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(54) **Anti-tampering method and system for automatic teller machines and similar devices**

(57) Method for detecting tampering in a dispenser of banknotes or the like comprising an automated withdrawal hatch and a presenter unit designed to convey bundles of banknotes from a region where the banknotes are collected together or formed to said hatch by means of a system of motor-driven belts (6, 6', 7, 7', 8, 8'), said method comprising the positioning of sensors (12) of a suitable type designed to detect objects in contact with at least one of said belts or in the vicinity thereof and detect the presence of these objects, at least during a period when said hatch is in the open condition, by means of said sensors.

Device designed to implement this method and presenter unit equipped with said device.

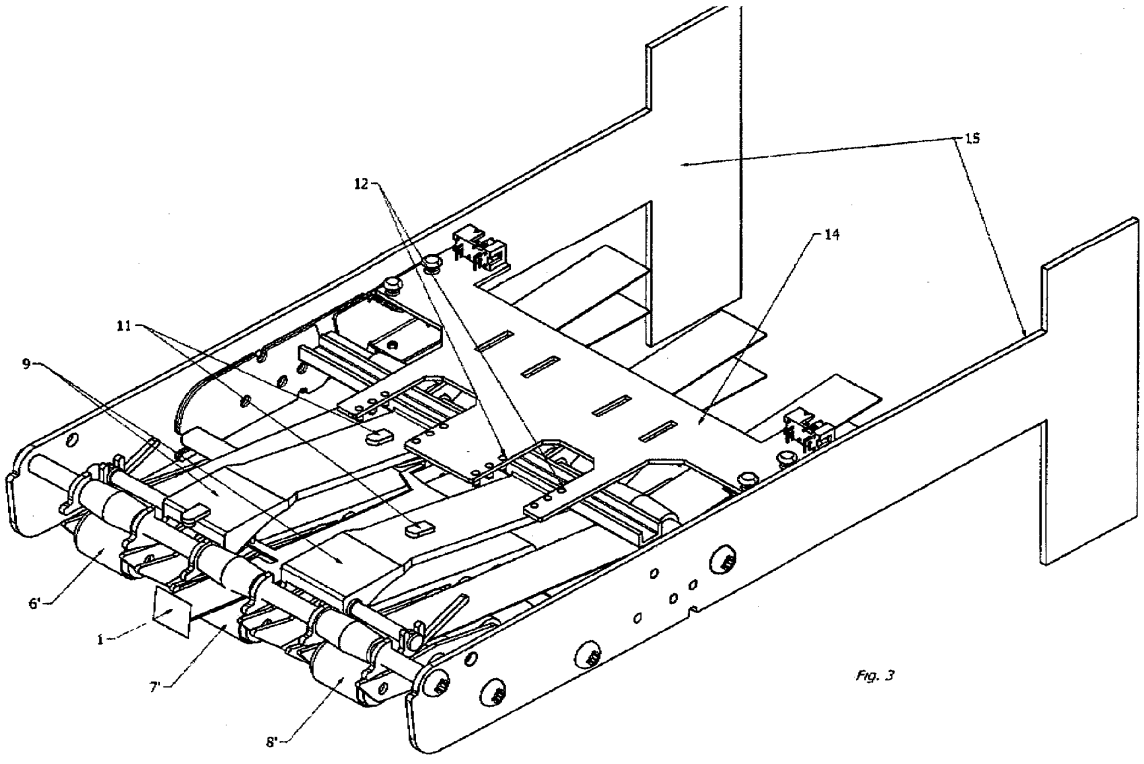

Fig. 3

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Description

[0001] The present invention relates to a method and a system for detecting attempts to tamper with automatic dispensers of banknotes or the like. In particular, it relates to a system for detecting in good time the introduction, into the dispenser, of foreign bodies intended to allow the illegal withdrawal of banknotes.

[0002] In a widely used type of automatic banknote dispenser, for example that based on NCR technology (often referred to by the name "Bancomat" in certain countries such as Italy or the abbreviation "ATM", i.e. automatic teller machine, in other countries), the banknotes which are withdrawn automatically from different drawers, during a withdrawal operation, are collected together in a bundle (which may comprise one or banknotes) at a first end of a presenter unit which has a system of pulleys and belts comprising a series of (for example three) pairs of belts. The belts of one pair move in the same plane, in a substantially symmetrical manner, and have a section along which they face each other and make contact or are at a small distance from each other. The bundle is gripped between the two belts which move along the aforementioned section in the same direction and substantially at the same speed. In this way the belt and pulley system is able to convey the bundle from one end to the other of the section in question. The two belts may in general be annular belts which perform an opposite rotation with their movement.

