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(54) POSITIONING METHOD AND DEVICE FOR A SERVICE CARRIAGE OF A TEXTILE MACHINE, AND A TEXTILE MACHINE COMPRISING SUCH A DEVICE

(57) A positioning device (12) for a service carriage (14) of a textile machine (16) comprising at least two operating units (18). The positioning device (12) comprises: handling means (15) for moving the service carriage (14) along said textile machine (16); positioning means (34) for positioning the service carriage (14) at an operating unit (18); and a control unit (40) operatively connected to said handling means (15), and to the positioning means (34). The positioning means (34) comprise at least one position transducer (38), for positioning the service carriage (14) with respect to an operating unit (18). The position transducer (38) is operatively connected to the control unit (40). The control unit (40) is configured to operate the handling means (15) to move said at least one service carriage (14) at an operating unit (18) by the positioning means (34).

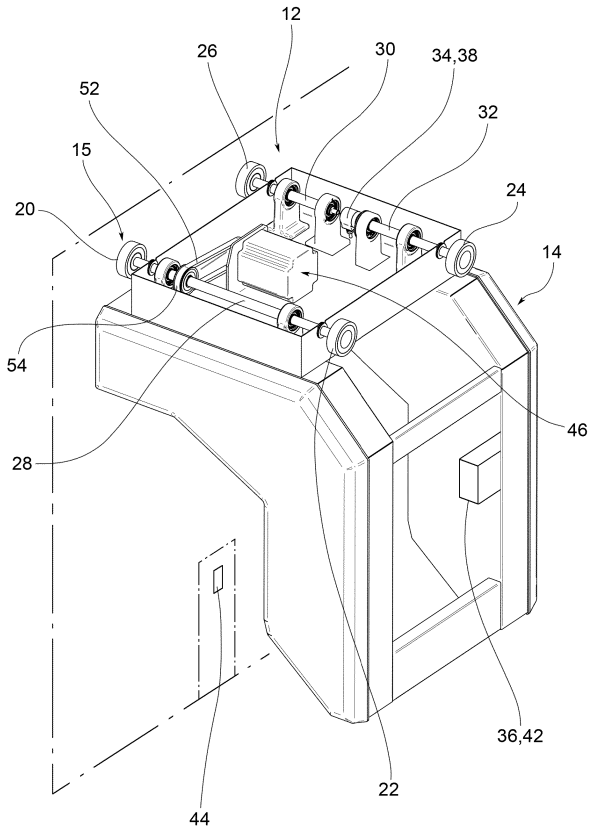

FIG.2

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Description

FIELD OF APPLICATION

[0001] The present invention relates to a positioning device for a service carriage of a textile machine, a textile machine comprising such a device, and a method for positioning a service carriage in a textile machine.

BACKGROUND ART

[0002] As is well known, the use of semi-automatic and/or automatic service carriages for the execution of the most common operating cycles, such as lifting a formed spool or joining thread following breakage, is widely used in textile machines.

[0003] Typically, each service carriage patrols the machine in the longitudinal direction, moving on special guides by means of handling means thereof, which are operated and managed by a processing and control unit to allow to position the carriage at a unit which, after sending a specific signal, requires the intervention thereof.

[0004] In this context, the problem arises of having to manage the positioning of a service carriage of a textile machine in a simple, reliable and repeatable manner.

[0005] In this discussion, explicit reference will be made to the lifting carriage of a spooling machine, however such reference is for explanatory purposes only and not limited to the machines to which the principles of the present invention can be applied. In particular, the invention can be applied to any carriage serving a generic textile machine.

[0006] The known systems make use, for example, of positioning devices of the transmitter/receiver type, with radio frequency or with laser scanners and barcode, which however entail considerable operating disadvantages, firstly the complexity of construction at the expense of the unit and the carriage and the sensitivity to dirt, with the consequent need for frequent cleaning and maintenance to avoid compromising the operation thereof.

[0007] Furthermore, the complexity of the equipment of the traditional systems generally leads to an increase in dimensions and does not allow a direct integration in the carriage handling means.

