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(54) **ENHANCED DEVICE FOR CHECKING BANKNOTES**

(57) The present invention relates to a device for checking banknotes (1) which comprises: a container (2) where at least one first opening (3) is defined for inserting at least one banknote (T); moving means (7a, 7b, 8, 9, 10, 11, 12) for carrying at least one banknote (T), which is inserted in the first opening (3), to an operative zone placed in the container (2); first sensor means (17, 18) for detecting at least one characteristic of the at least one banknote (T) in said operative zone and for ascertaining

the value of said at least one banknote (T) and/or whether said at least one banknote (T) is genuine or counterfeit based on said at least one characteristic. The above-mentioned device for checking banknotes (1) is also provided with a connector (20) to allow powering the device for checking banknotes (1) and transmitting data to the device for checking banknotes (1) and from the device for checking banknotes (1).

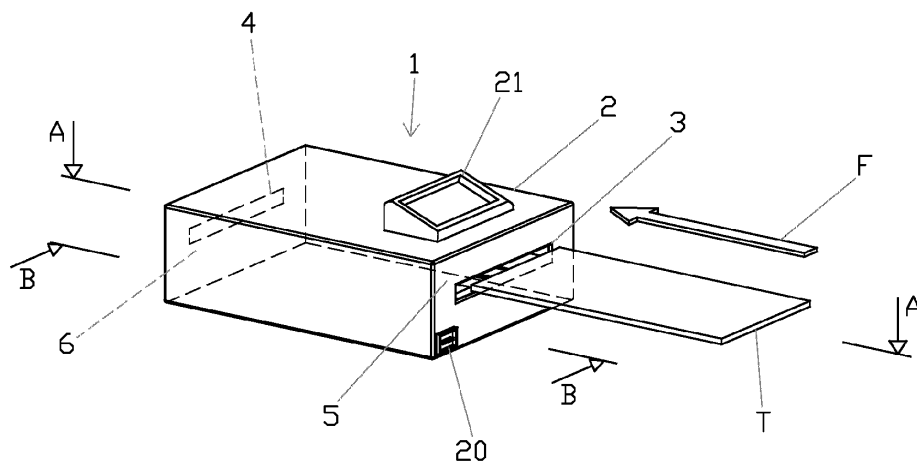


FIG. 1

Description

[0001] This invention relates to an enhanced device for checking banknotes.

[0002] Specifically, the invention proposed here relates to a device designed to check the authenticity of banknotes and, if necessary, also their value.

[0003] There are currently various types of devices for checking banknotes provided with various electronic components designed for carrying out one or more controls on the banknotes, in order to check their authenticity and in some cases also their value.

[0004] The aforementioned electronic components may comprise, for example, UV sensors for checking the presence and the positioning of ultraviolet inks, that is, UV markings, magnetic sensors for detecting the presence and the positioning of magnetic inks and metal wires, infrared sensors for checking the presence of inks sensitive to infrared rays and sensors (normally, pulsing LED transceivers and infrared sensors) for measuring the size and/or thickness of the banknotes.

[0005] The most sophisticated devices for checking banknotes are also able to measure the reaction of the various components of the banknote to the rays of different wavelengths emitted by the device itself.

[0006] The devices present on the market for checking banknotes have different shapes, sizes and also operating principles.

[0007] For example, the devices for checking banknotes that comprise an external case, that is, a container, in which a through opening is defined for the insertion of the banknotes to be tested, are very common.

[0008] A system for dragging the banknotes through the aforementioned through-opening and one or more sensors operating in such a way as to perform one or more authenticity checks on each banknote passing through the through-opening are provided inside the container.

[0009] The current devices for checking banknotes are provided with special connectors to allow the relative electric power supply by means of the connection to a power outlet.

[0010] However, the devices for checking banknotes currently on the market show a certain inconvenience of use and several limitations with regard to their use.

[0011] The aim of the invention is to overcome the aforementioned problems of the prior art.

[0012] Another aim of the invention is to provide a device for checking banknotes that is convenient to use.

