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(54) TUBE FOR TRACKING A REEL, WINDING APPARATUS WITH REEL TRACKING DEVICE AND WINDING METHOD THEREOF

(57) A tube (8) for tracking a reel (12) comprising:
- a tube body (20) having an outer lateral surface (24) adapted to receive yarn in winding so as to form a reel (12),
- said tube body (20) being axial-symmetric with respect to an axis of symmetry (S-S),

characterized in that
- said tube body (20) is associated with an identification device (44) adapted to uniquely identify said tube (8),
- wherein said identification device (44) is a radio frequency identification device (RFID) comprising an electronic identification code (EPC).

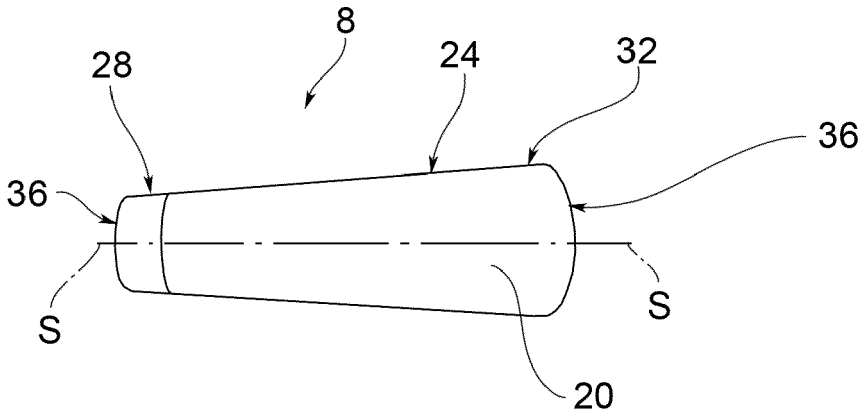

FIG.1a

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Description

FIELD OF APPLICATION

[0001] The present invention relates to a tube for tracking a reel, a winding apparatus with a reel tracking device and a winding method comprising the tracking of a reel.

BACKGROUND ART

[0002] As known, the thread or yarn produced is wound about a tube to form a reel in winding systems. It is worth noting that the term "thread" or monofilament or continuous filament means a single filament or continuous bave (e.g. in the case of silk, artificial or man-made fibers), while the term "yarn" means the set of fibrils of variable length which are parallelized and joined by twisting. Hereinafter, we shall use either term indiscriminately, meaning that the applications of the present invention are not limited to one type or the other. The reel is made by winding the thread of a spool after it was unwound from the spool and any defects were removed. In any case, the thread is wound about a tube which may have various shapes and materials. Cylindrical or conical tubes made of plastic or cardboard are typically used.

[0003] Winding machines have a number of winding units, each of which forms a reel by appropriately accumulating the yarn on a tube. The tubes are positioned in baskets above the winding head.

[0004] At the beginning of the winding process, the doffing cart used by the reeling machine takes a tube from the basket and positions it on the winding head. At the end of the winding process, the reel, consisting of the tube plus the deposited yarn, i.e. wound, on it, is removed from the winding unit by the doffing cart.

[0005] In particular, the doffing cart is positioned on the winding unit and removes the newly formed reel by loading a new tube on which the winding unit will form a new reel.

[0006] The known solutions do not provide any tracking of the reels formed by each spinning unit; in other words, the reels, once formed, are stacked in baskets as a function of the production batch.

[0007] In any case, during the successive steps of processing of the yarn, which must be unwound from the reels or dyed, for example, the information on the origin of the reel is lost.

[0008] In other words, the information about manufacturing date, production batch, winding machine and/or winding unit which produced the individual reel is lost.

[0009] The loss of this information does not allow, for example, to be able to trace back to the manufacturing batch and/or the winding machine or winding unit which generated the individual reel. This information could be extremely useful, for example, to be able to retrace the criticality of a production batch, of a winding machine or even of a single winding head or unit.

[0010] Furthermore, it is not possible to catalog the manufactured reels, for example, in order to differentiate their destination as a function of the characteristics of the manufacturing batch (or unit) itself.

PRESENTATION OF THE INVENTION

[0011] The need is therefore felt to solve the drawbacks and limitations mentioned above with reference to the prior art.

[0012] Such a need is met by a tube for tracking a reel according to claim 1, by a winding apparatus according to claim 7 and by a winding method according to claim 21.

DESCRIPTION OF THE DRAWINGS

[0013] Further features and advantages of the present invention will be more comprehensible from the following description of preferred embodiments given by way of nonlimiting examples, in which:

figures 1a-1b are perspective views of variant embodiments of a tube according to possible embodiments of the present invention;

figure 2 is a perspective view of a reel;

figures 3a-3b are front and rear views of an identification device (tag) according to a possible embodiment of the present invention;

figures 4a-4b are perspective views of variant embodiments of the positioning of an identification device on a tube according to possible embodiments of the present invention;

figure 5 is a perspective view of a reading device of an identification device of a reel, according to an embodiment of the present invention;

figures 6a-6c are perspective views of a portion of a winding unit forming part of a winding apparatus with respective doffing cart having a support arm in an extended configuration, according to a possible embodiment of the present invention;

figures 7a-7c are perspective views of the winding unit portion in figures 6a-6c with the respective doffing cart having a support arm in a retracted configuration;

figures 8a-8c are perspective views 7a-7c free from winding units;

figure 9 is an operating diagram of a winding apparatus according to the present invention.

[0014] Elements or parts in common to the embodiments described below will be indicated using the same reference numerals.

DETAILED DESCRIPTION

[0015] With reference to the aforesaid figures, reference numeral 4 indicates a winding apparatus, as described in greater detail below.

[0016] It is worth noting that the present invention pref-

erably but not exclusively applies to a winding apparatus in which the thread unwound from a spool is wound on a reel after any defects have been removed in a winding unit. Indeed, the present invention can be applied to a generic spinning apparatus, in which the thread is made, e.g. with air-jet or open-end technique, and then wound on a tube, in order to keep track of all the processes undergone by the thread itself (as described in greater detail below).

[0017] In any case, for the purposes of the present invention, the winding apparatus 4 may be of any type, shape, and size.

[0018] Said winding apparatus 4 typically comprises a spool on which the thread containing defects is wound, means for unwinding the thread from the spool, a yarn cleaner which analyses the unwound thread and detects its defects. The winding apparatus 4 further comprises means for cutting the portion of defective thread and means for reattaching the clues formed with the above-mentioned cutting of the portion of the defective thread. Finally, the winding apparatus 4 comprises means for rewinding the thread, having removed any defects, on a tube 8 so as to form a reel 12.

[0019] The reel 12 is biased in rotation by a thread guide shaped, for example, to impart a traversing movement of the thread being wound on the reel 12 and/or a rotation movement of the reel 12 to wind the thread about the tube 8.

[0020] In particular, the reel 12 is formed by winding the thread about the tube 8.

[0021] The tube 8 is advantageously configured to allow the tracking of the reel 12 wound on it.

[0022] More in detail, the tube 8 comprises a tube body 20 with an outer lateral surface 24 adapted to receive a winding yarn so as to form a reel 12.

[0023] The tube body 20 is axially symmetrical with respect to an axis of symmetry S-S.

[0024] Typically, the tube body is cylindrical or conical or better truncated conical with respect to said axis of symmetry S-S.

[0025] The tube body 20 is usually made of cardboard or plastic.

[0026] The tube body 20 extends between opposite axial ends 28,32, each provided with a lateral seat 36 for at least partially housing a respective tailstock for the rotational support of the tube 8 during yarn winding.

[0027] Advantageously, said tube body 20 is associated with an identification device 44 (EPC: electronic product code) adapted to uniquely identifying said tube 8.

[0028] Preferably, said identification device 44 is a radio frequency identification device (RFID) comprising an electronic identification code (EPC).

[0029] Obviously said radio frequency identification device 44 can be detected by a special reader, as described in greater detail below.

[0030] According to a possible embodiment, the radio frequency identification device 44 (RFID) is a UHF type tag operating at a frequency between 840 and 960 MHz. Preferably, said radio frequency identification device 44 (RFID) is a UHF type tag operating at a frequency equal to 850 MHz.

[0031] The identification device 44 can be placed in various positions with respect to the tube 8.

[0032] According to a possible embodiment, the identification device 44 is associated with the outer lateral surface 24 of the tube body 8.

[0033] According to an embodiment, the tube body 20 is at least partially hollow so as to define an inner cavity 48 delimited by an inner lateral surface 52, opposite to said outer lateral surface 24, wherein said identification device 44 is associated with the inner lateral surface 52 of the tube body 20.

[0034] According to a further embodiment, the identification device 44 is embedded within the tube body 20. The embedding of the identification device 44 can preferably take place in a plastic tube body 20, but also in a cardboard tube body 20.