[0008] In this regard, it is known to use a positioning device comprising a mechanical system consisting of a stop arranged on the service carriage, such as an electrically or pneumatically operated retractable lever, which engages inside a corresponding seat obtained in a fixed position of the unit. Furthermore, the device comprises an optical LED system of the transmitter/receiver type which allows the service carriage to decipher an identification code of a unit, such as the unit number.

[0009] Although widely appreciated and used, this solution is however subject to drawbacks, such as: the mechanical wear induced by the repetitiveness of the positioning cycles, the dirt produced by the textile environment which over time can compromise the kinematic mechanism of the centring assembly, the inaccuracy due to the elastic deformation of the structure subject to the weight of the service carriage, the need to have dedicated drives and related electrical equipment, and the consequent unwanted stresses that the drive can undergo in the event of inaccurate centring.

[0010] Furthermore, the mechanical centring system cannot be customized for each unit, being the same for all units in the same section.

[0011] Another known solution involves an optical communication system between the carriage and the unit, while the mechanical centring is replaced by a reflection system which uses a reflector. In this case, however, the operation is particularly compromised by the dirt induced by the fibrils which come to settle thereon, partially or completely obscuring the reflector.

[0012] Also forms a known technique, the use of a laser provided with the service carriage capable of reading the projection of a reference element of the unit, typically a plate made of plastic in the shape of a parallelepiped. By reading several points of the projection, the carriage is able to interpolate the nominal centring position. The identification of the number of units is instead carried out by means of a radio frequency system in which an antenna on the carriage generates an electric field which excites the circuit of a passive tag installed on the head.

[0013] Finally it is also prior art, the use of optical positioning and centring systems which make use of a laser pointer and barcode. The identification of the number of units is assigned to the number written on the tag, while the centring is carried out by means of two or more barcodes placed equidistant in series, such that the nominal centring position is obtained by the linear interpolation of the aforesaid subjections. However, this solution implies the need to have more subcodes to ensure accurate positioning, consequently increasing the dimensions of the code.

PRESENTATION OF THE INVENTION

[0014] The need is therefore felt to resolve the drawbacks and limitations mentioned with reference to the prior art.

[0015] Therefore, there is a need to provide a positioning device for a service carriage of a textile machine which is more reliable than the prior art devices.

[0016] Furthermore, there is a need for a device adapted to be easily integrated into the known type of carriages, limiting complexity and dimensions.

[0017] This need is met by a positioning device for a service carriage of a textile machine according to claim 1, by a textile machine according to claim 9, and by a process for positioning a service carriage in a textile machine according to claim 14.

DESCRIPTION OF THE DRAWINGS

[0018] Further features and advantages of the present invention will be more clearly comprehensible from the description given below of the preferred and nonlimiting embodiments thereof, in which:

- figure 1 schematically depicts a textile machine according to a possible embodiment of the present invention; and
- figure 2 schematically depicts a positioning device for a service carriage of a textile machine according to a possible embodiment of the present invention.

[0019] The elements or parts of elements common to the embodiments described below will be indicated using the same reference numerals.

DETAILED DESCRIPTION

[0020] Figure 2 shows a possible embodiment of a positioning device 12 for a service carriage 14 of a textile machine 16 comprising at least two operating units 18.

[0021] The device comprises handling means 15 for moving the service carriage 14 along the textile machine 16.

[0022] Furthermore, the device comprises positioning means 34 for positioning the service carriage 14 at an operating unit 18.

[0023] The device comprises a control unit 40 operatively connected to the handling means 15, and to the positioning means 34.

[0024] The positioning means 34 comprise at least one position transducer 38 for positioning the service carriage 14 with respect to an operating unit 18. The position transducer 38 is operatively connected to the control unit 40.

[0025] The control unit 40 is configured to operate the handling means 15 to move the at least one service carriage 14 at an operating unit 18 by the positioning means 34.

