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(54) **Method for processing bank notes and money counting station**

(57) A method for processing bank notes in an automatic money counting station, wherein
the bank notes are introduced into the money station;
the introduced bank notes are guided into a money counting device, wherein the type and the amount of the bank notes are detected and are automatically registered in a control system;
the bank notes are physically stored in a storage facility, whereby the storage location is registered in the control system;
the registered type and the registered amount are coupled in the control system to the physical storage location of the counted bank notes;
an order is placed;
the physical storage location of the types and amounts of bank notes corresponding with the order are detected;
and the corresponding bank notes are released for transport outside the money station.

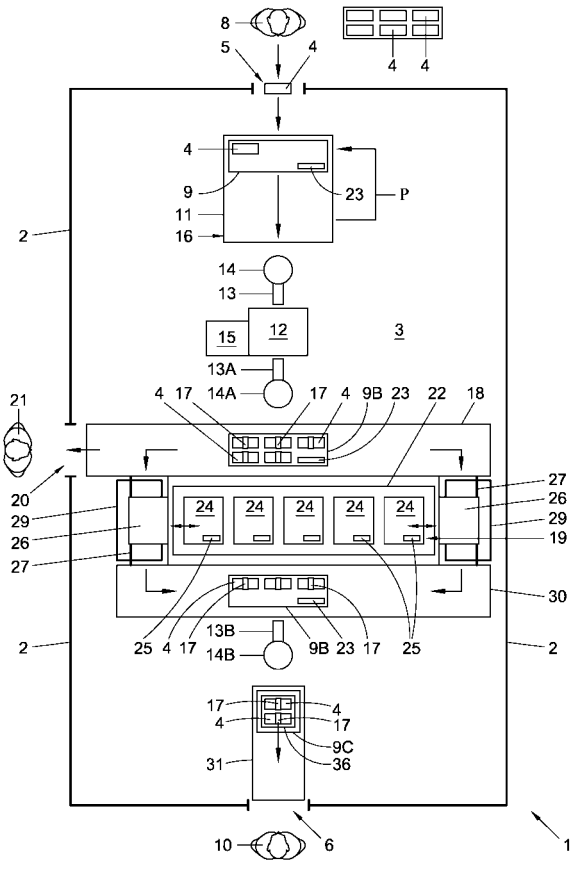

Fig. 1

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Description

[0001] The invention relates to a method for processing bank notes.

[0002] The invention also relates to a money counting station.

[0003] Money, and in particular bank notes, are collected and distributed by banks. For transporting the bank notes to and from the banks, often, high-security trucks for transporting valuables are deployed. Before the bank notes are transported to the banks, they are often first temporarily stored and counted in high-security money counting stations.

[0004] In the money counting station, the bank notes are supplied in, for instance, seal bags®, in which seal bags® the money is stored in unordered manner and/or in unordered packs. The money is taken from the seal bags® by an operator and introduced into money counting devices. The money counting device sorts and counts the bank notes so that counted packs of bank notes of the same type are passed from the money counting device. Then, the packs are tied into bundles, for instance in that a strip is placed therearound.

[0005] The counted and sorted bundles of bank notes are then passed to a storing facility, for instance by the operator. The amount and the type of bank notes, and the exact storage location within the storage facility are manually registered by the operator.

[0006] When, for instance, a bank or the storage company itself places an order, money is taken from the storage facility and recounted before it is transported to the bank. In principle, all operations in the money counting station take place under supervision of cameras.

[0007] Despite the fact that the areas where the money is stored are highly secured, it happens that bank notes are lost. It may be that an operator working inside the money station tries to steal money. But there can also be other causes for money getting lost.

[0008] An object of the invention is to present a relatively reliable and preferably efficient alternative to the existing methods and system for storing money.

[0009] This object and/or other objects can be achieved with a method for processing bank notes in a money counting station according to claim 1.

[0010] This object and/or other objects can also be achieved with a money counting station according to claim 13.

[0011] With a method and money counting station according to the invention, bank notes can be stored, automatically counted and bundled within a bounded area, after they have been introduced by a feed into the bounded area. The bank notes are led by a conveying mechanism along the money counting devices, while the amounts and the types of the bank notes can be registered using codes. The registered bank notes are automatically physically stored in a storage facility and are then coupled to a code. As the type, the amount and the storage location of the bank notes are automatically registered, the amounts of bank notes requested by means of orders can be conveyed directly from their storage location to a feed-out. Here, recounting is no longer necessary but it is still possible.

[0012] In one embodiment, coded carriers are provided which convey the money in packs and/or bundles within the bounded area. As a result, it can be registered where specific, introduced bank notes are located in the money station without the banks notes themselves having to be coded. Preferably, the carriers are conveyed largely by means of circulating conveying systems, wherein, in operation, on a relatively continuous basis, carriers are emptied and supplied again to be filled, with multiple carriers circulating.

[0013] Further advantageous embodiments according to the invention are represented in the subclaims and will also appear from the description, where the invention is described in further detail in several exemplary embodiments on the basis of the appended drawings. In the drawing:

Fig. 1 shows a schematic top plan view of a money counting station;
Fig. 2 shows a schematic flow chart of a control system for the money counting station;
Fig. 3 shows a perspective view of a money counting station;
Fig. 4 shows a perspective view of the money counting station of Fig. 3;
Fig. 5 shows a perspective view of a money counting station of Figs. 3 and 4.

[0014] In this description, identical or corresponding parts have identical or corresponding reference numerals. In the drawing, embodiments are shown merely by way of example. The elements used therewith are mentioned only by way of example and should not be construed to be limitative. The proportions of the embodiments shown in the Figures may be represented in a schematic and/or exaggerated manner and should not be understood to be limitative in any manner.

[0015] In Fig. 1, schematically in top plan view, a money counting station 1 is shown for processing money, preferably bank notes 4. The money counting station 1 is provided with a boundary 2 which at least largely seals off and encloses an area 3. In this specification, bank notes 4 are understood to mean at least paper money and/or bank-paper and the like.

