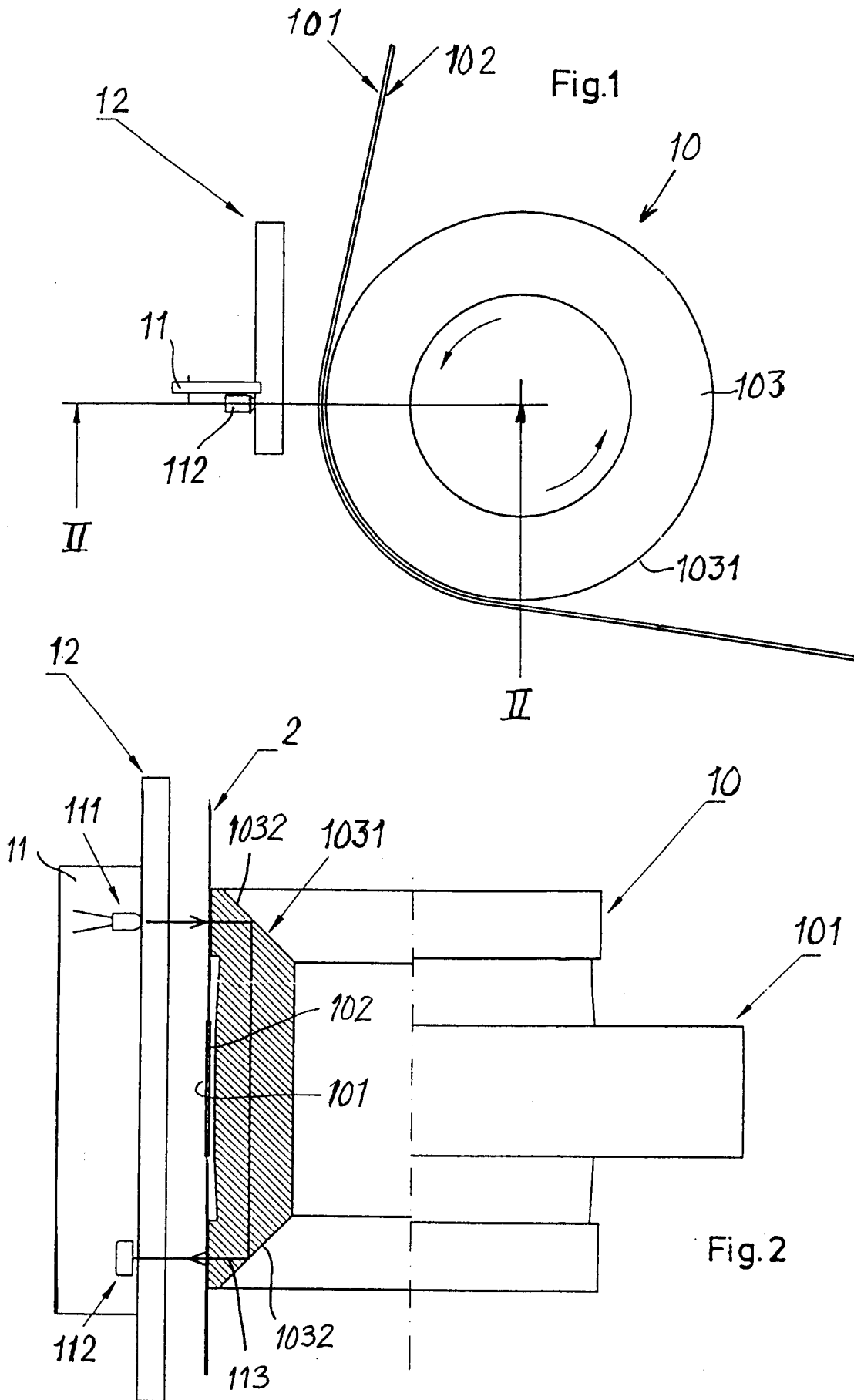
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EUROPEAN SEARCH REPORT

Application Number
EP 93 85 0240

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
Y	FR-A-2 492 349 (TRANSAC) * page 1, line 32 - page 2, line 20 * * page 2, line 33 - page 4, line 27 * * claim 1; figures 1,2 * ---	1,2	G07D1/00 G07D9/00 B65H7/14
Y	EP-A-0 504 997 (OCE-NEDERLAND) * column 1, line 1 - column 2, line 57 * * column 3, line 46 - column 4, line 39 * * claims; figures 1,2 * ---	1,2	
P,A	GB-A-2 257 509 (ICL PERSONAL SYSTEMS) * page 1, line 14 - page 2, line 13 * * page 3, line 17 - page 4, line 21 * * page 5, line 1 - page 7, line 13 * * claims 1-3,5; figure 1 * ---	1,2	
A	EP-A-0 058 285 (MANNESMANN AG) * claims 1-3; figures 1,2 * -----	1,2	
			TECHNICAL FIELDS SEARCHED (Int.Cl.5)
			G07D B65H G06K
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 24 March 1994	Examiner Piriou, J-C
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	

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