[0026] According to a possible embodiment, the handling means 15 can comprise translation wheels 20, 22, 24, 26 keyed on respective axes 28, 30, 32.

[0027] In this discussion, the axis of a translation wheel means both the mechanical component which defines the wheel support and its axis of rotation.

[0028] Furthermore, in this discussion, reference will be made to "positioning" to indicate the action of the service carriage reaching a specific operating unit, while "centring" will refer to the action of precision alignment of the service carriage with respect to the specific operating unit.

[0029] Advantageously, the position transducer 38 can be arranged at an axis 28, 30, 32 of a translation wheel 20, 22, 24, 26.

[0030] The service carriage 14, moving along the textile machine, performs the positioning with respect to the operating unit which requires the intervention of the service carriage, for example to carry out the lifting or reattachment cycle.

[0031] According to a possible embodiment, the at least one position transducer 38 can be arranged at an axis 32 of a translation wheel 24, which can be a motorized translation wheel, or idle.

[0032] Preferably, the at least one position transducer 38 can be arranged at an axis 32 of an idle translation wheel 24. This solution has the advantage that the idle wheel is less prone to any slippage on the sliding surface with respect to a driving wheel.

[0033] In accordance with a possible formalization, the position transducer 38 can be an encoder, i.e., an angular position transducer, preferably of an absolute multi-turn type.

[0034] In accordance with a possible embodiment, the device can comprise centring means 36.

[0035] For example, in accordance with a possible embodiment, the centring means 36 can comprise a laser scanner 42 adapted to identify a reference element 44 of an operating unit 18. In accordance with a possible embodiment, the reference element 44 can be a projection, for example in polymeric material.

[0036] However, the centring means 36 can comprise other types of centring devices known to the person skilled in the art.

[0037] Furthermore, in a possible embodiment, the positioning means 34 can comprise the position transducer 38, and the centring means 36 can comprise a further or the same position transducer 38. In this case, since the centring action requires a higher precision than the positioning action, the position transducer used for the centring means can have a higher precision than a transducer used for mere positioning.

[0038] In accordance with a possible embodiment, the positioning device 12 can comprise motor means 46 adapted to rotate at least one of the translation wheels 20, 22, 24, 26.

[0039] As seen in figure 2, in accordance with a possible embodiment, the translation wheels 20, 22, 24, 26 can be arranged at the vertices of a rectangle. Advantageously, the driving wheels 20, 22 can be keyed on the same axis 28, while the driven wheels 24, 26 can be keyed on axles 30, 32 independent of each other.

[0040] The motor means 46 can be of a known type, such as an electric motor.

[0041] As seen in the example of figure 2, the motor means can transmit the rotation motion to an axis 28 to which two translation wheels 20, 22 are keyed by means of a belt 52 which engages a corresponding pulley 54 arranged on the axis 28.

[0042] According to a possible alternative embodiment, the motor means can transmit the rotation motion to an axis 28 on which a translation wheel is keyed in another manner, for example by using a transmission chain coupled with a respective toothed gear, or through the use of toothed wheels.

[0043] The present invention further relates to a textile

machine 16 comprising at least two operating units 18 and at least one service carriage 14 adapted to serve the operating units 18 and equipped with a positioning device 12 as described above.

[0044] Furthermore, the textile machine 16 comprises a machine control unit 40 operatively connected to the positioning device 12, and can advantageously be the control unit 40 operatively connected to the handling means 15, the positioning means 34 and any centring means 36.

[0045] As seen in figure 1, the textile machine 16 can comprise sliding rails 48 for the translation wheels 20, 22, 24, 26.

[0046] In particular, the industrial textile machine 16 can be a spinning mill, or a spooling machine.

[0047] In accordance with a possible embodiment, the service carriage 14 can be an automatic or semi-automatic lifting carriage, or an automatic or semi-automatic reattachment carriage.