[0016] In this specification, a bounded area or boundary 2 can be understood to mean that, in principle, the area should not be accessible to persons. The bounded area will only be entered for maintenance operations to the money station itself. It may happen that a malfunction occurs, or that something gets jammed in a money counting device. In such a case, the bounded area can be opened temporarily to an operator, so that the operator can solve the problem. The boundary 2 is, for instance, a fence or a wall, or a graphic representation on the floor

combined with sensors for detecting any unauthorized person that might enter the bounded area 3.

[0017] In the boundary 2, a feed 5 is provided for introducing the bank notes 4 into the bounded area 3. Also, a feed-out 6 is provided for passing bank notes 4 out of the bounded area 3. For instance, before the feed 5, the bank notes 4 are supplied in packs and/or in unordered fashion for instance in a security bag 7, for instance a seal bag®. The seal bag® may be provided with a code, which code comprises, for instance, information of a customer of a bank which has supplied the bank notes 4 in the seal bag®. Here, it may also be known which bank has initially issued the bank notes 4. An operator 8 opens the seal bag® and feeds the bank notes 4 from the seal bag® into the feed 5. The operator 8 may put the bank notes 4 directly onto a carrier 9, for instance an unordered pack, while the carrier 9 will be carried along by a conveying mechanism 33, in particular a feed conveyor 11, for further processing. Here, the operator registers for instance the code that is coupled to the seal bag® so that, when the money is counted, it can be monitored in a system who has counted the money. Feeding the bank notes 4 and/or the code can be carried out automatically and/or manually.

[0018] In one embodiment, the carrier 9 is designed for conveying one or multiple bank notes 4, or packs or bundles of bank notes 4, and can also be provided with a machine-readable code 23. This carrier 9 is preferably designed for conveying one pack of bank notes (see for instance Fig. 1A). Preferably, the carrier 9 comprises a plate 37 and/or engaging elements 38 for holding at least one pack of bank notes 4 in place. The engaging elements 38 can be of resilient design in a direction towards the bank notes 4, so that packs with different amount of bank notes 4 and/or of different thicknesses can be held by the carrier 9. The operator 8 may put one or multiple packs of approximately 80, 100 and/or some tens or hundreds of bank notes 4 into the carrier.

[0019] First, the carriers 9 are conveyed by the conveying mechanism 33, in particular by a feed conveyor 11. The carriers 9 with the introduced bank notes 4 are conveyed towards a money counting device 12 for counting the bank notes 4. With the aid of the feed conveyor, a subsequent, still empty carrier 9 will present itself before the feeding operator 8, as indicated with arrow P. Preferably, the feed conveyor 11 comprises a circulating system, in which multiple carriers 9 circulate, so that full carriers 9 are emptied from a pick up position 16 and new, empty carriers 9 are supplied before the operator 8 to be provided with bank notes 4.

[0020] In one embodiment, one or multiple electromechanically controlled grippers 13 are provided, which are preferably designed for placing the bank notes 14 from the feed conveyor 11, or at least the carrier 19 located at a pick up position, into or on the money counting device 12. The gripper 13 is part of, for instance, a robot 14. In one embodiment, multiple robots 14, 14A, 14A and/or grippers 13,13A, 13B are provided for conveying the bank notes 4 into and/or from the carriers 9, for instance to a subsequent station.

[0021] The money counting device 12 can be a money counting device 12 known per se. It is preferred that the money counting device 12 is designed for counting and sorting the bank notes 4. Bank notes 4 are introduced for instance unordered and/or in packs, in the example shown by the gripper 13. In a manner known per se, the money counting device 12 can sort and/or categorize the bank notes 4 on the basis of the denomination, i.e. the type of bank note 4, and/or on the basis of suitability or unsuitability, the money counting device 12 can reject a bank note 4. The bank notes 4 can also be sorted on the basis of the code coupled to the seal bag, for instance on the basis of the customer who has deposited the bank notes 4 and/or the bank that has issued the bank notes 4. For instance, suitable money is denominated and passed further through the money counting station 1 so that at a later stage, for instance via a bank, it can be brought back into circulation. These bank notes 4 can be fed out from the station 1 and be transported to a commercial bank. Bank notes 4 that will no longer be brought back into circulation are regarded as unsuitable by the money counting device 12. These may be bank notes 4 that are suitable for payment but which, after being taken by the money counting station 1, are conveyed to a national money authority/national bank, for instance particular types of bank notes 4 not much in circulation. Further, particular bank notes 4 can be rejected by the money counting device 12, for instance because they are no longer suitable to function as money, for instance because the bank notes 4 are torn, or at least hard to recognize, or because the bank notes 4 may be forged. The rejected bank notes 4 too are conveyed to, for instance, a national money authority/national bank. The money counting device 12 is designed to sort the bank notes 4 per type, or per denomination, and to then supply it, counted, to a bundling device 15, for bundling the counted and sorted bank notes 4. In one embodiment, the bank notes 4 are supplied and/or bundled which are supplied by one carrier 9 or from one sealbag® for instance such that these bank notes can be stored separately or coupled to a specific bank, and eventually can be returned to the same bank that initially issued the bank notes.

[0022] In one embodiment, the bundling device 15 is provided separately or integrated with the money counting device 12. The bundling device 15 provides bank notes 4 with a strip 17, which strip 17 bundles several bank notes 4. The bundling device 15 can also be a device known per se.