[0035] According to a possible embodiment, the identification device 44 is arranged along a prevailing direction parallel to a generatrix straight line of the tube 8.

[0036] According to a further possible embodiment, the identification device 44 is arranged along a prevailing direction perpendicular to a generatrix straight line of the tube 8.

[0037] In general, the position and orientation of the tag, i.e. of the identification device 44 on the tube body 20 depends on the features of the tag itself, i.e. its radiation diagram.

[0038] As mentioned, the winding apparatus 4 comprises at least the winding unit 56 shaped to wind the yarn around a tube 8 so as to make a reel 12. Said winding apparatus 4 further comprises a doffing cart 60 having at least one support arm 64 configured to move said tube 8 and said reel 12.

[0039] In particular, the winding apparatus 4 comprises at least one reading device 68 of the identification device 44 of the tube 8, so as to identify each individual tube 8 or reel 12.

[0040] In particular, the reading device 68 is an electronic device configured to communicate with the radio frequency identification device 44, i.e. using an appropriate radio frequency, and to read the electronic identification code.

[0041] The operations which can be performed by means of the reading device 68 are typically the inventory of the tags or identification devices 44, i.e. their reading and recognition, but also the rewriting of the electronic identification code (EPC). In other words, the reading device 68 can also act as a writing device so as to add additional information to the tag or identification devices 44 of the unique identification code alone. Such additional information may comprise, for example, characteristics of the winding unit 56 or events which occurred during the step of winding, such as the number of thread breaks, or parameters/operating conditions of the winding unit 56 during the formation of the reel 12.

[0042] The reading device 68 of the identification device 44 is arranged on a support arm 64 of the doffing cart 60, so that the identification device 44 can be read when the support arm 64 moves the tube 8 or the reel 12.

[0043] It is also possible to provide the reading device 68 of the identification device 44 arranged on a specific reading arm of the doffing cart 60.

[0044] It is also possible to provide the presence of a reading device 68 of the identification device 44 at at least one winding unit 56, or also at each winding unit 56 of the winding apparatus 4.

[0045] The reading device 68 of the identification device 44 is supported by a relative support arm 64 or reading arm and is provided with movement means 72 adapted to allow an oscillation of the reading device 68 about an oscillation axis lying on a plane perpendicular and incident to the axis of symmetry S-S of the tube 8.

[0046] Preferably, said oscillation occurs during the step of reading so that the identification code 44 can be read correctly and more quickly.

[0047] According to a further possible embodiment, the winding apparatus 4 comprises a reading device 68 of the identification device 44 at an unloading belt of the reels 12.

[0048] Preferably, the reading device 68 of the identification device 44 is calibrated to emit a power of less than 15 dBm.

[0049] Even more preferably, the reading device 68 of the identification device 44 is calibrated to emit a power between 8 and 12 dBm.

[0050] Such power values are a trade-off which make it possible to read the concerned tag, i.e. the one applied to the tube to be identified, without having false readings from any other tags present on other parts of the winding unit 56, of the winding apparatus 4 or on other tubes adjacent to the concerned tube (e.g. because they are contained in bulk in a basket).

[0051] The winding unit 56 and/or winding equipment 4 also comprises at least one processing and control unit (not shown) programmed to:

- take the reading device 68 of the identification device 44 near the identification device 44,
- activate the reading device 68 so as to irradiate the identification device 44,
- actuate the rotation of the tube 8 or the reel 12 during the step of irradiating the identification device 44 so as to facilitate the reading thereof.

[0052] Indeed, the reading of said tag is improved or made faster by virtue of the relative movement between the tube 8 and thus of the identification device 44 and the reading device 68. Indeed, the radiation diagram of the tag itself changes according to the relative orientation between the reading device 68 and the identification device.

[0053] Such a relative movement can be done, for example, by rotating the tube 8 or the reel 12 about its axis of symmetry S-S and/or by tilting or swinging the reading device 68 around an oscillation axis lying on a plane perpendicular to, and incident with the axis of symmetry S-S of the tube 8.

[0054] Furthermore, said processing and control unit may be programmed to write information relating to the spinning unit and/or the operations carried out by the spinning unit on said tube/reel, and/or the operating conditions of the spinning unit during the formation of said reel 12 on the identification device 44 of a tube 8 or reel 12.

[0055] Preferably, said winding apparatus 4 comprises a data acquisition system 76 which stores the information relating to the processing steps of each reel 12 and associates it with the identification device 44 of each reel 12.

[0056] According to a possible embodiment, said apparatus comprises a portable device 80 for reading the identification code 44 of each tube 8, said portable device being operatively connected with the data acquisition system 76 so as to reconstruct the stored data for the identification device 44 of each tube 8. The data acquisition system may also be connected to a remote terminal 84 which can be used by the user to display any further information provided by the data acquisition system 76.

[0057] The operation of a winding apparatus according to the invention will now be described.

[0058] In particular, the winding apparatus according to the present invention works by implementing a winding method comprising the steps of:

- providing at least one tube 8 provided with an identification device 44 adapted to uniquely identifying said tube 8, wherein said identification device 44 is a radio frequency identification (RFID) device comprising an electronic identification code (EPC),
- loading said tube 8 onto a winding unit 56 and identifying the identification device 44 by means of a reading device 68 of the identification device 44 of the tube 8,
- storing the information relating to the operations carried out by the winding unit 56 on the yarn wound on said tube 8 to form a reel 12 in a database or data acquisition system 76,
- associating in said database or data acquisition system 76 the identification device 44 of the tube 8 with the information relating to the operations carried out by the winding unit 56 on the yarn wound on said tube 8.

[0059] More in detail, the method may comprise the step of: applying the RFID tags on the tubes 8 to be loaded on the baskets of the winder units 56, each tag having a unique EPC;
loading a new tube 8 on the winding unit 56 by means of the cart 60, and during this process writing the following information on the identification device 44:

a) The serial number of the winding apparatus 4,

b) The serial number of the winding unit 56 in which the winding process of the specific reel 12 will take place on the specific tube 8.
(c) The date, hour, minute, second of loading of tube 8 on winding unit 56.

[0060] Then the cart 60 communicates the EPC code of the identification device of the loaded tube 8 to the winding unit 56.

[0061] Thus, the winding unit 56, at the end of the winding process of the reel 12, communicates the statistics, the alarms, the types of cuts made during the formation of reel 12, to the processing and control unit of the winding equipment 4 using the EPC code as a unique key to identify the collected information.

[0062] The processing and control unit of the winding machine locally accumulates the data communicated by the winding units 56 concerning the formation of the reels 12 uniquely identifying them by virtue of the EPC provided by each tube 8.

[0063] The processing and control unit sends the collected data to the external data acquisition system 76, which stores the data related to the formed reels 12, again using the EPC identification code. Thus, an external acquisition system makes it possible to retrieve the data related to the formation of a particular reel 12 according to the EPC.

[0064] Finally, by using a portable reader 80 (e.g. smartphone with RFID reader system) it is possible to read the tag or identification device 44 of a particular reel 12 and by means of the EPC code to retrieve the data related to that particular reel 12 using the data present in the data acquisition system 76.

[0065] The data acquisition system also makes it possible to give feedback on any problems which may have occurred during the use of reel 12 itself in weaving or, for example, in dyeing or knitting or more generally in the subsequent steps of processing of the reel 12.

[0066] As can be appreciated from the description above, the present invention makes it possible to overcome the drawbacks of the prior art.

[0067] In particular, the present invention makes it possible to overcome the limits of known winding systems.

[0068] Indeed, the individual reels can be traced in a complete and exhaustive manner so as to reconstruct their entire history, starting from their formation. It is, therefore, possible to keep track of the manufacturing batch (date and location), the winding machine and also the individual unit or winding head.

[0069] Moreover, the stored information makes it possible to uniquely identify the single reel and to reconstruct, for example, all the operations carried out by the head on the single reel, such as the number of cuts (and their splices), the exact length, and so on. This information can be read back by the user to reconstruct the history of the reel.

[0070] It is worth noting that the tag does not necessarily store all the information related to the making of the single reel but it can only store the (unique) identification code of the reel itself which will be associated to a database which contains additional information about, e.g. the winding machine, the single winding unit, the number of splices/cuts and so on.

[0071] The reels can then be classified with a ranking or categorized in such a manner that they can be used for different purposes, for example, because of the respective quality resulting from the respective forming history.

[0072] It is, therefore, possible to catalog/discriminate reels of different type/quality for different uses. For example, the reels which have undergone a greater number of cuttings/reattachments may be used for weaving fabrics which are not intended to be visible in subsequent use (such as the cuffs of a shirt).

[0073] On the other hand, the reels which have undergone fewer cuttings/reattachments may be used for weaving parts of fabrics intended to be always in view in the subsequent use, such as fabrics for shirt front parts.

