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(54) **Title:** CONVEYOR, CONVEYING SYSTEM AND MANUFACTURING METHOD OF CONVEYOR

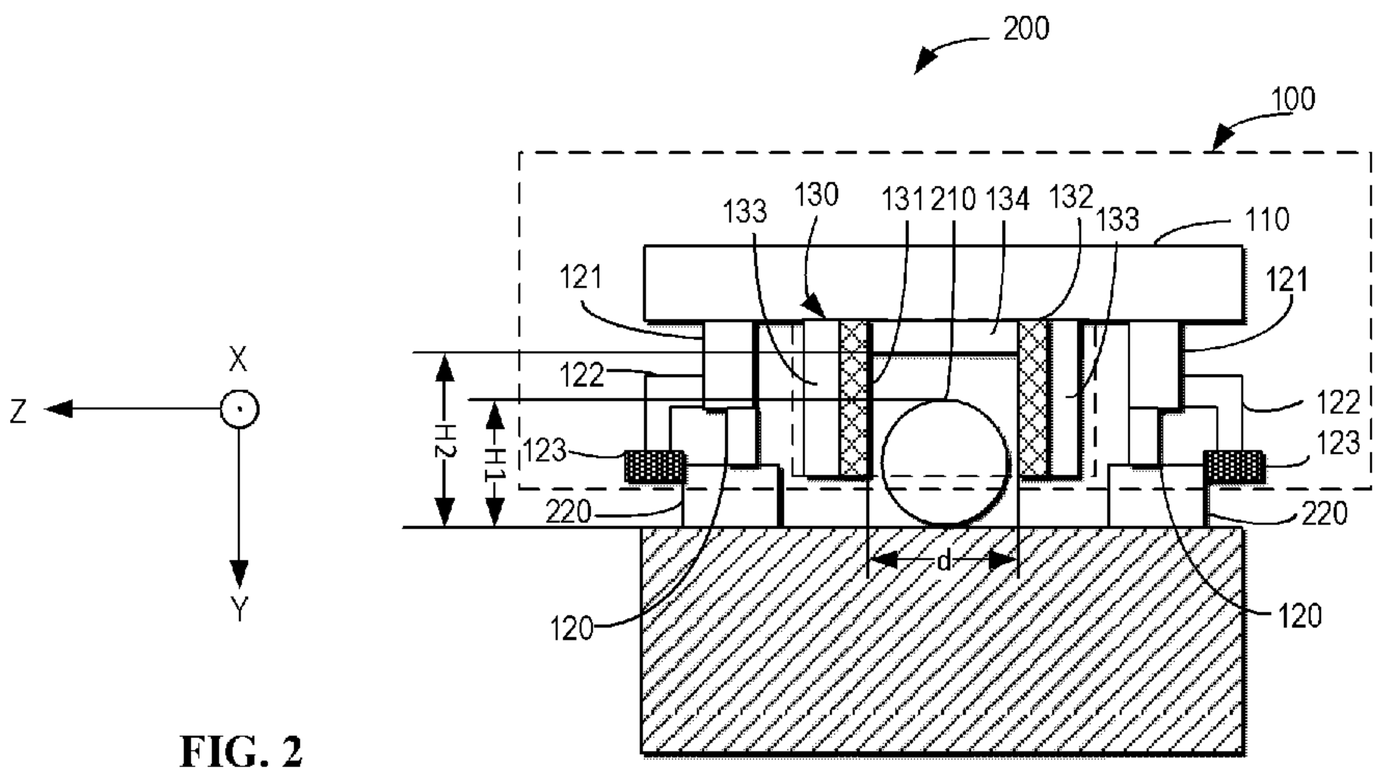


FIG. 2

(57) **Abstract:** The present invention provides a conveyor (100), a conveying system (200) having the same and a method of manufacturing the conveyor (100). The conveyor (100) comprises: a carrying member (110) adapted to carry an object to be conveyed; a plurality of rollers (120) arranged under the carrying member (110) and adapted to be guided to move along guide rails (220) in a first direction (X); and a first magnetic engaging portion (130) arranged to extend from a lower surface of the carrying member (110) to a position near to the guide rails (220) in a second direction (Y) normal to the first direction (X), and adapted to interact with a second magnetic engaging portion (210) on the guide rails (220), to generate a driving force for driving the conveyor (100) in the first direction (X). In this way, the first magnetic engaging portion (130) on the conveyor (100) may interact better with the second magnetic engaging portion (210) when a magnetic field is generated at the second magnetic engaging portion (210), thereby a sufficient driving force can be generated to improve carrying capacity of the conveyor (100).

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CONVEYOR, CONVEYING SYSTEM AND MANUFACTURING METHOD OF CONVEYOR

FIELD

[0001] Embodiments of the present disclosure generally relate to a conveyor, a conveying system having the same and a method of manufacturing the conveyor.

BACKGROUND

[0002] Cleanroom production lies at the heart of many of the world's leading industries. These include pharmaceutical, medical, semiconductor, etc. For example, in a Computer, Communication and Consumer (3C) industries, various products need to be assembled in a clean room, i.e. a dustless environment. Thus, components to be assembled are required to be carried and conveyed to the clean room rapidly and safety.

[0003] In a conventional way, the supporting member is driven by a rack-pinion mechanism through mechanical engagement or driven by a belt, a roller, and a link plate through friction. In this case, particles generated by mechanical engagement or friction cannot be ignored.

[0004] To eliminate most of contacting during conveying with simple structure and low-cost, it has been considered using a magnetic conveyor for clean room. However, this conveyor has the limitation of speed (400mm/s) due to the tangible magnetic field engagement between the magnetic gear and rack, which becomes a bottleneck for further reducing the production cycle time.

SUMMARY