[0048] The present invention further relates to a method for positioning a service carriage 14 in a textile machine 12 comprising at least two operating units 18 and at least one service carriage 14, which essentially comprises the steps of:

- arranging a textile machine 12 as described above;
- sending a service request signal from an operating unit 18 to at least one service carriage 14, by means of the control unit 40;
- operating the handling means 15 to move the at least one service carriage 14 at an operating unit 18 by the at least one position transducer 38 of the positioning means 34.

[0049] Advantageously, the positioning or centring of the service carriage occurs by means of the position transducer 38.

[0050] In accordance with a possible formalization, the method can comprise a step in which the positioning of the service carriage 14 occurs by means of the position transducer 38, in particular an absolute multi-turn encoder.

[0051] Furthermore, in accordance with a possible embodiment, the method can comprise a step in which the control unit 40 based on the operating information of the service carriages 14 decides which of the service carriages 14 to send to the operating unit 18 which requested the service.

[0052] The method can comprise an initial step of zeroing the position of the service carriage 14 with respect to a reference position of each operating unit 18, in which each position is defined by an operating unit identification number 18 and by an absolute position detected by the position transducer 38.

[0053] The initial zeroing step can be performed by manually positioning the service carriage in front of each operating unit to absolutely define a two-way correspondence between the specific operating unit and the encoder position.

[0054] Advantageously, the information related to the absolute positioning of each operating unit can be expressed with two variables, for example number of units j and angular position θj of the encoder.

[0055] Such information can be stored in a memory, for example in the form of a table, comprised in or connected to the central control unit 40.

[0056] In accordance with a possible alternative embodiment, such information can be stored in a control unit memory of a service carriage 14.

[0057] Thereby, upon a request for intervention, the control unit of the machine or on board the service carriage is configured to operate the handling means and move the service carriage at the requesting operating unit, after associating the requesting unit number with the absolute position assumed therein by the encoder and stored by the control unit at the first start-up of the machine.

[0058] In other words, the carriage moves searching for the absolute position previously saved in the aforesaid

table starting from the head number.

[0059] Of course, the absolute position provided by the encoder can also be used as centring information.

[0060] Advantageously, if an encoder positioning system and a centring system with laser scanner and reference element are used, if there are slippages on the sliding plane and therefore the angular position of the encoder does not lead the carriage exactly at the reference of the chosen unit but only in the immediate vicinity thereof, the carriage can proceed further in its stroke for a maximum tolerable section until the corresponding reference notch is intercepted with the laser, thus obtaining the actual centring.

[0061] In accordance with a possible embodiment, the new angular position which is read by the encoder can be written over the previous one. Thereby, the correct absolute positioning can be restored by compensating for the slippage error so as to arrange the carriage to reach a new unit.

[0062] The advantages which can be achieved with the device, the textile machine, and the process according to the present invention are therefore evident.

[0063] Firstly, the position transducer arranged on the carriage handling means allows the actual movement of the carriage to be considered by the position transducer. In fact, the handling means thereof coincide with the translation axes at the ends of which the translation wheels are keyed. The solution is therefore particularly advantageous if the encoder is arranged at the axis of a wheel, and even more advantageous if the encoder is arranged at the axis of an idle wheel.

[0064] The use of a multi-turn absolute decoder allows that, following an undesired power failure, the service carriage does not lose its position reference and therefore it is not necessary to repeat the initial zeroing pro-

cedure of its position.

[0065] Furthermore, the device according to the present invention allows greater compactness due to the possibility of integrating it directly within the carriage handling means, with consequent simplification of the machine and carriage architecture.

[0066] Furthermore, the device allows to automatically compensate the effect of the wear of the wheels and/or the sliding which can be created between the wheels and the sliding plane, for example due to the deposit of fibrils and/or paraffin sprayed on the tracks, with consequent lower disruption of the positioning of the carriage, lower maintenance demand and consequent greater productivity of the machine.

[0067] The system is also less sensitive to dirt by virtue of the possibility of housing the encoder inside the closed compartment which houses the carriage translation assembly.

[0068] To the embodiments described above, the person skilled in the art may, in order to meet specific needs, make changes and/or replacements of elements described with equivalent elements, without departing from the scope of the attached claims.