[0003] An automated hatch, via which the bundle is presented to the user, is present at the second end of the presenter unit opposite to the first end where the bundle is collected together. Sensors may be provided for detecting the presence of the banknotes at a given point along the path, so as to command the movement and stoppage of the belts and opening and closing of the hatch at the appropriate moment. The section which the formed bundle must travel along is sufficiently long to prevent access to the banknote drawers by breaking into the hatch. Usually, operating cycles are envisaged where the belts are moved in the opposite direction in order to bring the banknotes back to the first end of the aforementioned section where they are allowed to fall into a collecting container. These cycles are carried out in certain cases, such as when the bundle presented at the hatch is not withdrawn by the user within a predetermined time period or if the bundle fails to arrive in the vicinity of the hatch, owing to jamming along the aforementioned section. This latter condition offers the possibility of carrying out a tampering operation aimed at removing the banknotes which are intended for a user who is generally unaware. After a withdrawal, performed usually by means of a counterfeit (cloned) debit or credit card and before the hatch closes, a tool of suitable shape, for example such as that shown in Figure 1, is introduced in a suitable manner between the belts of a pair in the presenter unit, inside the space where the bundles of banknotes are usually conveyed, in the case, for example, of a presenter unit with three pairs of belts, usually between the belts of the central pair. The tool is introduced in the direction and sense of the arrow A. The tool 1 in position can be seen in the various figures showing different views of a presenter unit of the type mentioned above, in particular in Figure 3 which shows the presenter unit in a perspective view, from which, for greater clarity, the top belts of each pair of the three pairs present in the example have been eliminated.

[0004] The tool, which has a flat body 2, which may generally have a width smaller than that of a belt of the presenter unit, is positioned, with the two teeth 4 and the two tongues 3 arranged on either side of one of the belts between which it is inserted. When a subsequent user attempts to make a withdrawal, the banknotes intended for said person pass over the tongues and are prevented from moving towards the hatch by the teeth, while the hatch which is still closed prevents the tool from coming out. During the movement in the opposite direction, which is generated owing to the fact that the failure of the banknotes to reach the hatch is detected as being a jam, the tongues retain the bundle because of their form. The stop 5 has the function of preventing the tool from following the movement of the belts in the direction away from the hatch. At this point it is sufficient to force open the hatch in order to retrieve the tool together with the money. The systems for detecting the jamming action, which are based on suitable sensors activated in order to detect the passage of the bundles, are not sufficient for preventing the withdrawal attempt following tampering. It would instead be useful to render the dispenser inoperative before this stage, so as to prevent the money from being brought into a zone of the apparatus which can be easily reached, such as the banknote presenter unit.

[0005] The problem described above has now been solved according to the present invention by a method for detecting tampering in a dispenser of banknotes and the like comprising an automated withdrawal hatch and a presenter unit designed to convey bundles of banknotes from a region where the banknotes are collected together or formed to said hatch by means of a system of motor-driven belts, said method comprising the positioning of sensors of a suitable type designed to detect objects in contact with at least one of said belts or in the vicinity thereof and detect the present of these objects, at least during a period when said hatch is in the open condition, by means of said sensors.

[0006] The invention also relates to a detection device comprising said sensors or their components which is designed to be positioned in a suitable manner on a presenter unit of the type described above, so as to be able to detect the presence of objects, as well as a presenter unit equipped with such a device and a dispenser with a presenter unit provided with said device.

[0007] The contents of the accompanying claims form the particular subject of the invention.

[0008] The invention will now be illustrated more clearly by means of the description of preferred embodiments

provided by way of an example not intended to limit the scope of protection, with the aid of the accompanying figures in which:

Figure 1, as already discussed above, is a schematic perspective illustration of a tool commonly used when tampering with a banknote dispenser, with the intention of stealing banknotes prepared for a withdrawal operation;

Figure 2 is partial, perspective, schematic illustration of a presenter unit for banknote dispensers, of the type with three pairs of oppositely arranged belts, with inserted a tool such as that shown in Figure 1 as described above;

Figures 3 and 4a are partial, perspective, schematic, plan-view illustrations of the same presenter unit, but equipped with sensors for implementing a method according to the present invention, in which parts of the belts, such as the upper parts, have not been shown in order to facilitate interpretation of the figure;

Figure 4b shows a view, on a larger scale, of the area inside the circle B shown in Figure 4a, in which the inserted tool is shown in broken lines (for greater clarity both in the zones which are directly visible and in the zones hidden by other details);

Figure 5 is a cross-sectioned, lateral, schematic view of the same presenter unit, again equipped with sensors, according to the present invention.