[0005] Embodiments of the present disclosure provide a conveyor, a conveying system having the same and a method of manufacturing the conveyor.

[0006] In a first aspect, a conveyor is provided. The conveyor comprises a carrying member adapted to carry an object to be conveyed. The conveyor also comprises a plurality of rollers arranged under the carrying member and adapted to be guided to move along guide rails in a first direction. The conveyor further comprises a first magnetic

engaging portion arranged to extend from a lower surface of the carrying member to a position near to the guide rails in a second direction normal to the first direction, and adapted to interact with a second magnetic engaging portion on the guide rails, to generate a driving force for driving the conveyor in the first direction.

[0007] The conveyor of the first aspect proposes a novel arrangement of magnetic engaging portion on the conveyor, which may extend from the lower surface of the carrying member still a position adjacent to the guide rails. In this way, the first magnetic engaging portion on the conveyor may interact better with the second magnetic engagement portion when a magnetic field is generated at the second magnetic engagement portion, thereby a sufficient driving force can be generated to improve the carrying capacity of the conveyor.

[0008] Meanwhile, the conveyor will be lifted up at an assembly location. The first magnetic engaging portion of the first aspect makes it easier to separate the first magnetic engaging portion from the the second magnetic engagement portion at a tangible direction of the the second magnetic engagement portion. Without step change of magnetic force during separating, the lifting up motion can be smoother.

[0009] In some embodiments, the first magnetic engaging portion may comprise a first set of magnetic racks and a second set of magnetic racks. The second set of magnetic racks are arranged opposite to the first set of magnetic racks at a predetermined distance from the first set of magnetic racks such that the second magnetic engaging portion is located between the first set of magnetic racks and the second set of magnetic racks.

[0010] In this way, a plurality of magnetic racks can be arranged around the second magnetic engaging portion, which is protruded from the guide rails such that the magnetic coupling between the first magnetic engaging portion and the second magnetic engaging portion becomes more strengthen. Therefore, the driving capacity of the magnetic conveyor, especially the speed and load capacity of the conveyor can be significantly increased with the embraced magnetic field engagement around the second magnetic engaging portion.