Claims

1. Positioning device (12) for a service carriage (14) of a textile machine (16) comprising at least two operating units (18); said positioning device (12) comprising:

   - handling means (15) for moving said service carriage (14) along said textile machine (16);
   - positioning means (34) for positioning said service carriage (14) at an operating unit (18); and
   - a control unit (40) operatively connected to said handling means (15), and to said positioning means (34);

   characterized in that
   said positioning means (34) comprise at least one position transducer (38), for positioning the service carriage (14) with respect to an operating unit (18); said position transducer (38) being operatively connected to said control unit (40); said control unit (40) being configured to operate said handling means (15) to move said at least one service carriage (14) at an operating unit (18) by said positioning means (34).

2. Positioning device (12) according to the preceding claim, **characterized in that** said handling means (15) comprise translation wheels (20, 22, 24, 26) keyed on respective axes (28, 30, 32), said at least one position transducer (38) for positioning a carriage (14) with respect to an operating unit (18) being arranged at an axis (32) of a translation wheel (24).

3. Positioning device (12) according to the preceding claim, **characterized in that** said at least one position transducer (38) is arranged at an axis (32) of an idle translation wheel (24).

4. Positioning device (12) according to any one of the preceding claims, **characterized in that** said position transducer (38) is an encoder.

5. Positioning device (12) according to the preceding claim, **characterized in that** said position transducer (38) is a multi-turn absolute type encoder.

6. Positioning device (12) according to the preceding claim, **characterized in that** it comprises centring means (36) for centring a service carriage (14) with respect to an operating unit (18).

7. Positioning device (12) according to the preceding claim, **characterized in that** said centring means (36) comprise a laser scanner (42) and a reference element (44) arranged at an operating unit (18).

8. Positioning device (12) according to any one of the preceding claims, **characterized in that** said handling means (15) comprise motor means (46) adapted to rotate at least one of said translation wheels (20, 22, 24, 26) .

9. Textile machine (16) comprising at least two operating units (18) and at least one service carriage (14) adapted to serve said at least two operating units (18), said at least two operating units (18) and said at least one service carriage (14) being operatively connected to a control unit (40),
   characterized in that said at least one service carriage (14) comprises a positioning device (12) according to any one of the preceding claims.

10. Textile machine (12) according to claim 9, **characterized in that** said textile machine (16) is a spinning mill.

11. Textile machine (12) according to any one of claims 9-10, **characterized in that** said textile machine (16) is a spooling machine.

12. Textile machine (12) according to any one of claims 9-11, **characterized in that** said service carriage (14) is an automatic or semi-automatic lifting carriage.

13. Textile machine (12) according to any one of claims 9-12, **characterized in that** said service carriage (14) is an automatic or semi-automatic reattachment carriage.

14. Method for positioning a service carriage (14) in a textile machine (16) comprising at least two operating units (18) and at least one service carriage (14), said method comprising the steps of:

- arranging a textile machine (12) according to any one of claims 9-13;
- initial zeroing of the position of the service carriage (14) with respect to a reference position of each operating unit (18), wherein each position is defined by an operating unit identification number (18) and by an absolute position detected by the position transducer (38) .

15. Method according to the preceding claim, **characterized in that** the initial zeroing step of the position of the service carriage (14) with respect to a reference position of each operating unit (18), the at least one service carriage (14) is positioned in front of each operating unit (18) to absolutely define a two-way correspondence between the specific operating unit (18) and the position of the position transducer (38).

16. Method according to any one of the preceding claims, comprising the steps of:

- sending a service request signal by an operating unit (18) to at least one service carriage (14) by means of said control unit (40);
- operating said handling means (15) to move said at least one service carriage (14) at an operating unit (18) by means of said at least one position transducer (38) of said positioning means (34) after associating the number of said operating unit (18) with the absolute position assumed therein by the position transducer (38) and stored by said control unit (40) at the first start-up of the machine.