[0023] In one embodiment, a gripper 13A is provided which places sorted bank notes 4 on a feed-through conveyor 18, preferably in feed-through carriers 9B. In principle, these carriers 9B can be similar to the feed carriers 9. In another embodiment, the feed-through carriers 9B are designed for holding multiple bundles of bank notes 4, for instance four bundles, for instance designed with multiple engaging elements 38. This also holds for the

other carriers 9C in the money counting station 1. A central control system 32 (fig. 2) registers from which stack bank notes 4 sorted and counted by the gripper 13A are taken and are placed on the feed-through carrier 9B. As the respective bank notes are counted and sorted to type, the amount and the type of bank note 4, and the location thereof on the carrier 9B can be registered. To that end, the carriers 9B are preferably provided with a machine-readable code 23, for instance a bar code, a RFID (Radio Frequency Identification) chip, preferably a transponder, and/or an otherwise magnetically or electrically readable element. The other carriers 9, 9C too in the station can be provided therewith. In principle, within the bounded area 3, multiple detectors can be placed, for instance transmitters and/or receivers for RFID chips or other machine-readable codes 23, for machine reading the codes 23 of the carriers 9B, so that the location of the respective carrier 9B within the area 3 can be registered by the control system 32. In principle, the system can localise and identify the bundles on each carrier 9, 9B, 9C. Upon placing the counted and sorted bank notes 4 on the carrier 9B, the sorted type and the counted amount of bank notes 4 can be coupled to the code 23 of the carrier 9B, so that it will be known within the system which type, and which amount of bank notes 4 is located at which location within the area 3, and on the carrier 9B.

[0024] Depending on how the respective bank notes 4 are sorted by the money counting device 12, the bank notes 4 are fed through, with the aid of the feed-through conveyor 18, to a physical storage location 19, for instance within a storage facility 22, or are fed out from the bounded area 3 by an intermediate feed-out 20 for unsuitable and/or rejected bank notes 4. An operator 21 can be placed at the intermediate feed-out 20 for processing the unsuitable and/or rejected bank notes 4. There, the unsuitable and/or rejected bank notes can be inspected visually by the operator 21, and/or for instance by machine, by a specially designed inspection system.

[0025] The counted, sorted and preferably approved bank notes 4 are to be stored in the storage facility 22. The storage facility 22 is provided with, for instance, a vault, safe or bunker or the like where the bank notes 4 can be stored out of sight and/or out of reach of people. In one embodiment, elevators 23 are provided which can convey the bank notes 4 from and to a storage level of the storage location 19 in the storage facility 22.

[0026] In one embodiment, the storage facility 22 is provided with multiple receiving devices 24. The receiving devices 24 support the bank notes 4 during conveyance from and to the storage location 19, and can also serve as holder for the bank notes 4 during storage. The receiving devices 24 are preferably provided with a code 25. In one embodiment, the bank notes are transferred from the feed-through carrier 9B to the receiving device 24. This can be carried out, for instance, with the aid of a robot 26, for instance a robot 26 which is supported, in particular is suspended from, a portal frame 27 relative to which the robot 26 is for instance movably disposed. Preferably, the receiving devices 24 are movably arranged within the storage facility 22. For loading, the receiving device 24 can for instance be transported to a pick-up location to which end it is controlled by the control system 32. Conveyance of the receiving device 24 is preferably carried out by means of a continuous elevator system 29. The robot 26, for instance, places the bank notes 4 of one or multiple carriers 9 in or on the receiving device 24, while a second receiving device 24 which is already provided with bank notes 4, is passed through and from the continuous elevator system 29. In this manner, a continuous system can be achieved in which, in principle, the storage facility 22 can be loaded continuously and the receiving devices 24 circulate. The receiving device 24 is for instance loaded with a larger number of bundles than the number of bundles on the feed-through carrier 9B, for instance with approximately eighty bundles. As the location, the type and the amount of the bundles of bank notes 4 on the carrier 9 are known, also, the location, the type and the amount of the bundles of bank notes 4 that are transferred on the receiving device 24 can be registered in the overall control system. With the aid of the codes 25, the location and the content of each receiving device is known.

[0027] In one embodiment, the receiving device 24 is provided with a machine-readable code 25 such as, for instance, a bar code, a RFID (Radio Frequency Identification) chip, preferably a transponder, and/or an otherwise magnetically or electrically readable element. In principle, the money counting station 1, in particular the storage facility 22 can be provided with multiple detectors, for instance transmitters and/or receivers for RFID chips or other machine readable codes 23, for machine reading the codes 25.

[0028] The placement of the receiving device 24 in the storage facility 22 is registered so that the location, the type and the amount of bank notes 4 in the storage facility 22 can be registered. The code 25 can then also serve as extra verification means, in order that it can be registered to which location 19 the receiving devices 24 are conveyed.

[0029] After an order has been received, the respective bank notes 4 are taken from the storage facility 22 again, with the aid of, for instance, the continuous elevator systems 29. The robots 29 can be used for filling the carriers 9B at a feed-out side with the requested bank notes 4, which are, for instance, taken from the receiving device 24. Preferably, the carriers 9B are provided with boxes in which the bank notes are placed, preferably by the robot 29.

[0030] The carriers 9C filled with the requested bank notes 4 are for instance conveyed by means of the feed-through conveyor 18 in the direction of the feed-out 6. Here, the feed-through conveyor 18 is designed as, for instance, a circulating system, where the feed-through carriers 9B are emptied and filled while circulating on the feed and feed-out side of the storage facility 22, respectively.

[0031] The bank notes 4 in the carriers 9B can be conveyed by means of one or, for instance, multiple grippers 13B towards the feed-out 6, preferably in feed-out carriers 9C, or at least with a feed-out conveyor 31. These carriers 9C are preferably provided with boxes 36 in which the bundles of bank notes 4 are placed. The bank notes 4 are thus, preferably in boxes 36 in the carriers 9C, placed on the feed-out conveyor 31 with which the bank notes 4 are conveyed to an operator 10. The gripper 13B for placing the requested bank notes 4 on the feed-out conveyor 31 is for instance of the same type as the remaining above-mentioned grippers 13, 13A and part of a robot 14B. The feed-out conveyor 31 can be provided with, for instance, a part 31A which is disposed at a slight angle, so that the bank notes 4 glide towards the operator 10, or at least the box 36 with the requested bank notes 4 glides towards a second operator 10. Here, the box 36 is preferably disposed at an angle such that the bundles in the box 36 remain in place.