[0074] Furthermore, the reels with a greater or lesser number of interruptions/reattachments may be destined to a different step of dyeing; for example, it will be possible to change the bath immersion time in the case of yarn-dyed reels.

[0075] Another criterion according to which to modify the immersion time may be the exact length of the individual reel which obviously modifies the density of the thread.

[0076] Alternatively, it is possible to catalog reels with different thread winding densities because they come from winding units with a specific type of thread guide.

[0077] Furthermore, the information stored on the single reels may be useful to reconstruct the operating mode of the winding machine and the single winding heads/units, so that preventive maintenance can be carried out on the rotor heads/units themselves, for example.

[0078] A person skilled in the art can make numerous changes and variants to the winding apparatuses and methods described above, all contained within the scope of protection defined by the following claims in order to satisfy contingent and specific needs.

Claims

1. A tube (8) for tracking a reel (12) comprising:

- a tube body (20) having an outer lateral surface (24) suitable for receiving a yarn in winding so as to form a reel (12),
- said tube body (20) being axial-symmetric with respect to an axis of symmetry (S-S),

characterised in that

- said tube body (20) is associated with an identification device (44) suitable for uniquely identifying said tube (8),
- wherein said identification device (44) is a radio

frequency identification device (RFID) comprising an electronic identification code (EPC).

2. The tube (8) for tracking a reel (12) according to claim 1, wherein the radio frequency identification device (44) (RFID) is a UHF type tag operating at a frequency between 840 and 960 MHz.

3. The tube (8) for tracking a reel (12) according to claim 1 or 2, wherein said identification device (44) is associated with the outer lateral surface (24) of the tube body (20).

4. The tube (8) for tracking a reel (12) according to claim 1 or 2, wherein the tube body (20) is at least partially hollow so as to define an inner cavity (48) delimited by an inner lateral surface (52), opposite said outer lateral surface (24), wherein said identification device (44) is associated with the inner lateral surface (52) of the tube body (20).

5. The tube (8) for tracking a reel (12) according to claim 1 or 2, wherein the identification device (44) is embedded inside the tube body (20).

6. The tube (8) for tracking a reel (12) according to any one of the claims from 1 to 5, wherein the identification device (44) is arranged along a main direction parallel or perpendicular to a generatrix straight line of the tube (8).

7. Winding apparatus (4) comprising:

- at least one winding unit (56) shaped to wind yarn around a tube (8) so as to make a reel (12),
- a doffing cart (60) having at least one arm (64) configured to move said tube (8) and said reel (12), **characterised in that**
- the tube (8) is a tube (8) according to any one of the claims from 1 to 6,
- the winding apparatus (4) comprises at least one reading device (68) of the identification device (44) of the tube (8), so as to identify each individual tube (8) or reel (12).

8. The winding apparatus (4) according to claim 7, wherein the reading device (68) is an electronic device configured to communicate with the radio frequency identification device (44) and to read the electronic identification code.

9. The winding apparatus (4) according to claim 7 or 8, wherein the reading device (68) of the identification device (44) is arranged on a support arm (64) of the doffing cart (60), so that the identification device (44) can be read when the support arm (60) moves the tube (8) or the reel (12).

10. The winding apparatus (4) according to claim 7 or 8, wherein the reading device (68) of the identification device (44) is arranged on a specific reading arm of the doffing cart (60).

11. The winding apparatus (4) according to claim 7, 8, 9 or 10, wherein a reading device (68) of the identification device (44) is provided on at least one winding unit (56).

12. The winding apparatus (4) according to any one of the claims from 7 to 11, wherein the reading device (68) of the identification device (44) is supported by a relative support arm (64) or reading arm and is provided with movement means (72) suitable for allowing an oscillation of the reading device (68) around an oscillation axis lying on a plane perpendicular and incident to the axis of symmetry(S-S) of the tube (8).

13. The winding apparatus (4) according to any one of the claims from 7 to 12, wherein the reading device (68) of the identification device (44) is calibrated to emit a power of less than 15 dBm.

14. The winding apparatus (4) according to claim 13, wherein the reading device (68) of the identification device (44) is calibrated to emit a power between 8 and 12 dBm.

15. The winding apparatus (4) according to any one of the claims from 7 to 14, wherein the winding apparatus (4) comprises a reading device (68) of the identification device (44) at a reel unloading belt.

16. The winding apparatus (4) according to any one of the claims from 7 to 15, wherein the winding unit (56) and/or the winding apparatus (4) comprises at least one processing and control unit programmed to:

- bring the reading device (68) of the identification device (44) near the identification device (44),
- activate the reading device (68) so as to irradiate the identification device (44),
- activate the rotation of the tube (8) or reel (12) during the irradiation phase of the identification device (44) so as to facilitate the reading thereof.

17. The winding apparatus (4) according to any one of the claims from 7 to 16, wherein said winding apparatus (4) is provided with a processing and control unit programmed to move the reading device (68) during the irradiation phase so as to perform an oscillation of the reading device (68) around an oscillation axis lying on a plane perpendicular and incident to the axis of symmetry(S-S) of the tube (8).

18. The winding apparatus (4) according to any one of the claims from 7 to 17, wherein the apparatus is provided with at least one spinning unit (56) and comprises at least one processing and control unit programmed to:

- write on the identification device (44) of a tube (8) or reel (12) information relating to the winding unit (56) and/or the operations carried out by the winding unit (56) on said tube/reel, and/or the operating conditions of the winding unit (56) during the formation of said reel (12).

19. The winding apparatus (4) according to any one of the claims from 7 to 18, wherein said apparatus comprises a data acquisition system (76) that stores the information relating to the processing steps of each reel (12) and associates them with the identification code of each reel (12) .

20. The winding apparatus (4) according to claim 19, wherein said apparatus comprises a portable device for reading the identification code (44) of each tube (8), said portable device being operatively connected with the data acquisition system (76) so as to reconstruct the stored data for the identification code of each tube (8).

21. Winding method comprising the steps of:

- providing at least one tube (8) fitted with an identification device suitable for uniquely identifying said tube (8), wherein said identification device (44) is a radio frequency identification (RFID) device comprising an electronic identification code (EPC),
- loading said tube (8) onto a winding unit (56) and identifying the identification device (44) by means of a reading device (68) of the identification device (44) of the tube (8),
- storing in a database or data acquisition system (76) the information relating to the operations carried out by the winding unit (56) on the yarn wound on said tube (8) to form a reel (12),
- associating in said database (76) the identification device (44) of the tube (8) with the information relating to the operations carried out by the winding unit (56) on the yarn wound on said tube (8).