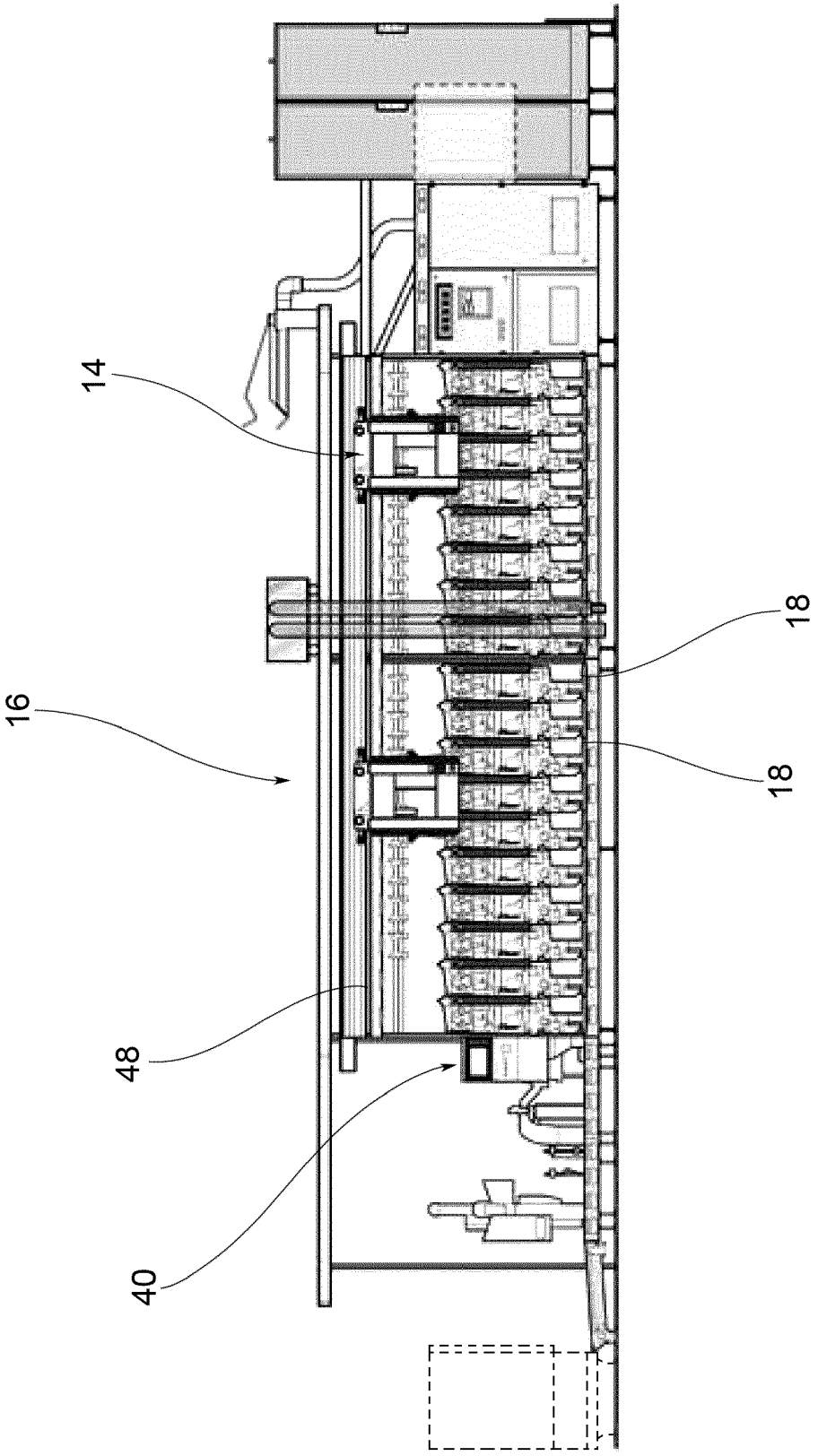

FIG.1

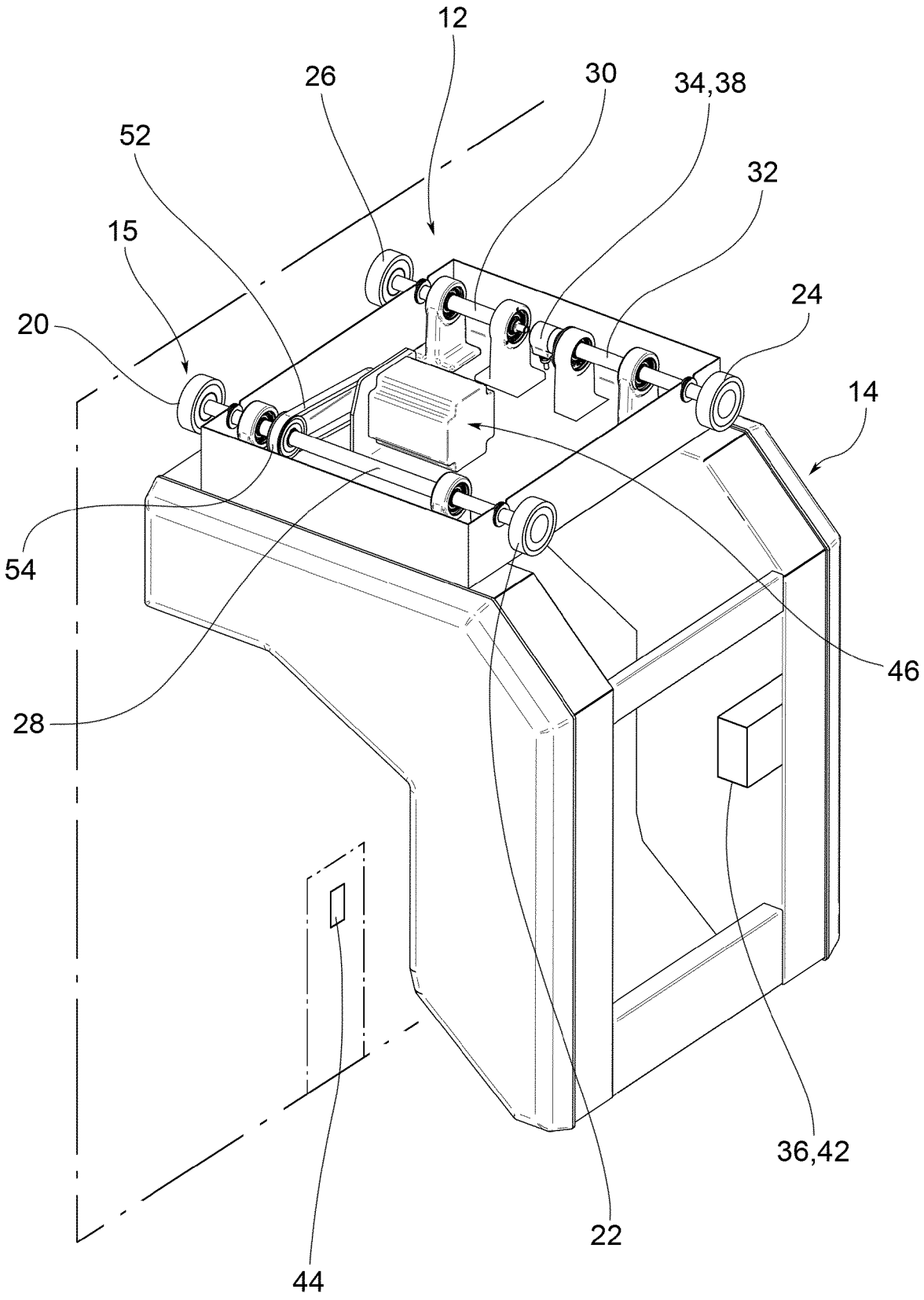

FIG.2

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EUROPEAN SEARCH REPORT

Application Number
EP 22 20 3492

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)
B65H D01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	1 March 2023	Pussemier, Bart

CATEGORY OF CITED DOCUMENTS

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