[0009] With reference to Figure 2, the presenter unit is, according to a preferred aspect, of the type in which a suitable number of pairs of oppositely arranged belts, for example the three pairs with the belts 6 and 6', 7 and 7', 8 and 8', are used to convey the bundles which are arranged between the opposite belts of a pair. The belts may be motor-driven in a suitable manner, positioned and guided with rollers and/or pulleys and are preferably of the annular type. It should be noted that the figures show only a front portion of the belts, namely that portion which is directed towards the withdrawal hatch. Other guiding elements may complete the presenter unit, for example the slides 9 which are visible in Figures 2 to 5, or the pivot system 10 for one of the belts of each pair, for adapting the position of the belt and allowing it to compress and retain the bundle at the end, when it is exposed through the hatch by the belts. It should be noted that the presenter unit, apart from the presence of the aforementioned sensors and any other modifications considered necessary, may be entirely the same as a presenter unit of the prior art and does not require a more detailed description; it may also consist of a presenter unit with a structure different from that shown, of a known type or with modifications which may be developed by a person skilled in the art. The presenter units according to the prior art may already be equipped with sensors of the type used also according to the present invention, for example infrared sensors 11 which are positioned on the slides 9, but are generally used only during movement of the bundle and not following withdrawal of the bundle, when the tampering operation described may occur. Moreover, since the bundles extend transversely with respect to the entire presenter unit, the existing sensors are generally not suitable for detecting the presence of an object such as the tool described which, generally, projects only slightly laterally from the belts and generally does not affect other guiding structures such as the slides.

[0010] According to the present invention, sensors are provided for detecting the presence or the passage of foreign objects at least during a period where there is no movement of money, such as that which occurs following a withdrawal at the hatch, before it closes.

[0011] According to a preferred aspect, said sensors consists of optical sensors, preferably of the infrared type, of the type commonly used to detect banknotes. However, it is possible to use also other types of sensors, such as sensors which operate with other types of radiation, or mechanical sensors, acoustic sensors, in particular ultrasound sensors or, in the case where metal objects are to be detected, also magnetic sensors. Unlike optical or mechanical sensors, they may detect objects also in a position hidden by the belts or some other non-metallic structure, such as the slides. The sensors of the acoustic type may be used in the same way as optical sensors and be positioned in the same way, being able to be designed or regulated as to monitor an area which also very small and, in the manner of optical sensors, being composed of one component only or several components such as an emitter, detector or emitter/detector and reflector. According to a different aspect, it is possible to design and regulate sensors of this type so as to be able to detect also objects which are hidden by other parts of the presenter unit or, more generally, of the dispenser; according to one particularly interesting aspect of the invention, objects may also be detected through the belts themselves, without - differently from magnetic detectors - being limited to the detection of metal objects.

[0012] The sensors must cover an area where a portion of the object is obliged to pass. In the case of optical sensors they may comprise emitter and receiver pairs, or an emitter/detector and reflecting element, as commonly occurs in the sensor sector, and an optical path is defined such that the presence of objects along it is detected should they interrupt it. Structures of the presenter unit must not be present along the optical path. According to a preferred aspect, the optical sensors may be positioned so that the optical path is transverse to the path of the bundles and situated laterally with respect to guide structures such as the belts or the slides. Substantially similar principles apply to any mechanical sensors, which must be able to be introduced laterally relative to the belts without interfering with operation of the presenter unit. The term "laterally" is understood in particular as meaning along the side of the belts in the direction transverse to that in which the banknotes are moving. Preferably, the sensors are positioned so as to detect objects in a

space situated along the side of the belt and delimited by another belt or another guide element arranged parallel to the belt. More preferably, the sensors are able to detect objects at a distance close to the belts, preferably within a range of 5 mm, more preferably within a range of 3 mm, so that they cannot be eluded by tools which project only slightly from the belt.

[0013] As can be seen in the figures, the sensors 12 may be arranged above or below the belts, in one or more suitable positions, at a distance from the hatch so that a tool such as that described above must reach or pass beyond them with its parts projecting laterally from the belts (in the example considered at least the tongues, but the sensors may also be arranged so that the teeth must also reach or pass beyond them), taking into consideration therefore the dimensions of the banknotes, which determine a minimum length of the tool.