[0011] In some embodiments, the first magnetic engaging portion may further comprise a connecting element fixed on the lower surface of the carrying member and a pair of first supporting members connected to the connecting element and adapted to support the first set of magnetic racks and the second set of magnetic racks respectively.

[0012] The connecting element and the pair of first supporting members may achieve a simple and stable connection of plurality of sets of magnetic racks to the carrying member, which is an indispensable intermediate structure for implementing the rack arrangement of the present disclosure.

[0013] In some embodiments, the first set of magnetic racks and the second set of magnetic racks may be arranged to be inclined in opposite directions with respect to the second direction on the respective first supporting members.

[0014] In some embodiments, the first set of magnetic racks may be inclined to form a predetermined angle with the second set of magnetic racks and the predetermined angle corresponds to half of an inclination angle of a magnetic pole generated by the second magnetic engagement portion with respect to the second direction.

[0015] The inclined first set of magnetic racks and the second set of magnetic racks may interact with the second magnetic engaging portion, respectively, to generate driving force in a same direction, such that the conveyor can be driven from both sides. By this inclination arrangement of the first and the second magnetic engagement portions, the driving force caused by the magnetic field may be optimized and therefore the plurality of rollers can slide more smoothly and rapidly.

[0016] In some embodiments, the conveyor may further comprise a third magnetic engaging portion arranged on the connecting element and adapted to interact with the second magnetic engaging portion on the guide rails, which may further increase the driving capacity of the magnetic conveyor.

[0017] In some embodiments, the conveyor may further comprise a pair of second supporting members fixed on the lower surface of the carrying member. The plurality of rollers may be mounted on the respective second supporting members such that a second height from a lower end of the connecting element to a bottom of the magnetic engagement portion is greater than a first height of the second magnetic engagement portion.

[0018] Since the rack arrangement is changed to improve the driving capacity, the height of the conveyor may be adjusted to avoid the contact between the connecting element and the second magnetic engagement portion, because particles may be generated due to the friction during the conveying, which is unexpected for the dustless environment. The arrangement of the second supporting members may lift the height of the conveyor, which

maintains the first magnetic engaging portion to be located at a position near the second magnetic engaging portion without contacting the second magnetic engagement portion.

[0019] In some embodiments, the conveyor may further comprise a pair of third supporting members fixed on the respective second supporting members and limiting member mounted in the respective third supporting members and adapted to limit the movement of the conveyor on the guide rails. In this way, the conveyor can be maintained on the guide rails to ensure a stable conveying process.

[0020] In a second aspect, a conveying system is provided. The conveying system comprises a conveyor according to the first aspect. The conveying system further comprises guide rails adapted to guide the plurality of rollers to move the conveyor in the first direction. The conveying system also comprises a driving shaft arranged between the guide rails and adapted to be driven to rotate in a third direction. Furthermore, the conveying system comprises a second magnetic engaging portion comprising a plurality of magnetic gear arranged on the driving shaft and adapted to rotate with the rotation of the driving shaft, to generate a magnetic field.

[0021] Due to the increased driving capacity of the conveyor, a conveying system with a simple structure and low-cost can be achieved, thereby the performance and the efficiency of the conveying system can be improved.

[0022] In some embodiments, the conveying system may comprise a motor adapted to drive the driving shaft.

[0023] In a third aspect, a manufacturing method of a conveyor is provided. The method comprises providing a carrying member adapted to carry an object to be conveyed; arranging a plurality of rollers under the carrying member. The plurality of rollers is adapted to be guided to move along guide rails in a first direction. The method further comprises arranging a first magnetic engaging portion to extend from a lower surface of the carrying member to a position near to the guide rails in a second direction normal to the first direction and adapted to interact with a second magnetic engaging portion on the guide rails, to generate a driving force for driving the conveyor in the first direction.

[0024] In this way, the conveyor of the first aspect of can be manufactured with a simple structure and low cost. In order to save costs, the conventional magnetic conveyor can be replaced by the conveyor according to the first aspect, without having to replace other

components, such as guide rail, in the conveying system.