[0032] The second operator 10 is preferably placed at the feed-out 6. The second operator 10 prepares the requested bank notes 4 for transport, for instance to a bank that has placed the order. Preferably, a box with requested bank notes 4 is taken from the carrier 9C by the second operator 10 and transported to a bank, while a second, empty box is placed on the carrier 9C and the carrier 9C with empty box is carried along by the feed-out conveyor 31, in particular a carry along part 31B thereof, for instance in the direction back towards the robot 14B. In one embodiment, also the feed-out conveyor. In one embodiment, the above mentioned boxes can be of a type known for money transport or be known otherwise.

[0033] In Fig. 2, an abstract schematic representation of an embodiment of the overall control system 32 is shown, comprising at least a processing circuit, a data base, preferably a SQL server and a memory device. This system 32 controls the conveying mechanism 33 of the money station 1. The conveying mechanism 33 comprises, for instance, a circulating feed conveyor 11, robots 14, 14A, 14B, 26, feed-through conveyors 18, 30, a continuous elevator system 29, and/or a circulating feed-out conveyor 31. The control system 32 registers the amounts, denominations, and/or assessments of the bank notes 4, which it receives via the money counting device 12, for instance via an Ethernet connection. It also registers the locations of, and the bank notes 4 present in the carriers 9 and receiving devices 24 via detectors 34 which read the codes 23, 25.

[0034] Via a graphic user interface 35, the settings of the system 32 can, for instance, be adjusted and/or orders can be placed for requesting specific bank notes 4. The control system 32 will control the conveying mechanism 33 for conveying the bank notes 4 from the storage facility 22 to the feed-out 6.

[0035] In one embodiment, multiple continuous elevator systems 29 are provided. In yet another embodiment, the continuous elevator system 29 is of mobile design, where, first, the continuous elevator system 29 is fully loaded to then convey the load to a location, for instance an underground location, whereupon the elevator system 29 can be unloaded.

[0036] In Figs. 3, 4 and 5, in different views, an embodiment according to the invention is shown. In Fig. 3, a perspective view to the feed side of the money station 1 is shown. Multiple operators 8 feed the money into the carriers 9, via two feeds 5, with the carriers 9 circulating, via a feed conveyor 11, along robots 14. The robots 14 convey the bank notes 4 in money counting devices 12, after which the counted and sorted bank notes 4 are bundled by the bundling devices 15. Second robots 14A convey the bundles from the bundling devices 15 to a feed-through conveyor 18, towards third robots 26, or towards an intermediate feed-out 20 for bank notes 4 which are rejected and/or declared unsuitable by the money counting device 12.

[0037] In Fig. 4, a perspective view is shown of third robots 26 in the portal frames 27 which take up the bank notes 4 from the carriers 9 and place them in the continuous elevators 29. Also, detectors 34 are provided for detecting the code 23 of the carriers 9. The storage facility 22 is provided in which multiple receiving devices 24 are located, which receiving devices are preferably movably arranged within the storage facility 22 to be transported to and from the continuous elevators 29.

[0038] In Fig. 5, a perspective view to the feed-out side is shown. A second feed-through conveyor 30 is provided which conveys the bank notes 4 from the third robots 26 to fourth robots 14B. The fourth robots 14B convey the requested bank notes 4 to the feed-out conveyor 31 so that the requested bank notes 4 end up with the operators 10.

[0039] The embodiments described and many comparable variations, as well as combinations of the embodiments are understood to fall within the frame of the invention as outlined by the claims. Naturally, different aspects of different embodiments and/or combinations thereof can be combined and exchanged. Therefore, there should thus be no limitation to only the embodiments mentioned.

Claims

1. A method for processing bank notes in an automatic money counting station, wherein
   the bank notes are introduced into the money station;
   the introduced bank notes are guided into a money counting device, wherein the type and the amount of the bank notes are detected and are automatically registered in a control system;
   the bank notes are physically stored in a storage facility, whereby the storage location is registered in the control system;
   the registered type and the registered amount are coupled in the control system to the physical storage location of the counted bank notes;

an order is placed;
the physical storage location of the types and amounts of bank notes corresponding with the order are detected; and
the corresponding bank notes are released for transport outside the money station.

2. A method according to claim 1, wherein the bank notes are bundled and in bundles are physically stored and/or transported out of the closed area.

3. A method according to claim 1 or 2, wherein the bank notes are registered with the aid of a code, wherein the registered bank notes are physically stored and the code is coupled in the control system to the registered type and the registered amount of the accompanying bank notes.

4. A method according to any one of the preceding claims, wherein the bank notes, at least after having been counted, are placed, in bundles, in a carrier, in which carrier the bank notes are conveyed between different locations within the money station.

5. A method according to claim 4, wherein the carriers circulate substantially within circulating guide systems.

6. A method according to claim 4 or 5, wherein the carrier comprises a code and is registered by means of the code in the control system, wherein the code of the carrier is coupled in the control system to the type and the amount of the bank notes held in the carrier.

7. A method according to any one of the preceding claims, wherein the storage facility comprises multiple receiving devices.

8. A method according to claim 7, wherein the receiving devices comprise a code, and the bundled bank notes are stored in the receiving devices.

9. A method according to claim 7 or 8, wherein the bank notes are transferred from the carriers to the receiving devices and are conveyed by the receiving devices to the storage location and there are stored in the storage facility.

10. A method according to any one of the preceding claims, wherein a gripper is provided for conveying the bank notes into and/or from the carriers.

11. A method according to any one of the preceding claims, wherein the money station comprises a bounded area within which the operations take place.

12. A money counting station, provided with
a in-feed for introducing bank notes into the station;
a feed-out for passing bank notes out of the station;
a bank note conveying mechanism provided between said in-feed and feed-out, designed for conveying, within the area, the bank notes which are associated with a code,
a money counting device for counting the bank notes, which is designed between the in-feed and the storage facility;
a storage facility for storing the bank notes;
a code detecting device for registering the code associated with the counted amounts of bank notes;
a user interface for placing orders, and
a control system connected to the user interface and the conveying mechanism, which is designed for coupling an order to an amount of bank notes coupled to a code, and for controlling on the basis thereof the conveying mechanism for conveying the requested bank notes from the storage facility to the feed-out.