[0013] Another aim of the invention is to provide a device for checking banknotes that requires the least number of cables connecting to external devices for its use.

[0014] Another aim of the invention is to provide a device for checking banknotes that can also be used in environments where there are no power outlets.

[0015] A further aim of the invention is to provide a device for checking banknotes that is effective in detect-

ing the authenticity, and possibly also the value, of banknotes.

[0016] Another aim of the invention is to provide a device for checking banknotes that is relatively inexpensive.

[0017] The specific object of the invention is therefore a device for checking banknotes comprising: a container in which at least one first opening is defined for inserting at least one banknote; moving means for carrying, in use, at least one banknote, which is inserted in the first opening, to an operative zone placed in the container; first sensor means for detecting at least one characteristic of the at least one banknote in said operative zone and for ascertaining the value of said at least one banknote and/or whether said at least one banknote is genuine or counterfeit, based on said at least one characteristic; and a connector to allow powering the device for checking banknotes and transmitting data to the device for checking banknotes and from the device for checking banknotes.

[0018] Preferred embodiments are defined in the dependent claims.

[0019] Characteristics and advantages will become more obvious from the following description of preferred but not exclusive embodiments illustrated, purely by way of non-limiting example, in the accompanying drawings, wherein:

- Figure 1 is an axonometric view of a device for checking banknotes according to the invention;
- Figure 2 is a cross-section view through the line B-B of Figure 1; and
- Figure 3 is a cross-section view through the line A-A of Figure 1.

[0020] With reference to accompanying drawings, a device for checking banknotes according to the invention has been indicated in its entirety with the reference numeral 1.

[0021] The device for checking banknotes 1 comprises an outer container 2 in which a first opening 3 for inserting a banknote T and a second opening 4 for extracting said banknote T are provided.

[0022] In particular, the first opening 3 and the second opening 4 are formed, respectively, at a first side 5 and a second side 6 of the outer container 2, opposite to the first side 5.

[0023] According to the accompanying drawings, the outer container 2 has a parallelepiped shape; however, according to further variants of the invention, it can also adopt shapes different from that shown in the drawings.

[0024] Inside the outer container 2, between the first opening 3 and the second opening 4, there is a pair of conveyor belts 7a, 7b parallel to each other and both mounted on a first shaft 8 and a second shaft 9.

[0025] The first shaft 8 and the second shaft 9 are also parallel to each other and mounted, respectively, at the first opening 3 and the second opening 4 in a rotatable manner about their respective axes.

[0026] For the movement of the conveyor belts 7a, 7b an electric motor 10 of reduced power is provided connected to the first shaft 8 by means of a connecting belt 11, so as to be able to rotate it about the relative axis, thus setting in motion the pair of conveyor belts 7a, 7b according to the advancement direction F, that is, from the first opening 3 towards the second opening 4.

[0027] Above the conveyor belts 7a, 7b there is a plurality of rollers 12 directed parallel to the first shaft 8 and to the second shaft 9 and idly rotatable about their respective axes, in such a way that the banknote T carried by the conveyor belts 7a, 7b remains adherent to the latter under the thrust, from above, of the rollers 12.

[0028] The aforementioned rollers 12 are uniformly distributed over the entire length of the conveyor belts 7a, 7b so that the banknote T remains adherent to the latter throughout the passage from the first opening 3 to the second opening 4.

[0029] A pressing system (not shown in the drawings) acting on the plurality of rollers 12 can also be provided in the device for checking banknotes 1 in such a way as to push them, constantly, against the underlying conveyor belts 7a, 7b, in order to favour the adhesion of the banknote T to the latter and therefore the relative transport.

[0030] According to further possible embodiments of the invention, not shown in the accompanying drawings, the aforementioned conveyor belts 7a, 7b and the plurality of rollers 12 can be replaced with other movement systems suitable to allow the transport of a banknote T from the first opening 3 to the second opening 4.

[0031] A first pair of presence sensors 13, 14, for example of the infrared type, is also provided at the first opening 3, for detecting the insertion of a banknote T in the first opening 3.