[0025] It is to be understood that the Summary is not intended to identify key or essential features of embodiments of the present disclosure, nor is it intended to be used to limit the scope of the present disclosure. Other features of the present disclosure will become easily comprehensible through the description below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] The above and other objectives, features and advantages of the present disclosure will become more apparent through more detailed depiction of example embodiments of the present disclosure in conjunction with the accompanying drawings, wherein in the example embodiments of the present disclosure, same reference numerals usually represent same components.

[0027] FIG. 1A and 1B show a side view of a conveyor according to embodiments of the present disclosure;

[0028] FIG. 2 shows a front view of a conveying system having a conveyor according to embodiments of the present disclosure;

[0029] FIG. 3A and 3B show the inclined magnetic racks according to embodiments of the present disclosure;

[0030] FIG. 4 shows a front view of a conveying system having a conveyor according to embodiments of the present disclosure;

[0031] FIG. 5A and 5B show a side view of a conveying system having the conveyor according to further embodiments of the present disclosure; and

[0032] FIG. 6 shows a flowchart illustrating a manufacturing method of a conveyor according to embodiments of the present disclosure.

[0033] Throughout the drawings, the same or similar reference symbols are used to indicate the same or similar elements.

DETAILED DESCRIPTION

[0034] The present disclosure will now be discussed with reference to several example embodiments. It is to be understood these embodiments are discussed only for the

purpose of enabling those skilled persons in the art to better understand and thus implement the present disclosure, rather than suggesting any limitations on the scope of the subject matter.

[0035] As used herein, the term "comprises" and its variants are to be read as open terms that mean "comprises, but is not limited to." The term "based on" is to be read as "based at least in part on." The term "one embodiment" and "an embodiment" are to be read as "at least one embodiment." The term "another embodiment" is to be read as "at least one other embodiment." The terms "first," "second," and the like may refer to different or same objects. Other definitions, explicit and implicit, may be comprised below. A definition of a term is consistent throughout the description unless the context clearly indicates otherwise.

[0036] Unless specified or limited otherwise, the terms "mounted," "connected," "supported," and "coupled" and variations thereof are used broadly and encompass direct and indirect mountings, connections, supports, and couplings. Furthermore, "connected" and "coupled" are not restricted to physical or mechanical connections or couplings. In the description below, like reference numerals and labels are used to describe the same, similar or corresponding parts in the figures. Other definitions, explicit and implicit, may be included below.

[0037] As mentioned above, in a Computer, Communication and Consumer (3C) industries, various products need to be assembled in a clean room, i.e. a dustless environment. Thus, components to be assembled are required to be carried and conveyed to the clean room rapidly and safety. Particles may be generated by mechanical engagement or friction in a conventional way. In order to eliminate most of contacting during conveying, the magnetic engaging components can be used for the conveying.

[0038] However, the conveyor has the limitation of speed and load capacity due to insufficient driving force and the weak magnetic field engagement. Thus, a conveyor with high efficiency and low cost is expected.

[0039] FIG. 1A and 1B show a side view of a conveyor according to embodiments of the present disclosure. In a case that the conveyor 100 moves along with the direction X, FIG. 1A, for example, may show the conveyor 100 from left side, i.e. in a direction Z while FIG. 1B show the conveyor 100 from the right side, i.e. in a direction Z' opposite to the direction Z. The direction Z and Z' are arranged to be normal to the direction X.

[0040] As shown, the conveyor 100 may comprise a carrying member 110. An object to be conveyed may be carried by the carrying member 110 and transferred to a target destination. A plurality of rollers can be arranged under the carrying member 110. For example, as shown, two pairs of rollers 120_1, 120_2 and 120_3 and 120_4, hereafter may be referred to rollers 120 collectively, can be mounted under the carrying member 110. The plurality of rollers 120 may be guided to be moved on the specific rails (not shown) along the driving direction X.