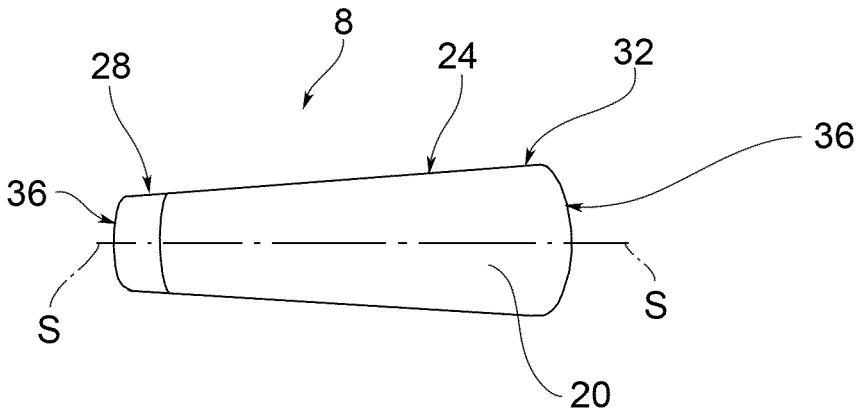

FIG.1a

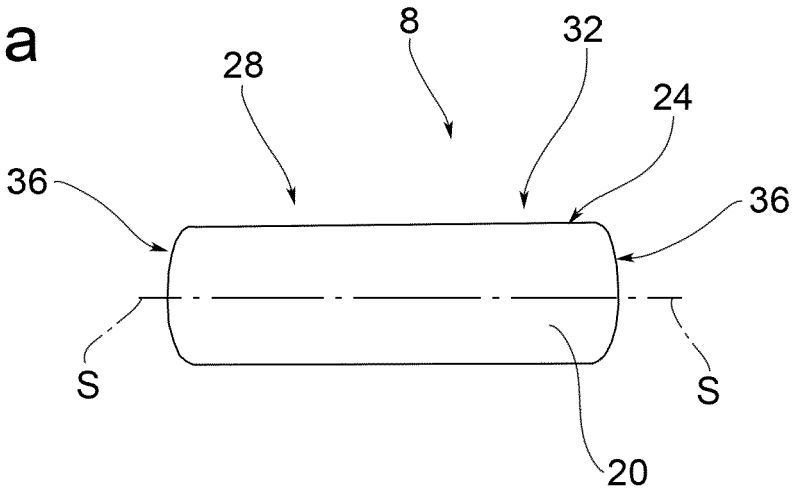

FIG.1b

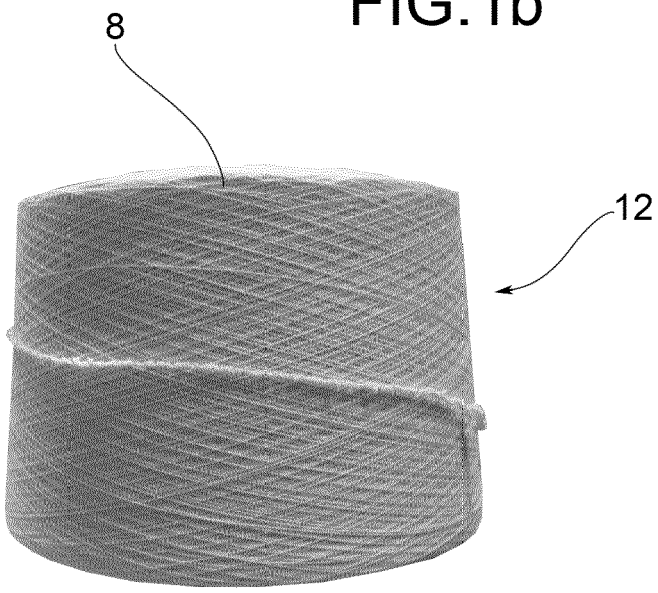

FIG.2

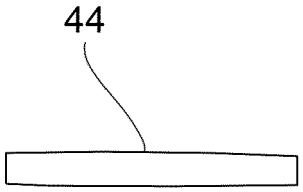

FIG.3a

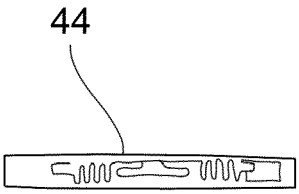

FIG.3b

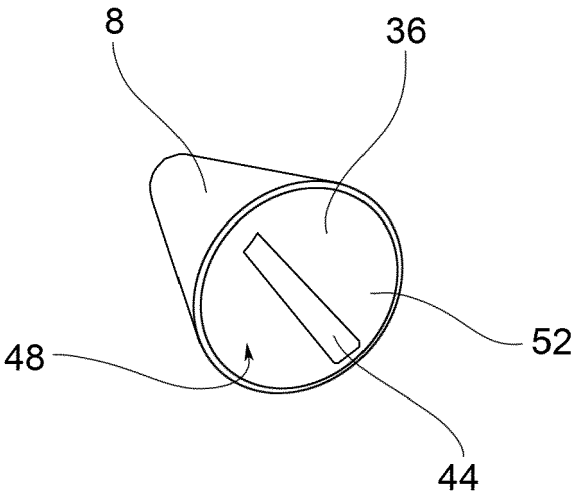

FIG.4a