13. A money counting station according to claim 12, wherein the conveying mechanism comprises carriers for holding multiple bundles of bank notes.

14. A money counting station according to claim 12 or 13, wherein the storage facility is provided with multiple receiving devices for physically storing bundles of bank notes.

15. A money counting station according to claim 13 or 14, wherein the carriers and/or the receiving devices are provided with a code.

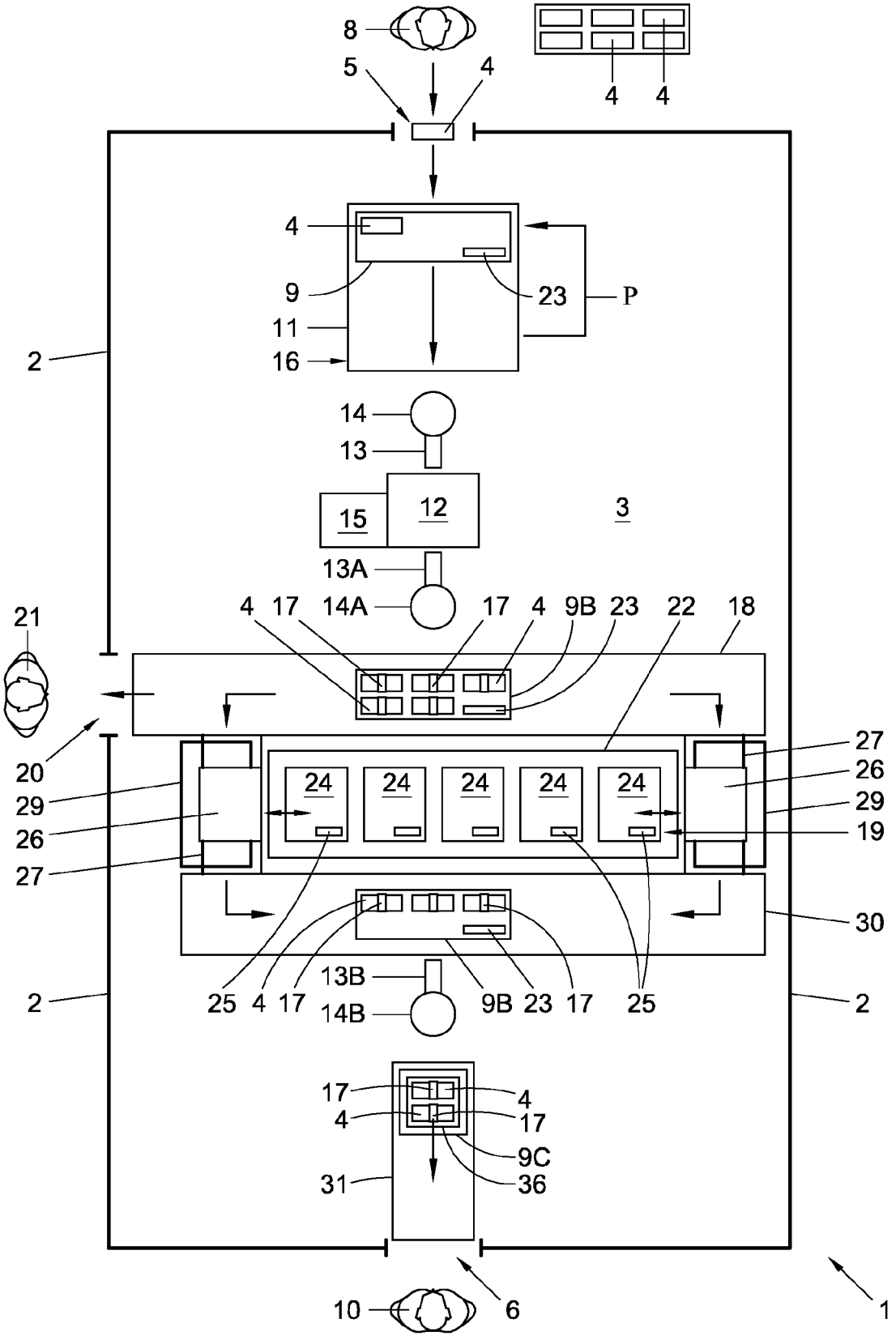
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Fig. 1