[0041] A first magnetic engaging portion 130 may be arranged to extend from a lower surface of the carrying member 110 to a position near to the guide rails (not shown), on which the conveyor 100 can be guided to move, in a second direction Y. The first magnetic engaging portion 130 may comprises a first set of magnetic racks 131_0-131_6 (as shown in FIG. 1A and hereafter may be also referred to as a first set of magnetic racks 131 collectively) and a second set of magnetic racks 132_0-132_6 (as shown in FIG. 1B and hereafter may be also referred to as a second set of magnetic racks 132 collectively.) The second set of magnetic racks 132 may be arranged opposite to the first set of magnetic racks 131.

[0042] It should be understood that the first set of magnetic racks 131_0-131_6 and the second set of magnetic racks 132_0-132_6 may be covered by other elements, for example, a supporting element and therefore cannot be seen in the direction Z and Z'. The illustration of the magnetic racks as shown in FIGs. 1A and 1B is only for the sake of explanation.

[0043] In some embodiments, the first magnetic engaging portion 130 may comprise a pair of first supporting members 133, which may be arranged under the carrying member 110 and configured to support the first set of magnetic racks 131 and the second set of magnetic racks 132 respectively.

[0044] Additional, in some embodiments, the conveyor 100 may further comprises a pair of second supporting members 121 fixed on the lower surface of the carrying member 110. The plurality of rollers 120 may be mounted on the respective second supporting members 121.

[0045] FIG. 2 shows a front view of a conveying system 200 having a conveyor 100 according to embodiments of the present disclosure. With reference to FIG. 2, the magnetic engagement arrangement according to the present disclosure may be further described in detail.

[0046] As shown in FIG. 2, a plurality of rollers 120 of the conveyor 100 can be guided to move along guide rails 220 in a driving direction X, for example, to transfer electronic components to be mounted in the clean room to the target destination. The first magnetic engaging portion 130 can extend from a lower surface of the carrying member 110 to a position near to the guide rails 220 in a direction Y, which may be normal to the driving direction X. When the magnetic field is generated at the second engagement portion 210 on the guide rails 220 of the conveying system 200, the first magnetic engaging portion 130 may interact with a second magnetic engaging portion 210, to generate a driving force in the driving direction X, so that the conveyor 100 may be driven by the driving force.

[0047] In this way, compare with the conventional magnetic engagement arrangement, the first magnetic engaging portion 130 of the conveyor 100 may be disposed closer to the second magnetic engagement portion 210 and therefore may interact better with the second magnetic engagement portion 210 when a magnetic field is generated at the second magnetic engagement portion 210. By using this novel magnetic engagement arrangement, a sufficient driving force can be generated to improve the carrying capacity of the conveyor 100.

[0048] Meanwhile, the conveyor will be lifted up at an assembly location. The first magnetic engaging portion of the first aspect makes it easier to separate the first magnetic engaging portion from the the second magnetic engagement portion at a tangible direction of the the second magnetic engagement portion. Without step change of magnetic force during separating, the lifting up motion can be smoother.

[0049] As shown in FIG. 2, the second set of magnetic racks 132 may be arranged opposite to the first set of magnetic racks 131 at a predetermined distance d from the first set of magnetic racks 131 such that the second magnetic engaging portion 210 is located between the first set of magnetic racks 131 and the second set of magnetic racks 132.

[0050] In this way, a plurality of magnetic racks 131 and 132 can be arranged around the second magnetic engaging portion 210, which may protrude from the guide rails 220 such that the magnetic engagement between the first magnetic engaging portion 130 and the second magnetic engaging portion 210 becomes more strengthen. Therefore, the driving capacity of the magnetic conveyor 100, especially the speed and load capacity of the conveyor 100 can be significantly increased with the embraced magnetic field engagement around the second magnetic engaging portion 210.

[0051] Furthermore, in some embodiments, the first magnetic engaging portion 130 may further comprise a connecting element 134 fixed on the lower surface of the carrying member 110 and a pair of first supporting members 133 connected to the connecting element 134, by which the first set of magnetic racks 131 and the second set of magnetic racks 132 may be supported respectively.