[0032] In the specific case shown in the accompanying drawings, the two sensors of the first pair of presence sensors 13, 14 are arranged, respectively, above and below the first opening 3.

[0033] The first pair of presence sensors 13, 14 is operatively connected to the electric motor 10, in such a way that when the pair of presence sensors 13, 14 detects the insertion of a banknote T in the first opening 3, the electric motor 10 automatically comes into operation by advancing both conveyor belts 7a, 7b according to the advancement direction F.

[0034] Similarly, at the second opening 4 a second pair of presence sensors 15, 16 is provided, for example of the infrared type, for detecting the exiting, at least partial, of said banknote T from the second opening 4.

[0035] In the specific case shown in the accompanying drawings, the sensors of the second pair of presence sensors 15, 16 are arranged, respectively, above and below the second opening 4.

[0036] The second pair of presence sensors 15, 16 is also operatively connected to the electric motor 10, in such a way that when this pair of presence sensors 15, 16 detects the at least partial exiting of said banknote T

from the second opening 4, the electric motor 10 is automatically deactivated and therefore the interruption of the advancement of the conveyor belts 7a, 7b according to the aforementioned advancement direction F.

[0037] Inside the outer container 2 there are also one or more sensors 17, 18, of known type, for detecting one or more characteristics of the banknote T carried by the conveyor belts 7a, 7b from the first opening 3 to the second opening 4.

[0038] Specifically, the aforementioned characteristics are characteristics that allow determination of whether each banknote T is genuine or counterfeit, and possibly also the value of the banknote T itself.

[0039] The aforementioned sensors 17, 18 may comprise, for example, magnetic sensors for detecting the presence of magnetic inks and/or metal wires in the banknotes T, and/or sensors which use ultraviolet rays (UV), normally composed of a transmitter and a receiver of UV radiation, for detecting any inks with fluorescent phosphors in the banknotes T, and/or sensors which use infrared rays (IR), normally composed of a transmitter and a receiver of IR rays, for detecting in the banknotes T both the inks that reflect the infrared light and those that instead absorb said light becoming black, and/or sensors that use the reflected white light, for identifying the details of the printing not conforming to the original, and the transmitted white light for checking the presence of the normal components of the banknote T visible only with backlight.

[0040] The sensors 17, 18 may also include detectors capable of subjecting the banknote T to a wide spectrum of electromagnetic radiation and detecting how the various components thereof react to the various wavelengths emitted, thus making it possible to accurately identify the composition of the various substances present in the banknote T itself.

[0041] The same sensors 17, 18 may also comprise devices for detecting one or more surface dimensions (for example, length, and/or width and/or diagonal) and/or the thickness of the banknotes T, in order to check their authenticity and/or value.

[0042] The aforementioned sensors 17, 18 are arranged inside the outer container 2 in positions such as to be able to emit radiation, if provided for by their operation, on each banknote T that transits on the conveyor belts 7a, 7b from the first opening 3 to the second opening 4.

[0043] Since the aforementioned sensors 17, 18 are of known type, it is considered unnecessary to provide here further technical details regarding their structure and their operation.

[0044] Inside the outer container 2 there is also an electronic control board 19 for controlling and coordinating the operation of the first pair of presence sensors 13, 14, of the second pair of presence sensors 15, 16, of the electric motor 10 and of the sensors 17, 18 for detecting the authenticity and/or the value of the banknotes T.

[0045] For this reason, the first pair of presence sen-

sors 13, 14, the second pair of presence sensors 15, 16, the electric motor 10 and also the sensors 17, 18 for detecting the authenticity and/or the value of the banknotes T are electrically and operatively connected, directly or indirectly, to the electronic control board 19.

[0046] In particular, when the banknote T is inserted into the first opening 3, the electronic control board 19 will command the activation of the electric motor 10 so as to advance the conveyor belts 7a, 7b with the relative banknote T according to the advancement direction F, and subsequently the deactivation of the electric motor 10 at the moment in which the second pair of presence sensors 15, 16 detects that the banknote T has reached the second opening 4.