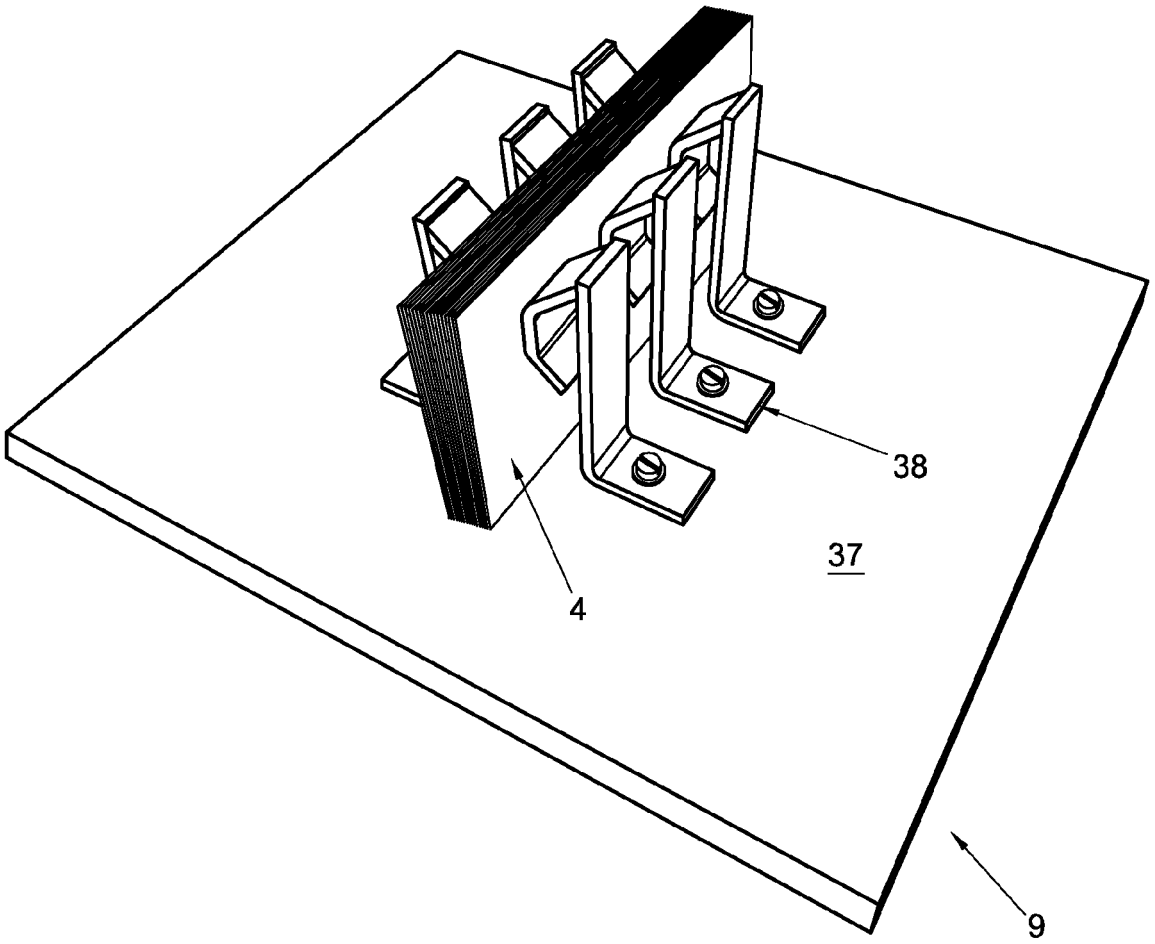

Fig. 1A

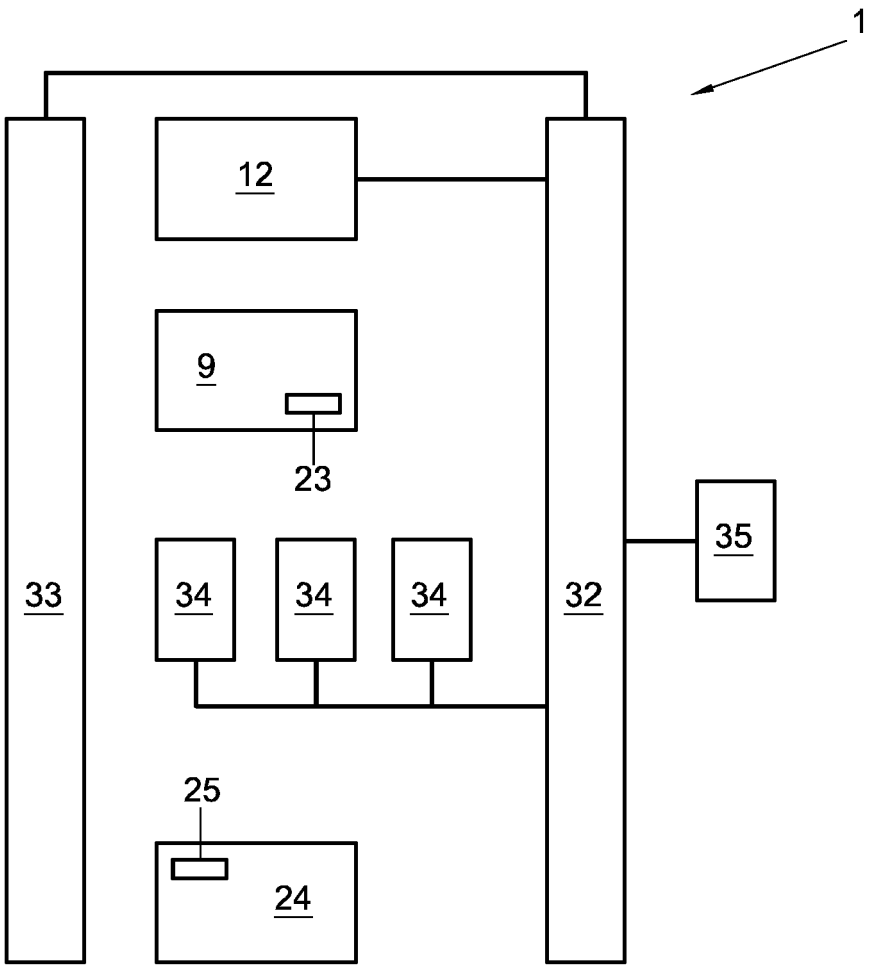

Fig. 2

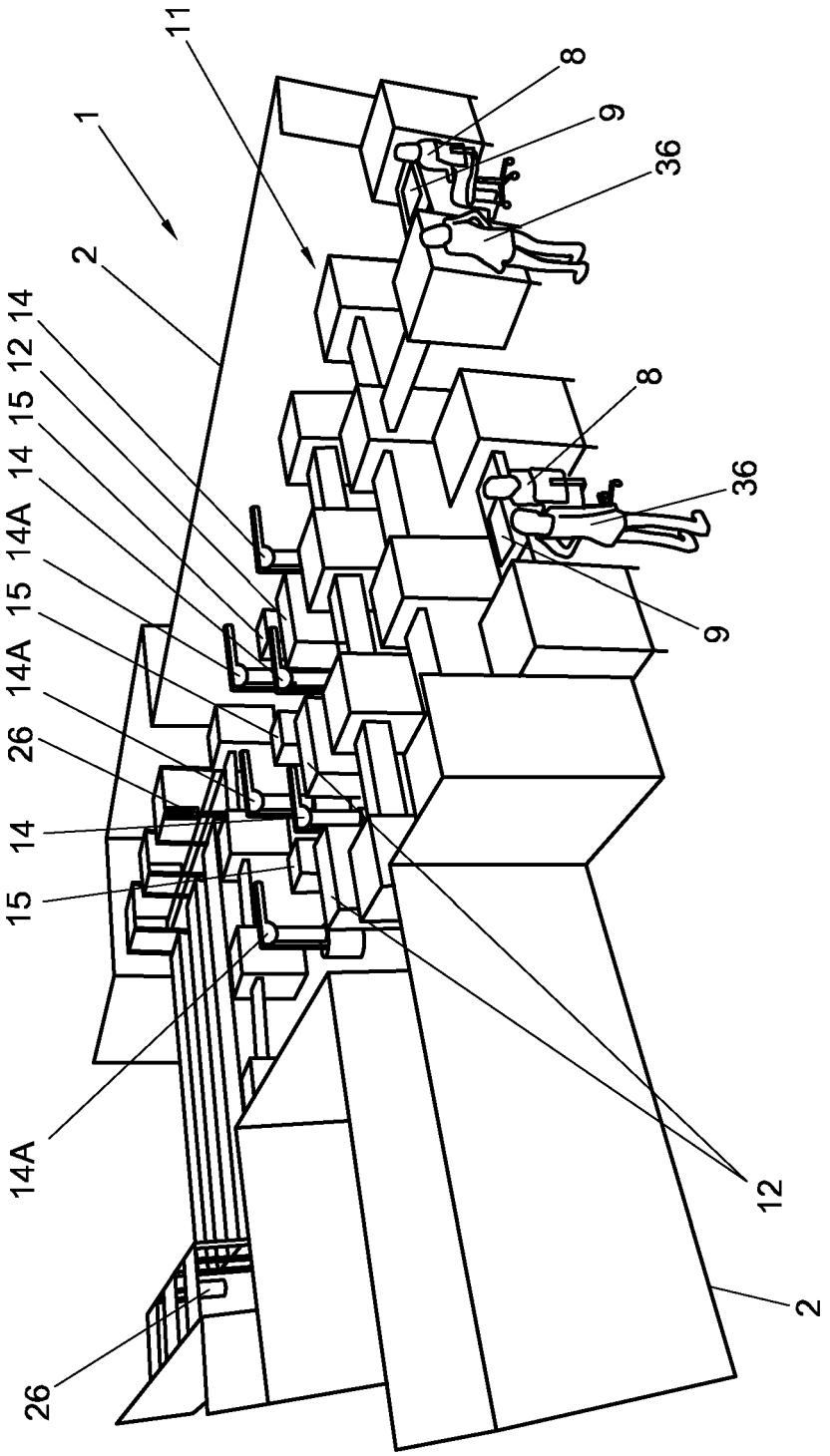

Fig. 3

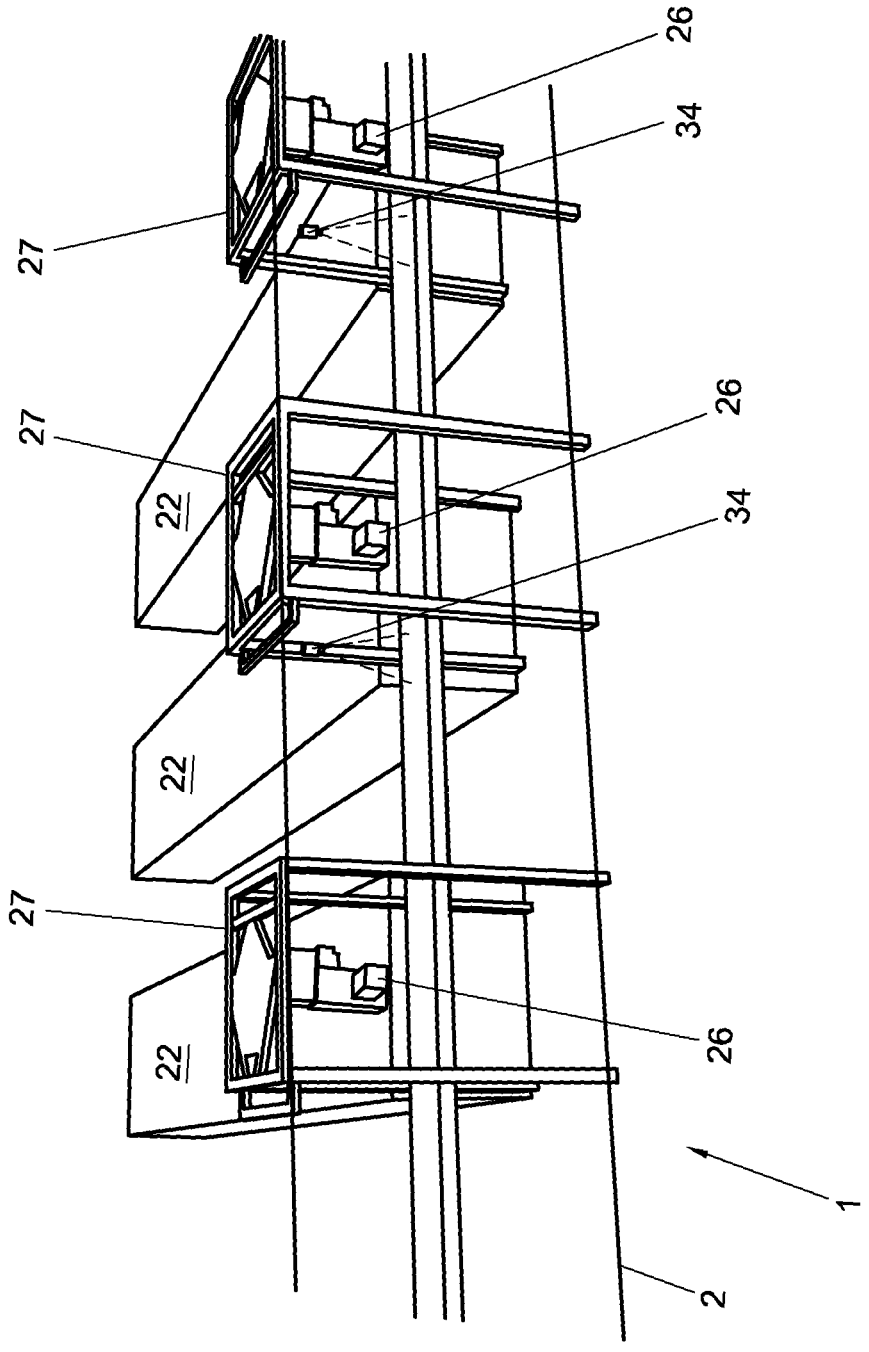

Fig. 4

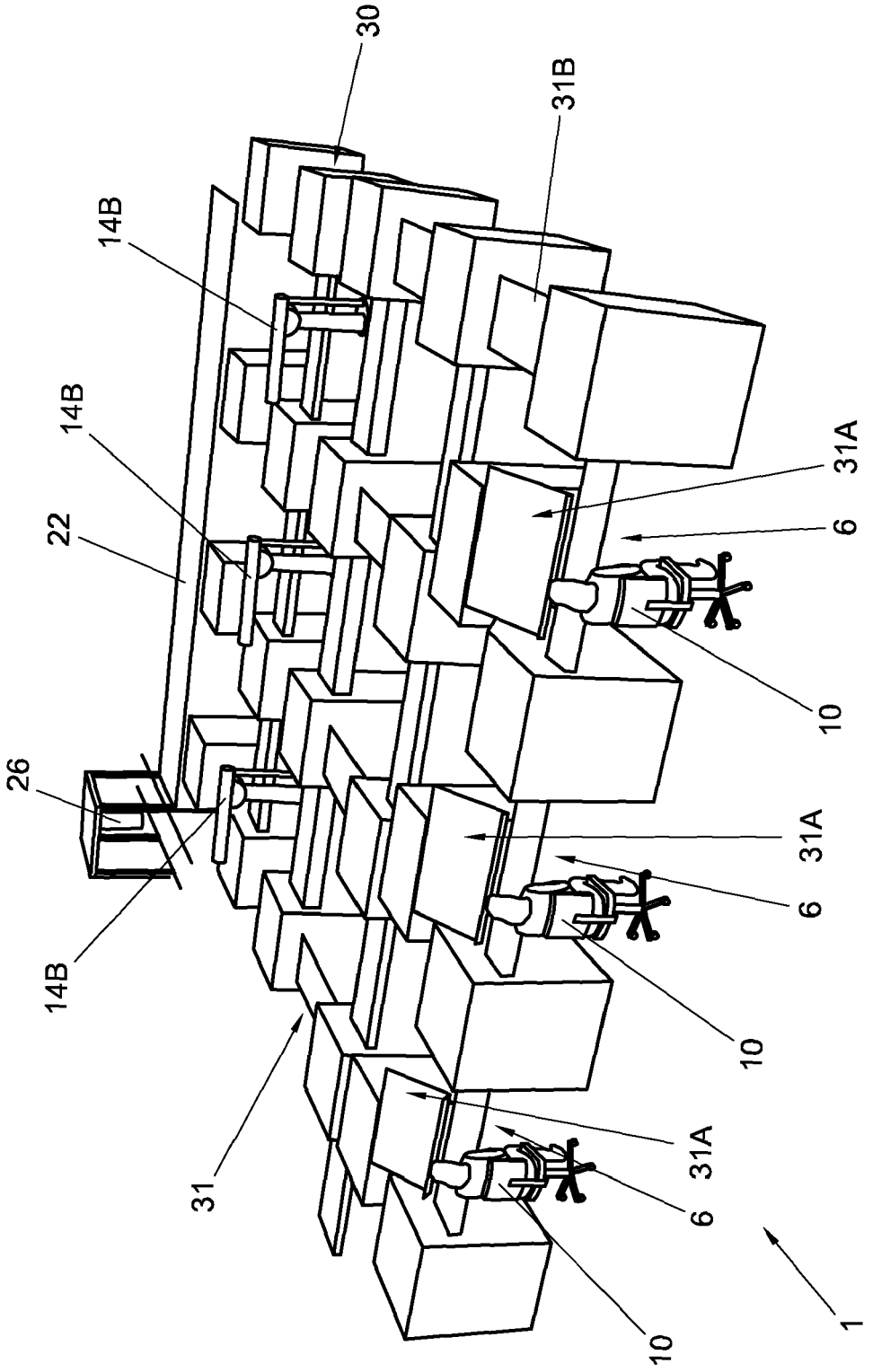

Fig. 5

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European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 09 15 9709

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 4 988 849 A (SASAKI ET AL.) 29 January 1991 (1991-01-29) * column 2, line 54 - column 3, line 58; figures 1-3 * -----	1-15	INV. G07D9/00
X	EP 0 143 663 A (FUJITSU) 5 June 1985 (1985-06-05) * page 12, line 25 - page 29, line 16; figures 6-14 * -----	1-15	
X	WO 2005/096233 A (GIESECKE & DEVRIENT) 13 October 2005 (2005-10-13) * page 5, line 11 - page 12, line 17 * * page 18, line 15 - page 19, line 28; figures 1-3,6 * -----	1-15	
A	EP 0 379 638 A (LANDIS & GYR) 1 August 1990 (1990-08-01) * column 7, line 5 - line 18 * * column 10, line 11 - line 39; figures * -----	1-15	
A	EP 1 833 029 A (GLORY KOGYO) 12 September 2007 (2007-09-12) * paragraphs [0021] - [0036], [0089], [0090]; figures 1-4,7 * -----	1-15	TECHNICAL FIELDS SEARCHED (IPC) G07D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	27 July 2009	Neville, David

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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D : document cited in the application
L : document cited for other reasons

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1 EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 09 15 9709

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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27-07-2009

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