[0052] By using the connecting element and the pair of first supporting members, a simple and stable connection of plurality of sets of magnetic racks to the carrying member may be achieved, which is an indispensable intermediate structure for implementing the magnetic rack arrangement of the present disclosure.

[0053] As mentioned above, a pair of second supporting members 121 may be fixed on the lower surface of the carrying member 110 and the plurality of rollers 120 may be mounted on the respective second supporting members 121. In this way, as shown in FIG. 2, a height H2 from a lower end of the connecting element to a bottom of the magnetic engagement portion is greater than a height H1 of the second magnetic engagement portion.

[0054] Due to the position of the magnetic rack arrangement, which extends towards to the guide rails in a direction Y, the height of the conveyor 100 may be adjusted to avoid the contact between the connecting element 143 and the second magnetic engagement portion 210, because particles may be generated due to the friction during the conveying, which is unexpected for the dustless environment. The second supporting members 121 may lift the height of the conveyor 100, which maintains the first magnetic engaging portion 130 to be located at a position near the second magnetic engaging portion 210 without contacting the second magnetic engagement portion 210.

[0055] In some embodiments, the conveyor 100 may further comprise a pair of third supporting members 122 fixed on the respective second supporting members 121 and limiting member 123 mounted in the respective third supporting members 122 and adapted to limit the movement of the conveyor on the guide rails 220. For example, the limiting member 123 may be formed as a roller. As an option, the limiting member 123 may also be formed as a limiting block. In this way, the conveyor can be maintained on the guide rails to ensure a stable conveying process.

[0056] In addition, the first set of magnetic racks and the second set of magnetic racks may be arranged to be inclined with respect to the direction Y on the respective first supporting members, which may further refer to FIGs. 3A and 3B, which show the

perspective view of the inclined magnetic racks according to embodiments of the present disclosure in the direction Z.

[0057] As shown in FIG. 3A, the first set of magnetic racks 131_0-131_6 and the second set of magnetic racks 132_0-132_6 may be arranged to be inclined in opposite directions with respect to the second direction Y on the respective first supporting members 133.

[0058] In some embodiments, each of the first set of magnetic racks 131_0-131_6 may be inclined to form a predetermined angle with the respective ones of the second set of magnetic racks 132_0-132_6. For example, FIG. 3B shows the angle θ formed between the magnetic rack 131_0 and the magnetic rack 132_0 when assuming that the magnetic rack 131_0 and the magnetic rack 132_0 are placed in a same plane.

[0059] As an option, the predetermined angle θ may corresponds to half of an inclination angle of a magnetic pole generated by the second magnetic engagement portion 210 with respect to the direction Y. By this inclination arrangement of the first and the second magnetic engagement portions, the driving force caused by the magnetic field may be optimized and therefore the plurality of rollers can slide more smoothly and rapidly.

[0060] FIG. 4 shows a front view of a conveying system 200 having a further conveyor 100 according to embodiments of the present disclosure. The most components and structures shown in FIG. 4 are same or similar with the conveyor shown in FIG. 2, which may not be repetitively explained here.

[0061] Different with the conveyor shown in FIG. 2, the conveyor 100 shown in FIG. 4 may further comprise a third magnetic engaging portion 140 arranged on the connecting element 134. The third magnetic engaging portion 140 may also be interact with the second magnetic engaging portion210 on the guide rails 220, which may further increase the driving capacity of the magnetic conveyor.

[0062] By illustrating the embodiments in FIG. 1A to FIG. 4, a novel magnetic engagement arrangement has been explained. It can be realized, from figures and description, the driving capacity and the load capacity of the conveyor may be increased due to a more strengthen magnetic engagement between the first and the second magnetic engagement portions.

[0063] The present disclosure also proposes a conveying system having the conveyor as mentioned above. FIG. 5A and 5B show a side view of a conveying system having the

conveyor according to further embodiments of the present disclosure. In a case that the conveyor 100 moves along with the direction X, FIG. 5A, for example, may show the conveying system 200 from left side (in a direction Z) while FIG. 5B show the conveying system 200 from the right side (in a direction Z'). With reference to FIGs. 5A and 5B, a conveying system will be explained as below.