[0014] Figure 5 shows in broken lines the optical path 13 monitored by the sensors.

[0015] The sensors may be suitably fixed in the desired position, for example to parts of the presenter unit or other elements of the banknote dispenser. Devices comprising one or more sensors or components thereof (emitter, detector, reflector) may be provided. The devices may comprise a support structure 14 which supports the sensors or their components 12 and which may be fixed to the presenter unit or to another part of the dispenser. In the example shown the structure is designed to be fixed to the side supports 15 of the presenter unit and there are two structures arranged in a substantially symmetrical manner above and below the belt system. According to a preferred aspect, the structure may support other elements in addition to the components of the sensors. For example the circuitry for powering and connecting the sensors to processors or other units designed to receive the data and process it or part of it, and optionally logic circuits, such as memories, processors or the like, designed to process the data of the sensors or manage operation thereof.

[0016] According to a possible aspect of the invention, the aforementioned circuitry and also the logic circuits, or parts thereof, may be produced using the technique of printing on said structure which may be made of suitable material, for example Bakelite or some other plastic suitable for this purpose. In any case the structure will be made of suitable material which has a suitable mechanical strength.

[0017] It should be noted that if, as in the example considered, the device must be used in combination with a similar device, they may be all the same or different. For example, one device may have circuitry which is more complex than the other one, being in any case intended to be interconnected, or one device may have only emitters or detectors or they may be alternated and the choice as to how to distribute said circuitry or other circuits may be established by a person skilled in the art. In the case where a device has only reflectors, for example, it may not be provided with power supply and connection circuits, which will be distributed only on the other device.

[0018] By means of the method according to the present invention, it is possible to detect tampering attempts such as that described above as soon as they occur and, therefore, the machine may be shut down before the banknotes are exposed to the risk of theft. The method has been described in the case of a dispenser where the bundles are conveyed between two belts of a pair, but it may also be implemented, with due modifications to other types of plant, for example with there is on the one hand the belt and on the other hand rollers or other movement systems.

[0019] Sensors may be provided for some or all the belts or pairs of belts, as shown in the Figure, depending on the requirements and their accessibility.

[0020] The sensors may also be activated during other stages of the delivery process for other functions and may be used in combination with or also partly instead of the sensors used to detect the position of the bundles.

[0021] The data detected by the sensors may be processed locally or remotely and used in any possible manner, for example in order to disable the machinery and/or generate alarms and/or activate other security systems.

Claims

1. Method for detecting tampering in a dispenser of banknotes or the like comprising an automated withdrawal hatch and a presenter unit able to convey bundles of banknotes from a region where the bundles are collected together or formed to said hatch by means of a system of motor-driven belts (6, 6', 7, 7', 8, 8'), said method comprising the positioning of sensors (12) of a suitable type able to detect objects in contact with at least one of said belts or in the vicinity thereof and detect the presence of these objects, at least during a period when said hatch is in the open condition, by means of said sensors.

2. Method according to claim 1, wherein said presenter unit has pairs of opposite belts able to convey the bundles between the belts of one pair and said sensors are able to detect the presence of an object between the belts of a pair, or its parts projecting laterally from the belts.

3. Method according to any one of the preceding claims, wherein said sensors are of the mechanical, acoustic, in particular ultrasound, or optical type, in particular infrared sensors able to monitor a zone or optical path situated on the side of at least one belt and lying between two belts or a belt and another guide element, optionally a slide (9) or pair of opposite slides, arranged parallel to each other.

4. Method according to any one of the preceding claims, wherein the sensors are able to detect ob-

jects at a distance from the side edge of the belt of 5 mm and optionally 3 mm.

5. Presenter unit for a banknote dispenser able to convey bundles of banknotes from a region where the bundles are collected together or formed to said hatch by means of a system of motor-driven belts (6, 6', 7, 7', 8, 8') or banknote dispenser comprising said presenter unit, comprising sensors positioned so as to be able to implement a method according to any one of the preceding claims, if suitably activated.

6. Presenter unit according to claim 5, comprising one or more devices, in particular a pair of said devices arranged in a substantially symmetrical manner, with a support structure (14) which is fixed to the presenter unit and said sensors or their components (12) which are suitably arranged.