[0047] According to an important technical aspect of the invention, a connector 20 is provided in the device for checking banknotes 1 for the transfer of data input to and output from the device 1 and for the electrical supply of the latter by means of, for example, an electrical cable (not shown) connected to a power outlet (not shown).

[0048] The connector 20 can be, for example, a PoE (*Power over Ethernet*) socket or a USB socket of the type suitable to perform the dual function of allowing the transfer of data and the electric power supply of the device on which the USB socket is mounted.

[0049] The connector 20 is connected, electrically and operationally, to the electronic control board 19 where the software for the operation of the device for checking banknotes 1 is stored.

[0050] By connecting a special external electronic device (not shown) to the connector 20 via a cable suitable for the purpose, it is therefore possible to supply the electrical power to the electronic control board 19 and also perform data transfers in input to and output from the electronic control board 19, including updates of the software installed therein.

[0051] For this reason, when the aforementioned external electronic device is electrically connected to the connector 20, the aforementioned functional components of the device for checking banknotes 1 (i.e. the first pair of presence sensors 13, 14, the second pair of presence sensors 15, 16, the electric motor 10, and the sensors 17, 18 for detecting the authenticity and/or the value of the banknotes T), being electrically connected to the electronic control board 19, will in turn be electrically powered by the latter.

[0052] According to a technical variant of the invention, not shown in the accompanying drawings, the device for checking banknotes 1 also includes one or more rechargeable batteries electrically connected to both the connector 20 and to the electronic control board 19, in such a way that the latter and consequently also the aforementioned functional components can receive the electrical power from said one or more rechargeable batteries even when the connector 20 is not connected to a socket.

[0053] The device for checking banknotes 1 according to the invention may comprise, in a position visible on

the outer container 2, a display 21 and/or a visual and/or audible indicator for visually and/or acoustically indicating whether the banknote T inserted in the first opening 3 is genuine or counterfeit, and possibly also for visually indicating the value of the banknote T itself; the display 21 and/or the visual and/or audible indicator being operatively connected to the electronic control board 19.

[0054] Alternatively or in addition to the aforementioned display 21 and visual and/or sound indicator, a socket and/or a wireless transceiver, connected to the electronic control board 19, can be provided in the device for checking banknotes 1 to allow for example the cable and/or wireless connection to an external display or to an external visual and/or sound indicator to visually and/or acoustically indicate whether the banknote T inserted in the first opening 3 is genuine or counterfeit, and possibly also to visually indicate the value of the banknote T.

[0055] According to the operation of the device for checking banknotes 1, when a banknote T is inserted into the first opening 3, the first pair of presence sensors 13, 14 sends an electrical insertion signal to the electronic control board 19, which automatically provides for the activation of the electric motor 10 in such a way as to advance the conveyor belts 7a, 7b with the banknote T according to the advancement direction F.

[0056] During the passage of the banknote T from the first opening 3 to the second opening 4, the aforementioned sensors 17, 18 carry out all the checks on the banknote T required to detect its authenticity and/or the value.

[0057] Subsequently, when the same banknote T arrives at the second opening 4, the second pair of presence sensors 15, 16 transmits an electrical output signal to the electronic control board 19, which in turn automatically deactivates the electric motor 10 and then stops the advancement of the conveyor belts 7a, 7b.

[0058] According to a variant of the device for checking banknotes 1 described above, the electronic control board 19 can be configured in such a way that the exit of the banknote T, following the checking of authenticity and/or value by the sensors 17, 18, can occur from the first opening 3, that is, from the same opening in which the same banknote T has been inserted.

[0059] Again according to this latter variant, the electronic control board 19 can for example be programmed in such a way that in the event that the aforementioned sensors 17, 18 detect that the banknote T is not genuine, the exit of the banknote T from the first opening 3 is arranged by means of the conveyor belts 7a, 7b, while, if the banknote T is genuine, the exit of the latter from the second opening 4 is always commanded by means of the conveyor belts 7a, 7b.

[0060] According to a further embodiment of the invention not shown in the accompanying drawings, in the device for checking banknotes according to the invention, only one opening (i.e. the first opening 3 or the second opening 4) may be provided; in this case, both the entry

and exit of the banknote T from the aforementioned device takes place, in any case, through this single opening.