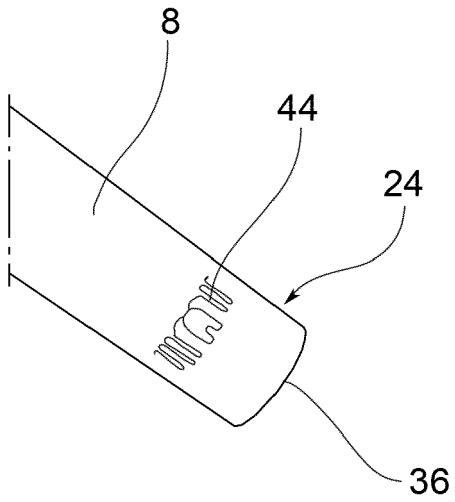

FIG.4b

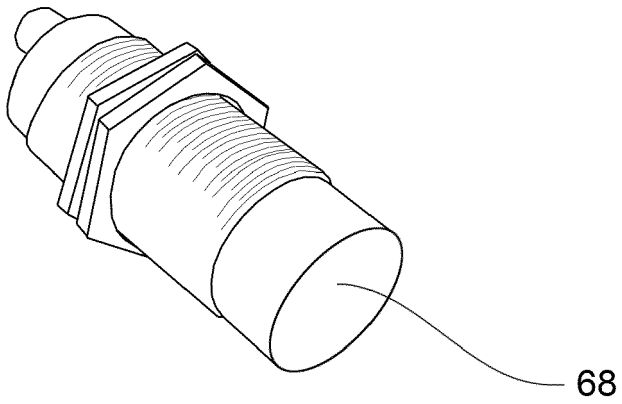

FIG.5

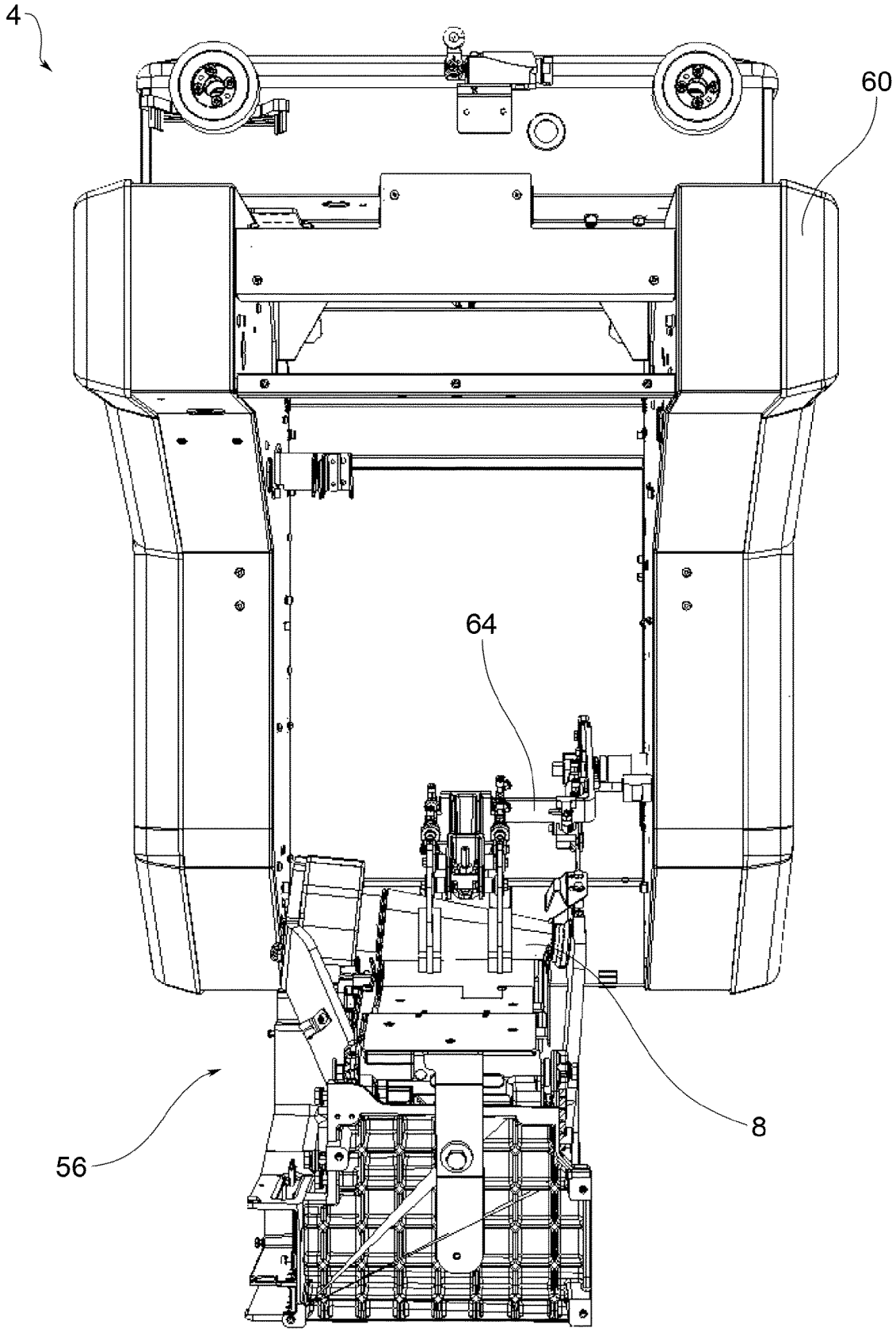

FIG.6a

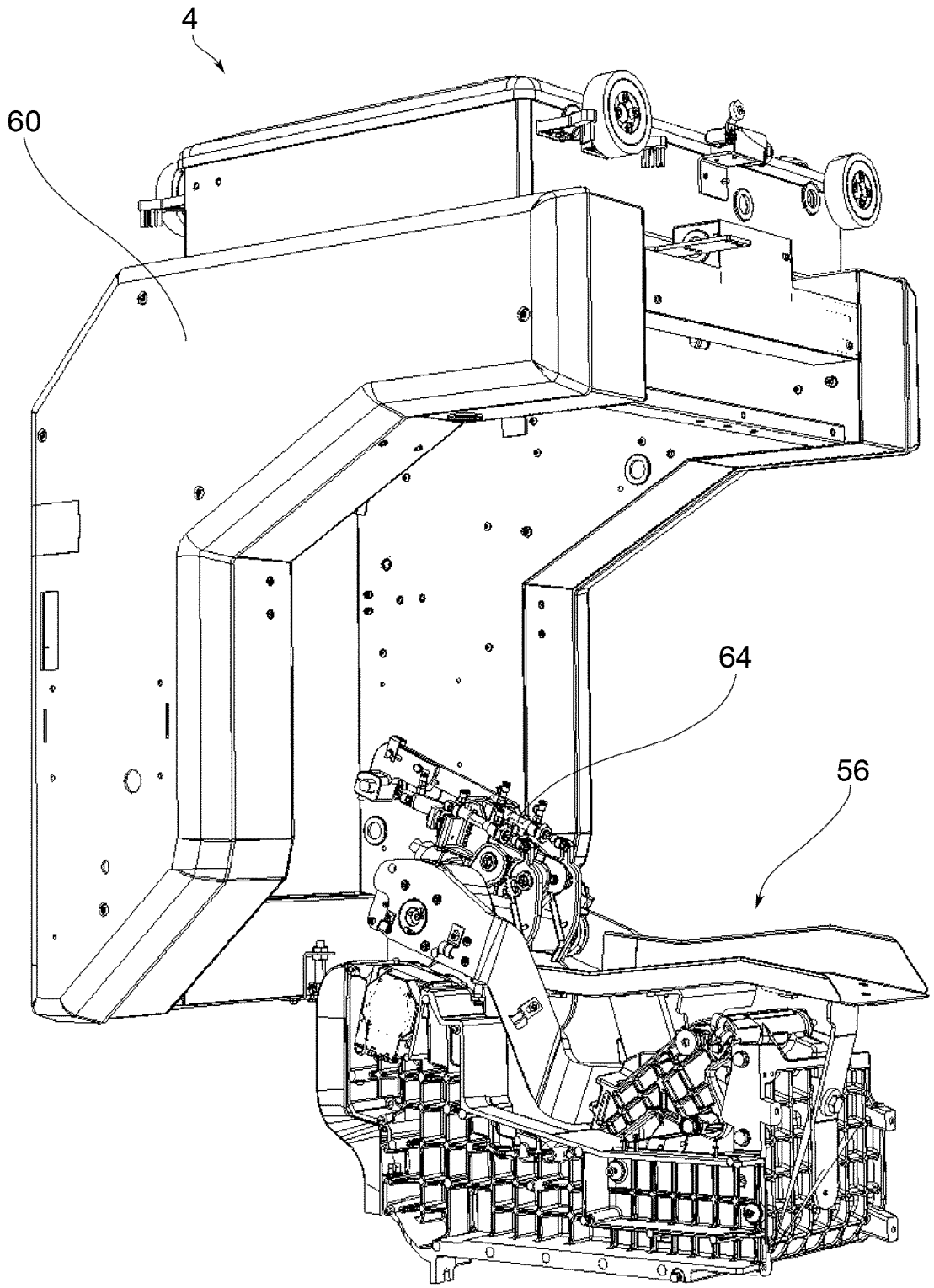

FIG.6b

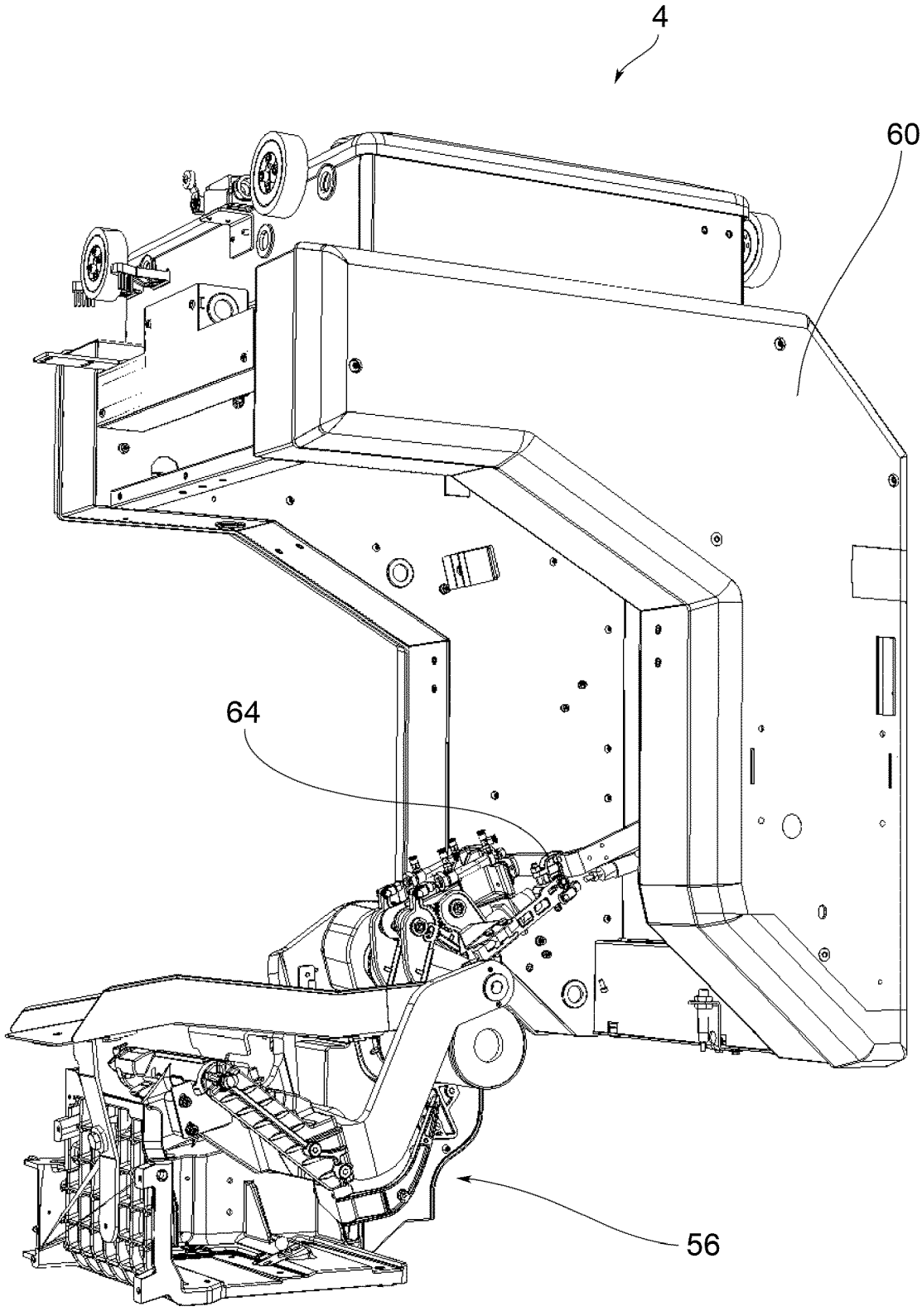

FIG.6c

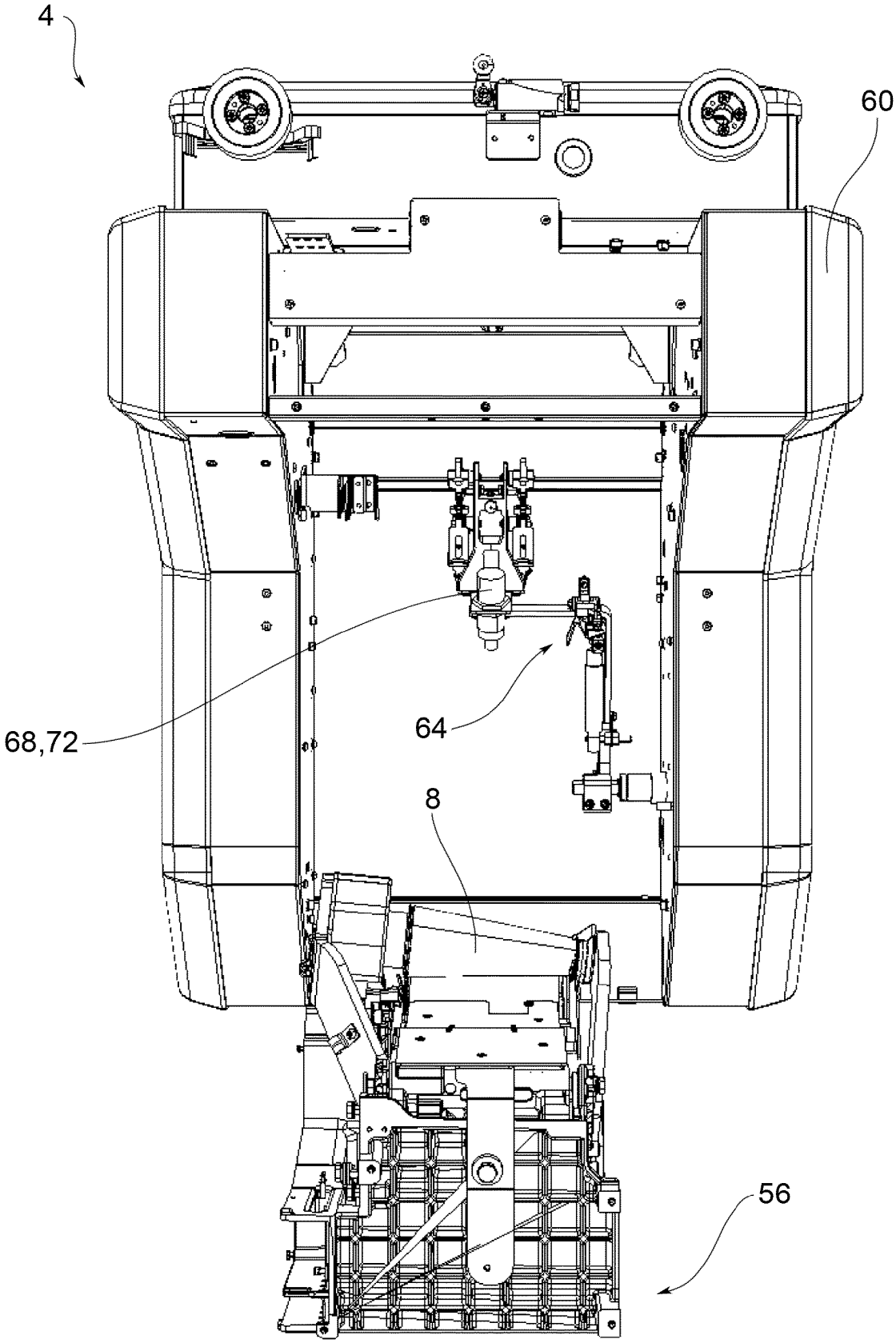

FIG.7a