7. Device designed to be fixed to a presenter unit for a banknote dispenser able to convey bundles of banknotes from a region where the bundles are collected together or formed to said hatch by means of a system of belts (6, 6', 7, 7', 8, 8') having a support structure (14) able to be fixed to the presenter unit and sensors or their components suitably arranged so as to implement a method according to any one of claims 1 to 4.

8. Device according to claim 7, comprising circuitry for powering and/or connecting and/or controlling said sensors or components, optionally formed using the technique of circuits printed directly thereon.

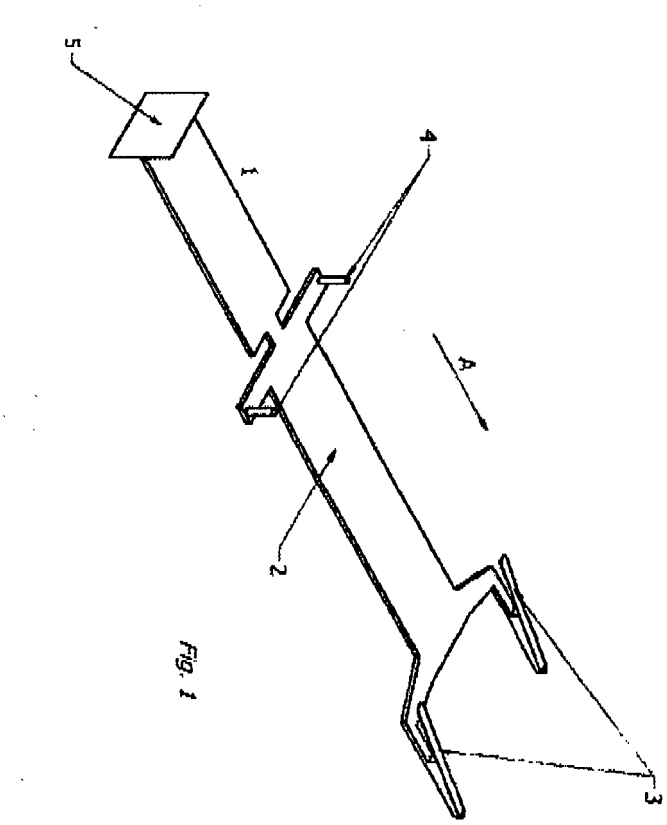

Fig. 1

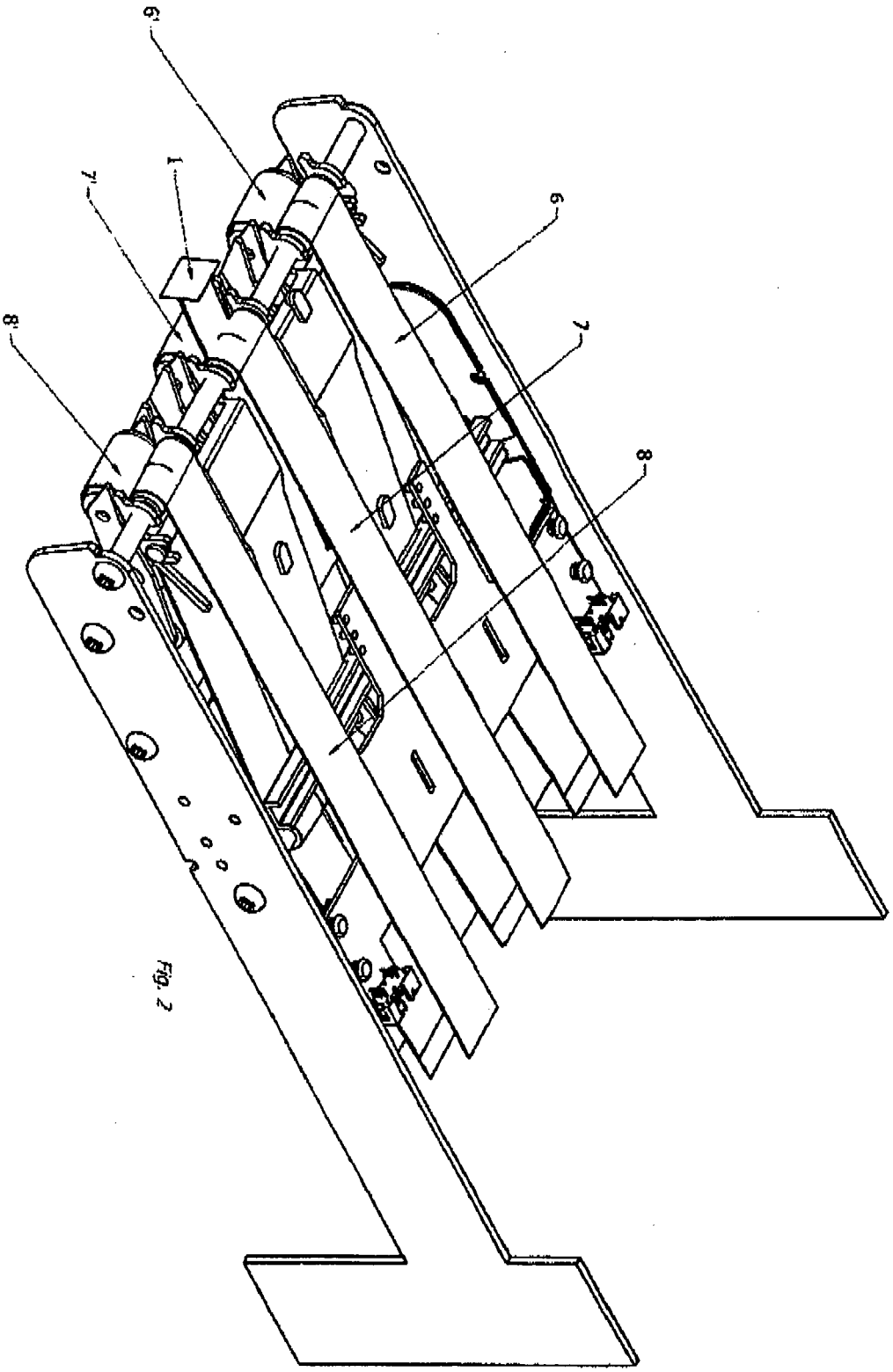

Fig. 2

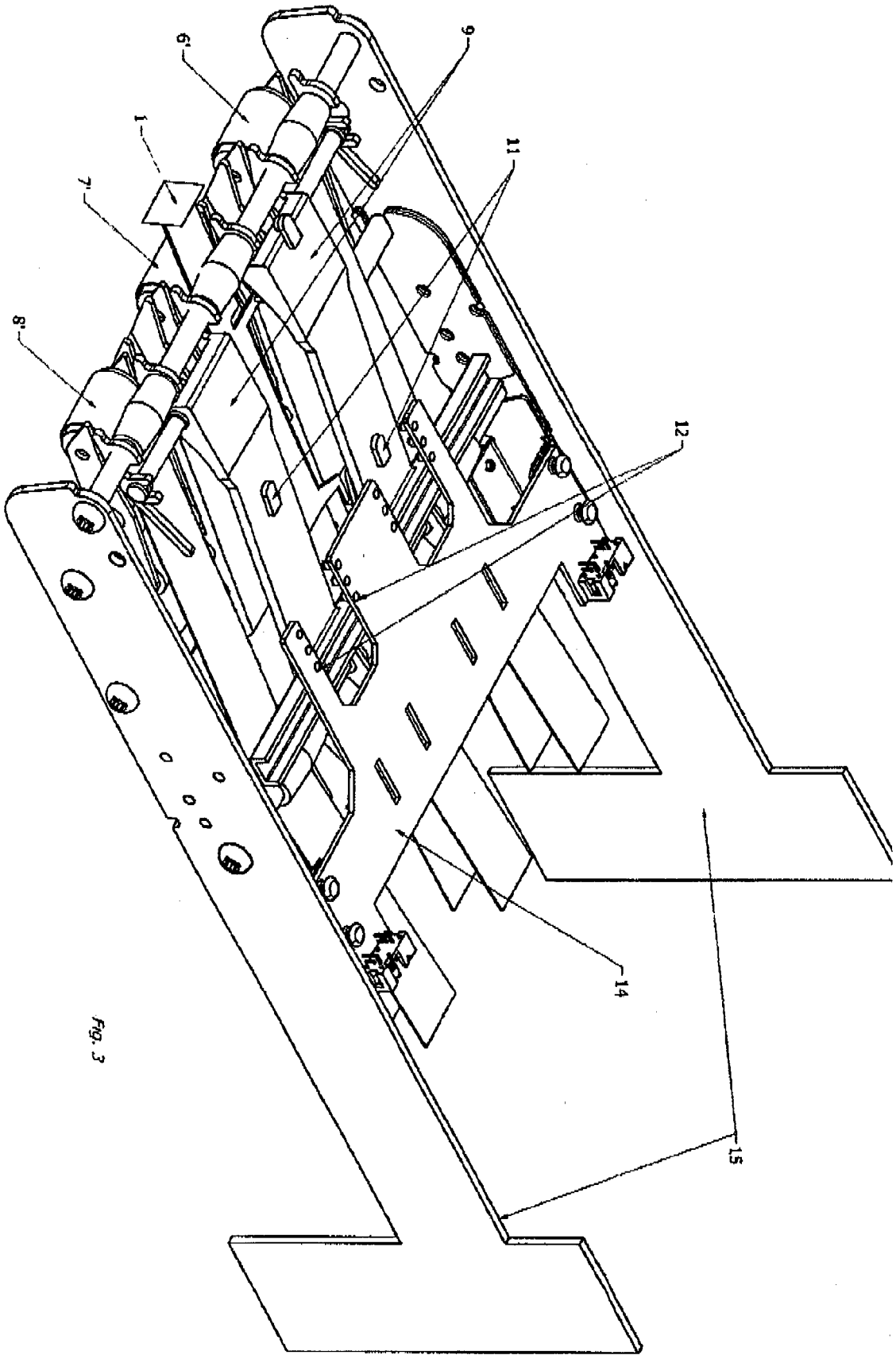

Fig. 3

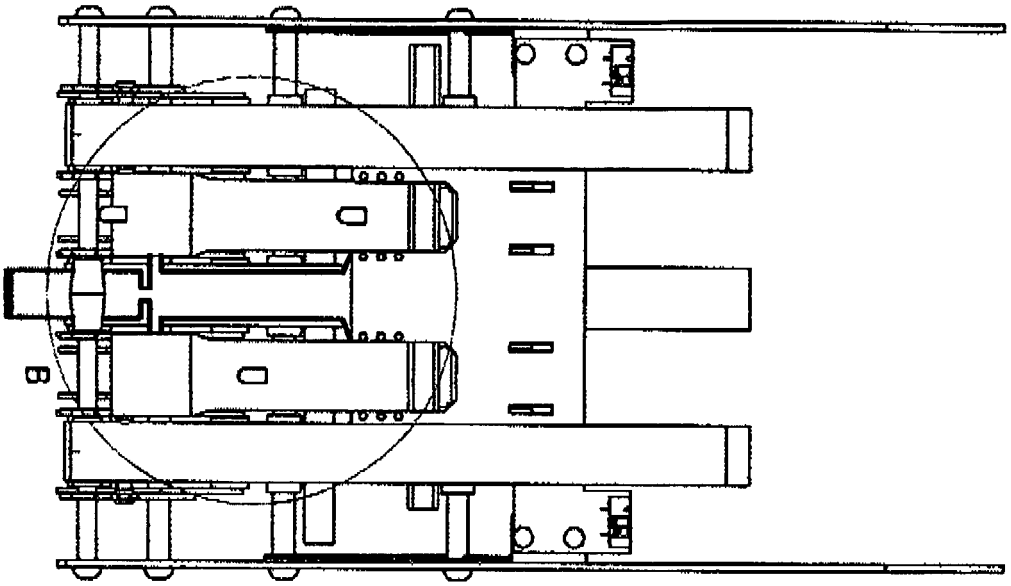