[0061] As can be seen from the above description, the device for checking banknotes 1 is, in addition to being effective in detecting the authenticity (and possibly also the value) of the banknotes T, also particularly convenient to use, since it can also be used in cases where no electricity socket is available in the immediate vicinity.

[0062] The device for checking banknotes 1 also allows savings in terms of the number of cables to be used for its operation.

[0063] It is understood that the above has been described by way of non-limiting example, so that any construction variations should be considered as falling within the scope of the present technical solution, as described above and claimed below.

Claims

1. Device for checking banknotes (1) which comprises:

- a container (2) where at least one first opening (3) is defined for inserting at least one banknote (T);
- moving means (7a, 7b, 8, 9, 10, 11, 12) for carrying, in use, at least one banknote (T), which is inserted in the first opening (3), to an operative zone placed in the container (2);
- first sensor means (17, 18) for detecting at least one characteristic of the at least one banknote (T) in said operative zone and for ascertaining the value of said at least one banknote (T) and/or whether said at least one banknote (T) is genuine or counterfeit, based on said at least one characteristic; and
- a connector (20) to allow powering the device for checking banknotes (1) and transmitting data to the device for checking banknotes (1) and from the device for checking banknotes (1).

2. Device for checking banknotes (1) according to claim 1, **characterized in that** said connector (20) comprises a PoE socket or an USB socket.

3. Device for checking banknotes (1) according to claim 1 or 2, **characterized in that** it comprises a control electronic board (19) for controlling and coordinating the operation of the first sensor means (17, 18) and the moving means (7a, 7b, 8, 9, 10, 11, 12); the control electronic board (19) being electrically connected, directly or indirectly, with said connector (20) such that powering the control electronic board (19) and transferring data to and from the control electronic board (19) are allowed in use by said connector (20).

4. Device for checking banknotes (1) according to claim

3, **characterized in that** the first sensor means (17, 18) and the moving means (7a, 7b, 8, 9, 10, 11, 12) are electrically and operatively connected with the control electronic board (19).

5. Device for checking banknotes (1) according to any one of the preceding claims, **characterized in that** the moving means (7a, 7b, 8, 9, 10, 11, 12) are also configured to carry the banknote (T) from said operative zone to the first opening (3).

6. Device for checking banknotes (1) according to any one of the preceding claims, **characterized in that** a second opening (4) for making the banknote (T) exit is defined in the container (2), and **in that** the moving means (7a, 7b, 8, 9, 10, 11, 12) are also configured to carry the banknote (T) from said operative zone to the second opening (4).

7. Device for checking banknotes (1) according to any one of the preceding claims, **characterized in that** it comprises at least one rechargeable battery which is electrically connected with said connector (20).

8. Device for checking banknotes (1) according to claims 3 and 7, **characterized in that** said at least one rechargeable battery is electrically connected with the control electronic board (19).

9. Device for checking banknotes (1) according to any one of the preceding claims, **characterized in that** the first sensor means (17, 18) comprise at least one magnetic sensor, and/or at least one sensor using ultraviolet rays or infrared rays or white light, and/or at least one sensor using electromagnetic radiations with different wavelengths, and/or at least one device for detecting at least one size of the banknote (T).

10. Device for checking banknotes (1) according to any one of the preceding claims, **characterized in that** it comprises a display (21) and/or a visual and/or acoustic indicator for visually and/or acoustically indicating whether said banknote (T) is genuine or counterfeit, and/or for visually indicating the value of said banknote (T).

11. Device for checking banknotes (1) according to any one of the preceding claims, **characterized in that** it comprises a socket and/or a wireless transceiver to allow, in use, a cable and/or wireless connection with an external display or with an external visual and/or acoustic indicator for visually and/or acoustically indicating whether said banknote (T) is genuine or counterfeit, and/or for visually indicating the value of said banknote (T).