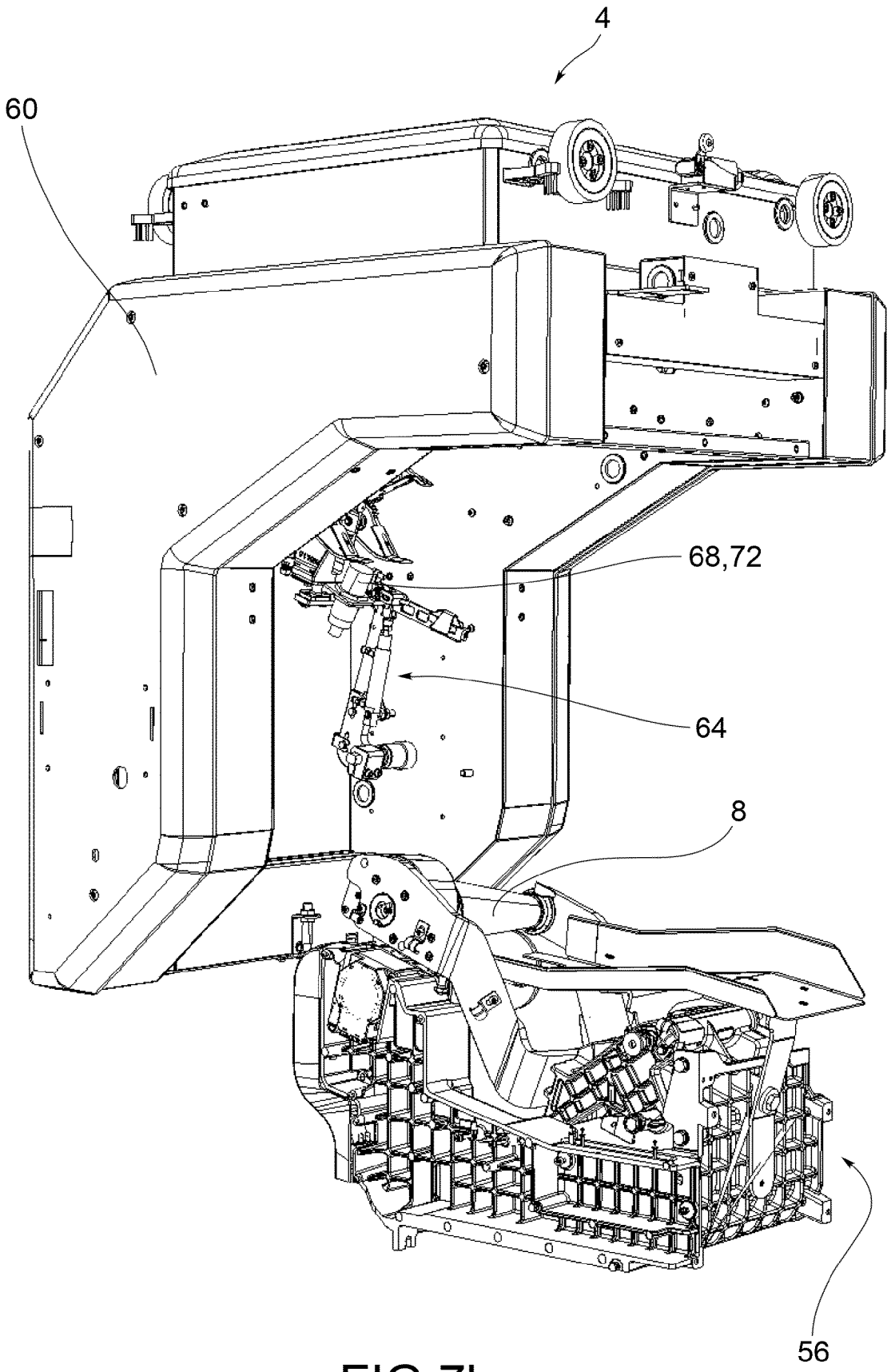

FIG.7b

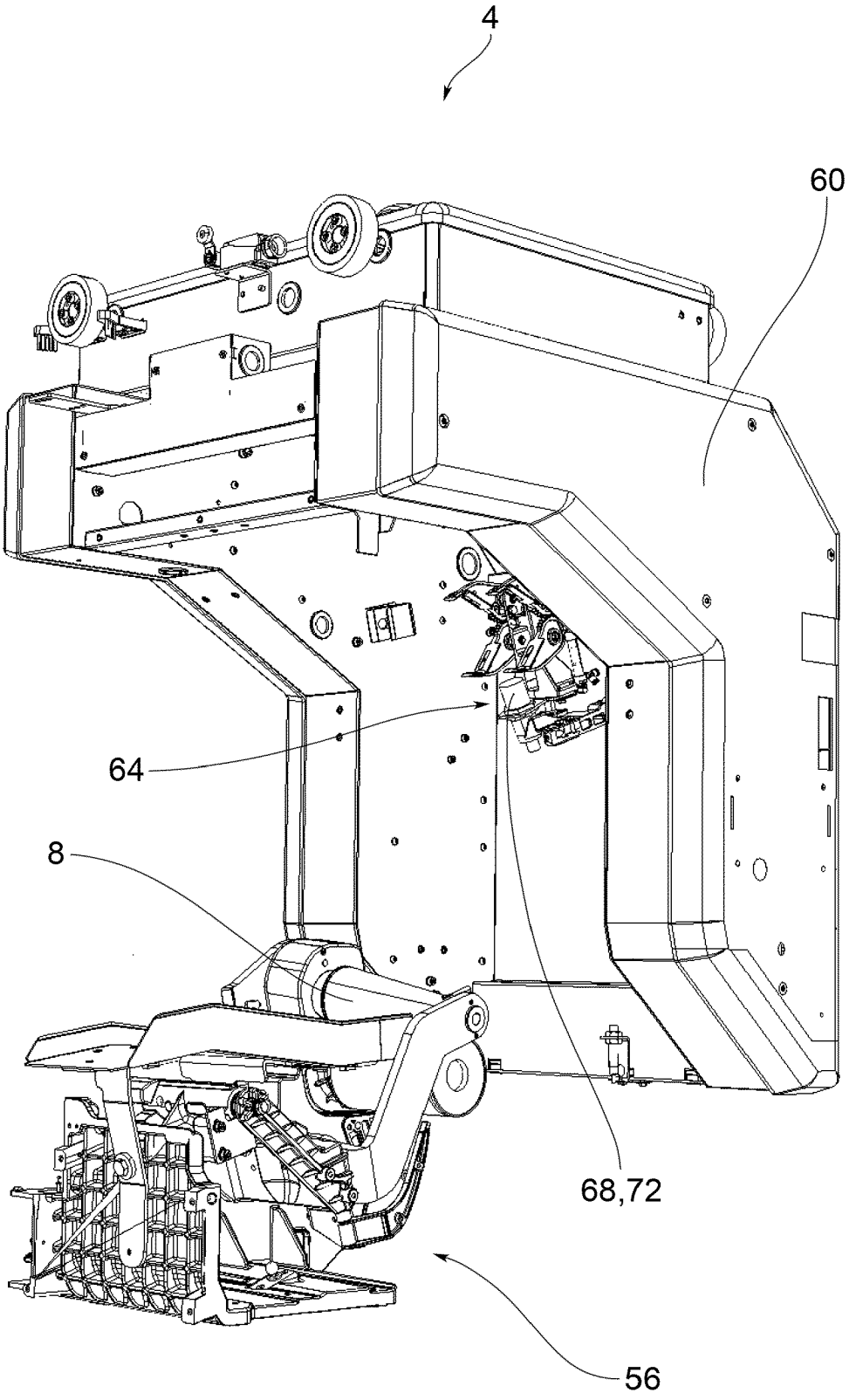

FIG.7c

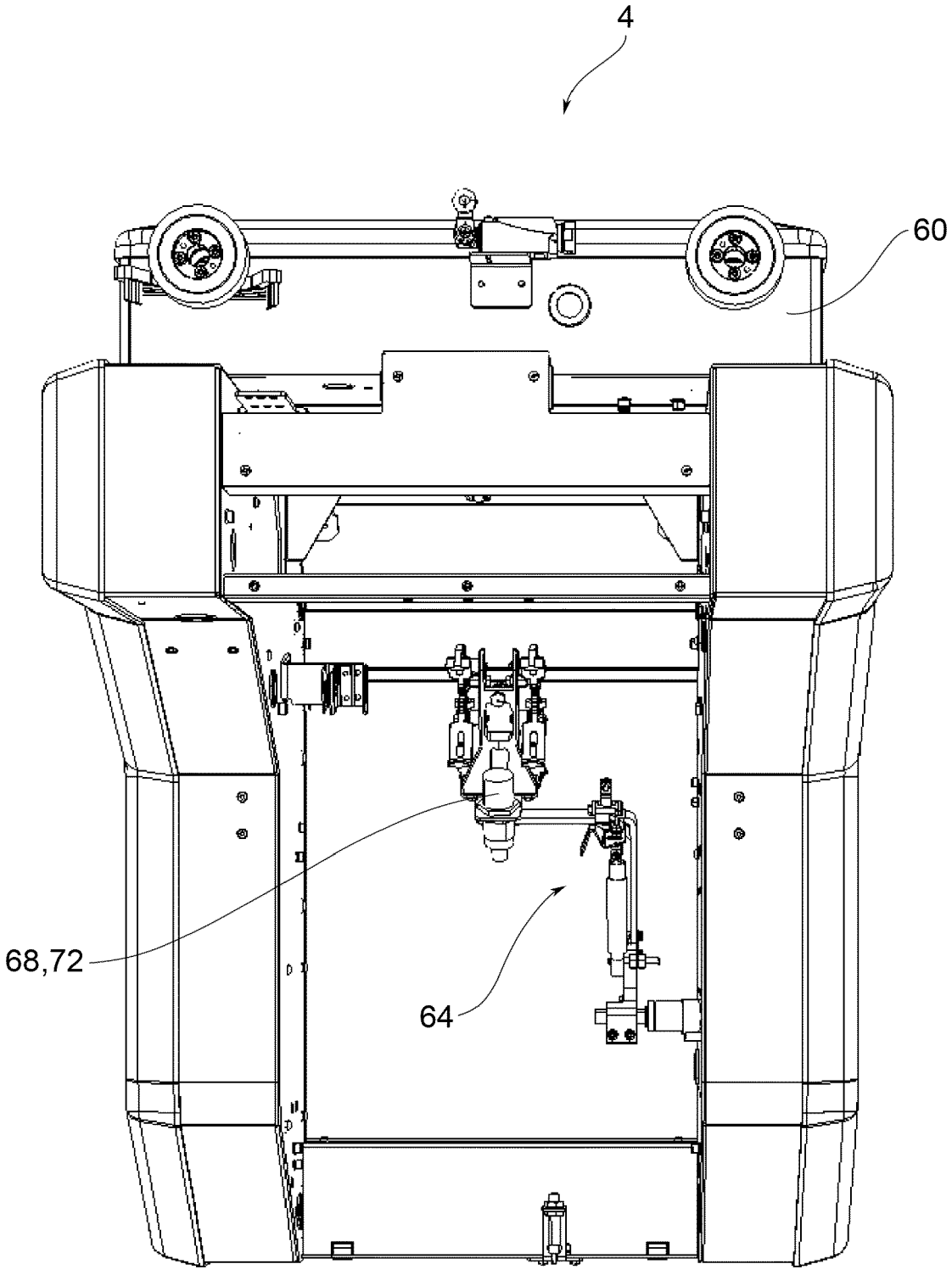

FIG.8a

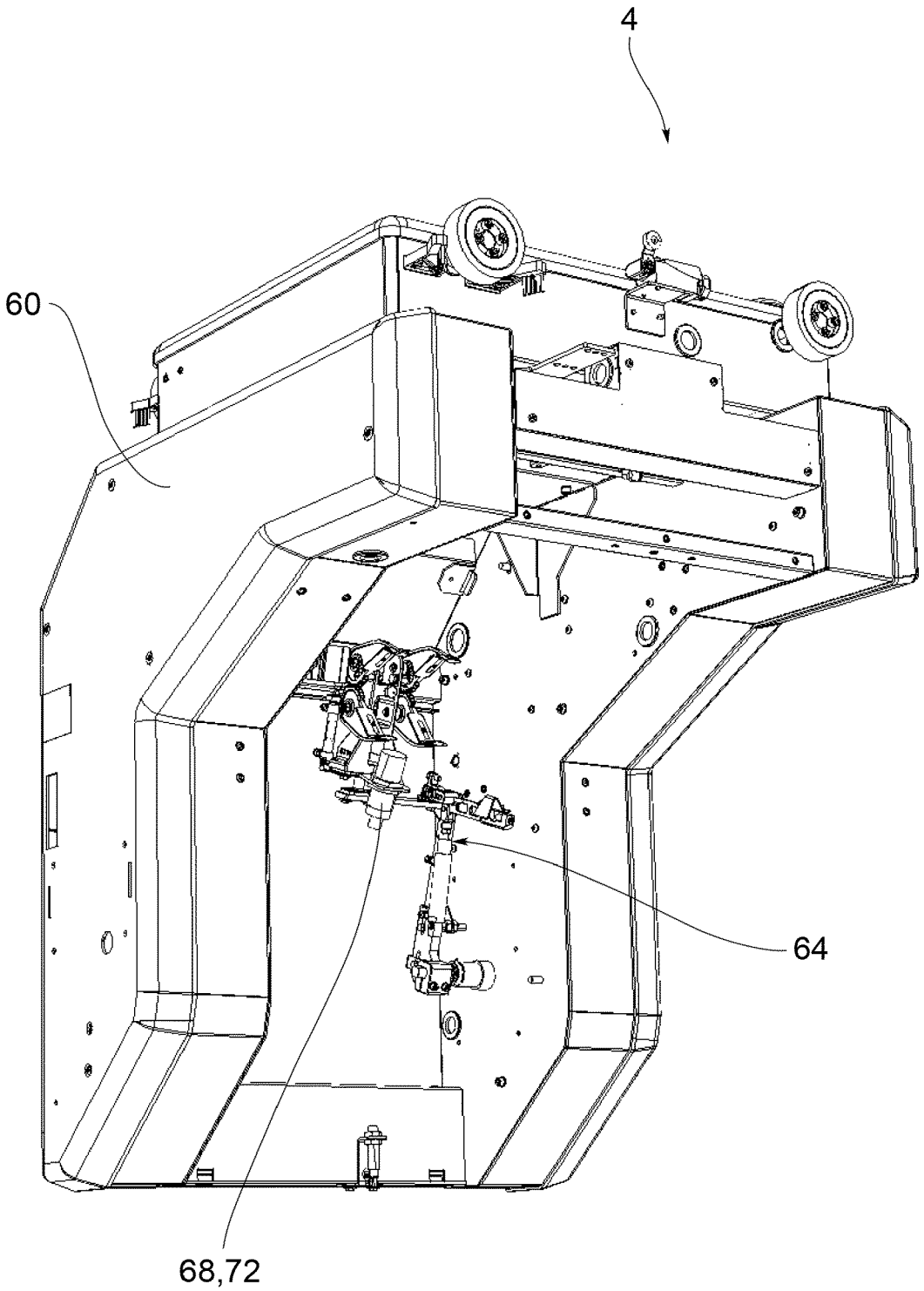

FIG.8b

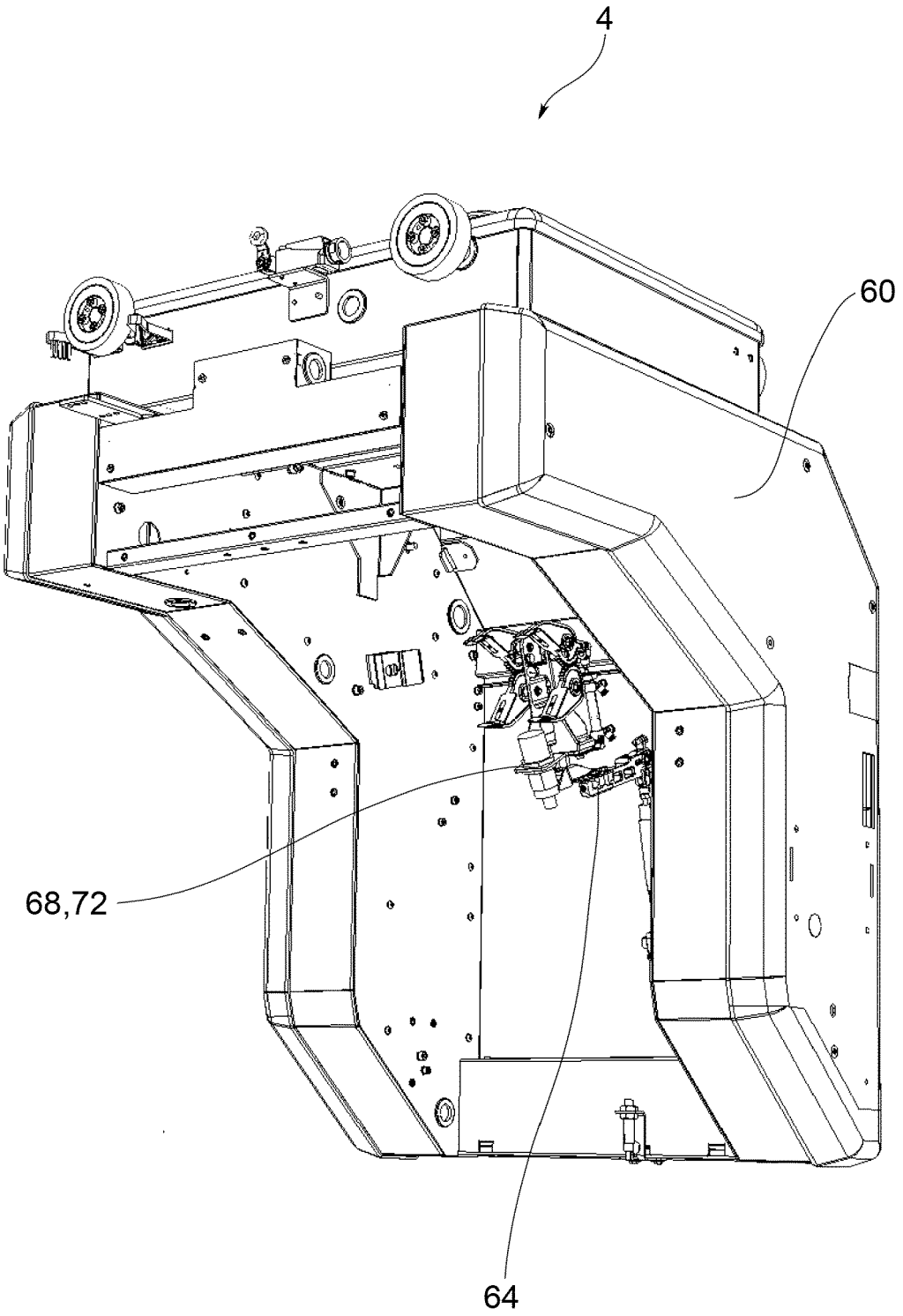

FIG.8c

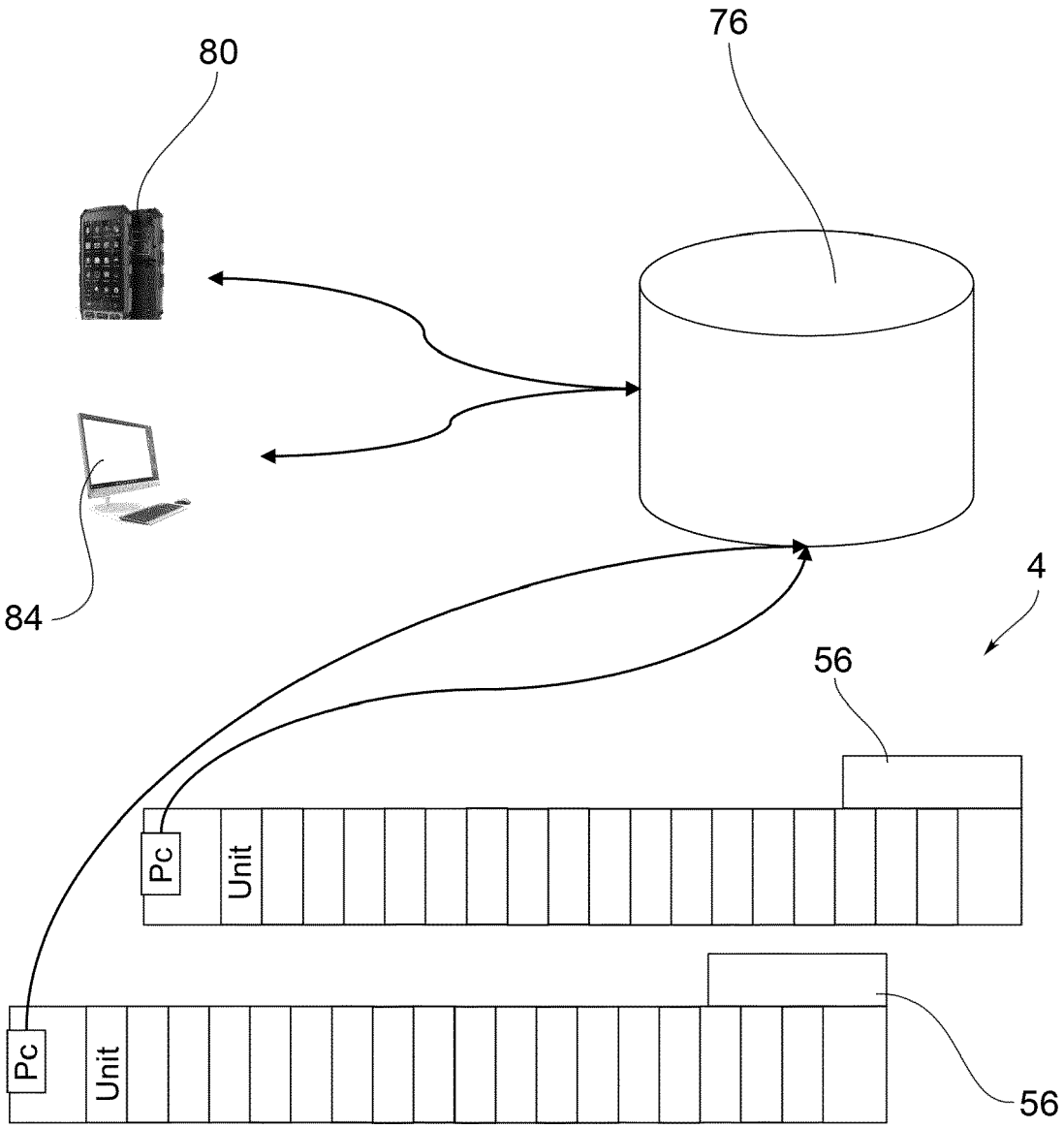

FIG.9

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EUROPEAN SEARCH REPORT

Application Number
EP 20 16 3492

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X Y	WO 2006/134783 A1 (MURATA MACHINERY LTD [JP]; MASAI TETSUJI [JP]) 21 December 2006 (2006-12-21) * paragraphs [0022], [0027], [0028], [0034], [0036] - [0041]; figures * -----	1,2, 6-17, 19-21 3-6,18	INV. B65H75/10 B65H75/18 B65H67/04 B65H67/06
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B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	9 July 2020	Lemmen, René

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