Fig. 4a

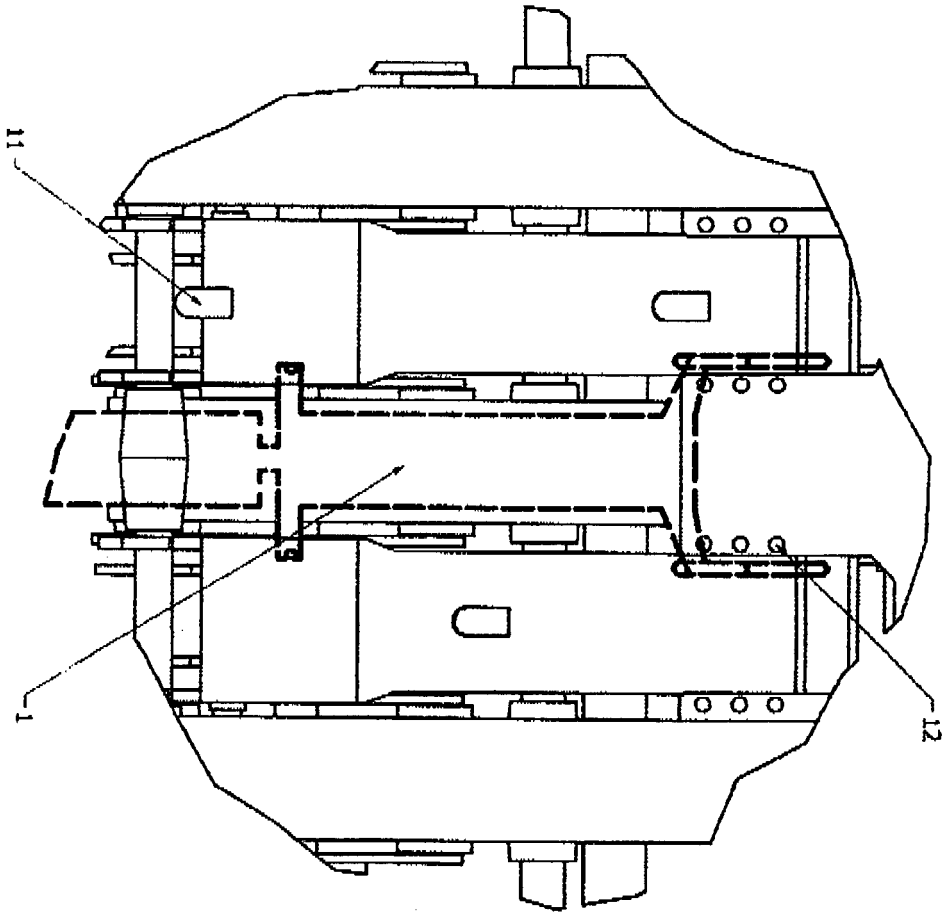

Fig. 4b

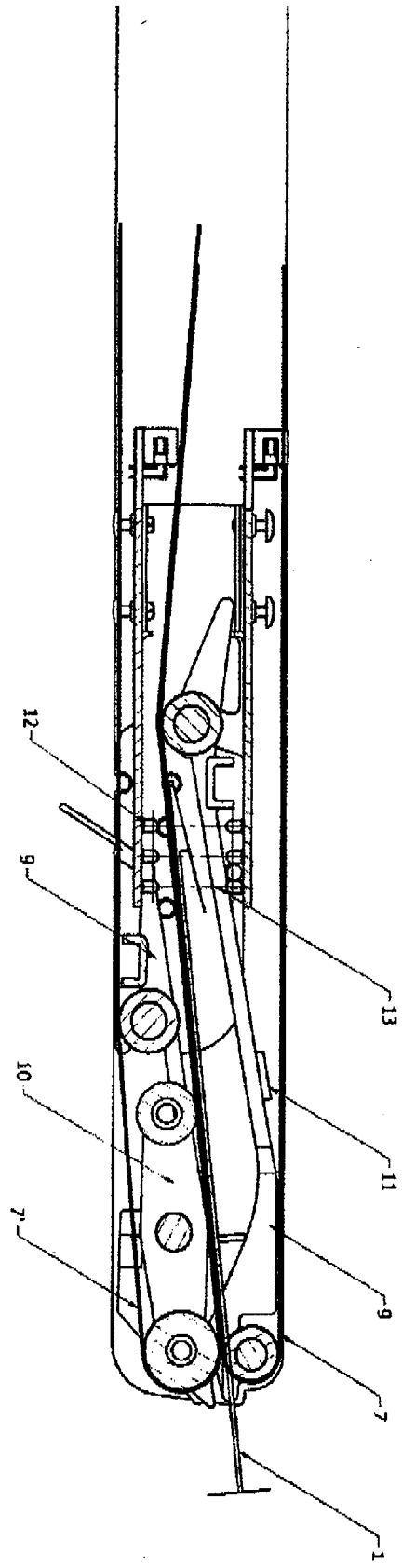

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 13 00 5018

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	EP 0 965 960 A2 (NCR INT INC [US]) 22 December 1999 (1999-12-22) * abstract * * paragraphs [0001], [0002], [0011] - [0014]; figures 1-3 *	1-8	INV. G07F19/00
X	US 2008/136657 A1 (CLARK BARRIE [GB] ET AL) 12 June 2008 (2008-06-12) * abstract * * paragraphs [0001], [0010], [0016], [0032] - [0039]; figures 1,4,5 *	1-8	

TECHNICAL FIELDS SEARCHED (IPC)

G07F
G07D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	10 January 2014	Fyhr, Jonas

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 00 5018

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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