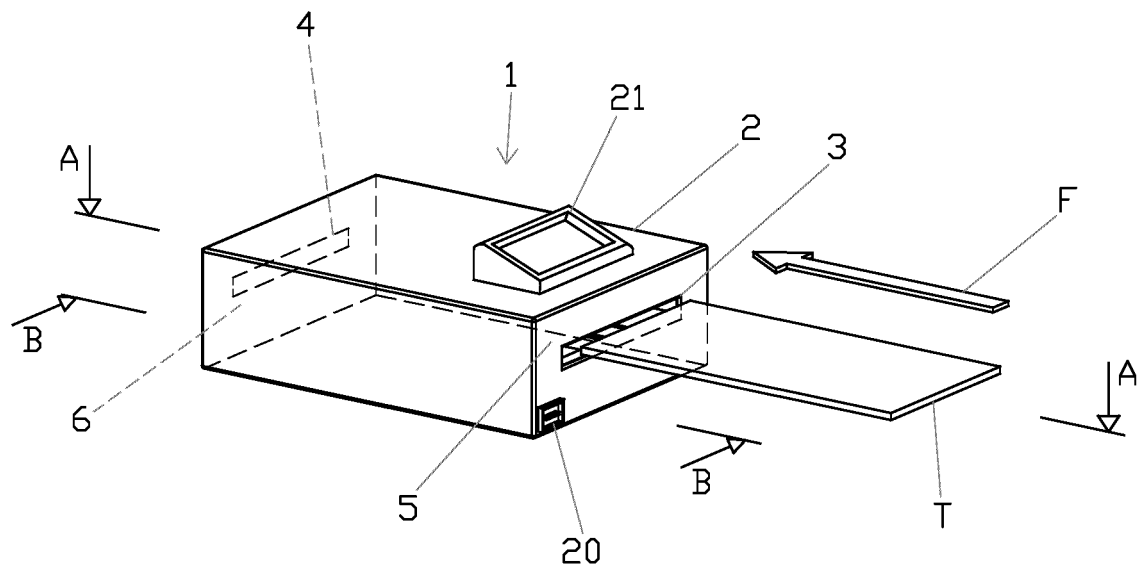


FIG. 1

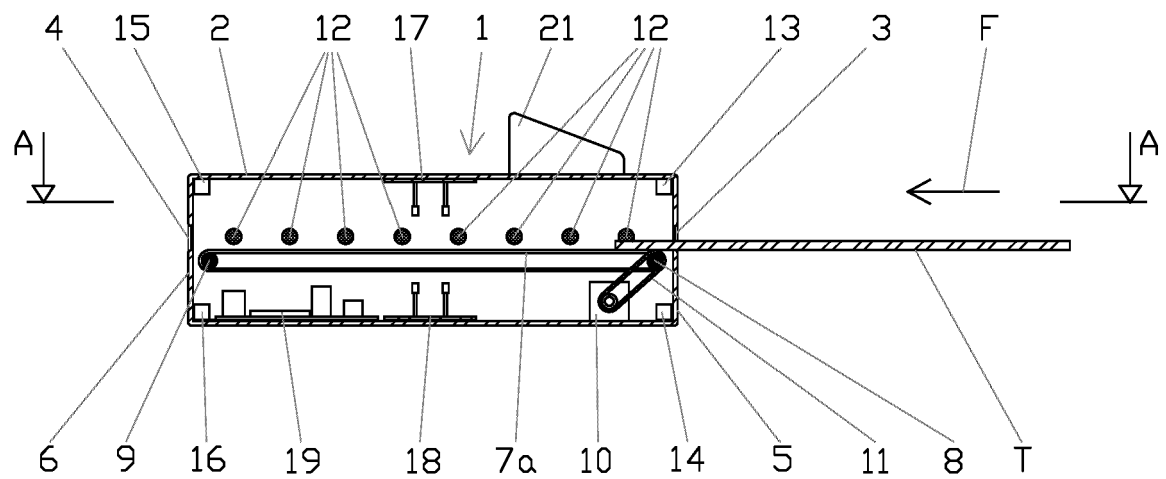


FIG. 2

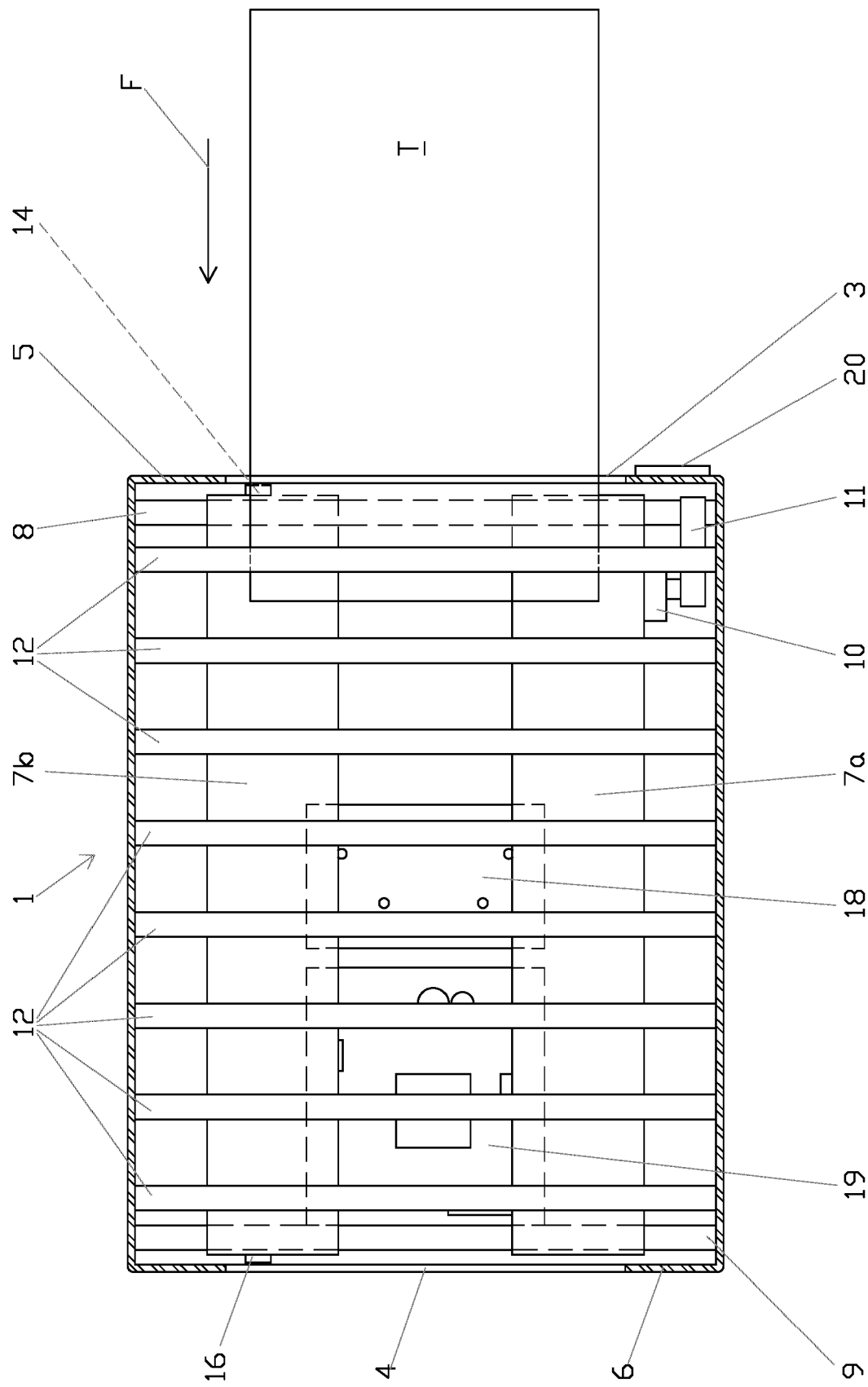


FIG. 3



EUROPEAN SEARCH REPORT

Application Number

EP 23 02 0243

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)
			G07D
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 24 August 2023	Examiner Schikhof, Arnout
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	

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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24-08-2023

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