[0064] As shown, the conveying system 200 comprises a conveyor 100 which has been described above. The conveying system 200 may further comprise guide rails 220, which can guide the plurality of rollers 120 of the conveyor 100, to move the conveyor 100 in the driving direction X.

[0065] Furthermore, the conveying system 200 may also comprise a driving shaft 230. The conveyor 100 may be arranged between the guide rails 220. When the power is applied to the driving shaft 230, the driving shaft 230 may be driven to rotate in a rotating direction R. It should be understood that only a schematic rotating direction R is shown in FIGs. 5A and 5B, which can be set to be clockwise or counterclockwise depending on the application.

[0066] In addition, the conveying system 200 may also comprise a second magnetic engaging portion 210 comprising a plurality of magnetic gear arranged on the driving shaft 230. The plurality of magnetic gear may be configured to rotate with the rotation of the driving shaft 230, to generate a magnetic field.

[0067] In some embodiments, the conveying system 200 may also comprise a motor M, which may be configured to apply the power to the driving shaft 230, to drive the driving shaft to be rotated.

[0068] Due to the increased driving capacity of the conveyor, a conveying system with a simple structure and low-cost can be achieved, thereby the performance and the efficiency of the conveying system can be improved.

[0069] Furthermore, a method 600 of manufacturing a conveyor according to the embodiments of the present disclosure is provided. FIG. 6 shows a flowchart illustrating a manufacturing method of a conveyor according to embodiments of the present disclosure. The method 600 may be implemented for manufacturing the conveyor 100 described with reference to FIG. 1A to FIG. 4.

[0070] At 610, a carrying member is provided to carry an object to be conveyed. At 620,

a plurality of rollers is arranged under the carrying member. The plurality of rollers is adapted to be guided to move along guide rails in a first direction.

[0071] At 630, a first magnetic engaging portion is arranged to extend from a lower surface of the carrying member to a position near to the guide rails in a second direction normal to the first direction. The first magnetic engaging portion can interact with a second magnetic engaging portion on the guide rails, to generate a driving force for driving the conveyor in the first direction.

[0072] In this way, the conveyor of the first aspect of can be manufactured with a simple structure and low cost. In order to save costs, the conventional magnetic conveyor can be replaced by the conveyor according to the first aspect, without having to replace other components, such as guide rail, in the conveying system.

[0073] It should be appreciated that the above detailed embodiments of the present disclosure are only to exemplify or explain principles of the present disclosure and not to limit the present disclosure. Therefore, any modifications, equivalent alternatives and improvement, etc. without departing from the spirit and scope of the present disclosure shall be comprised in the scope of protection of the present disclosure. Meanwhile, appended claims of the present disclosure aim to cover all the variations and modifications falling under the scope and boundary of the claims or equivalents of the scope and boundary.

WHAT IS CLAIMED IS:

1. A conveyor (100) comprising:

a carrying member (110) adapted to carry an object to be conveyed;

a plurality of rollers (120) arranged under the carrying member (110) and adapted to be guided to move along guide rails (220) in a first direction (X); and

a first magnetic engaging portion (130) arranged to extend from a lower surface of the carrying member (110) to a position near to the guide rails (220) in a second direction (Y) normal to the first direction (X) and adapted to interact with a second magnetic engaging portion (210) on the guide rails (220), to generate a driving force for driving the conveyor (100) in the first direction (X).

2. The conveyor (100) of Claim 1, wherein the first magnetic engaging portion (130) comprises:

a first set of magnetic racks (131); and

a second set of magnetic racks (132) arranged opposite to the first set of magnetic racks (131) at a predetermined distance (d) from the first set of magnetic racks (131) such that the second magnetic engaging portion (210) is located between the first set of magnetic racks (131) and the second set of magnetic racks (132).

3. The conveyor (100) of Claim 2, wherein the first magnetic engaging portion (130) further comprises:

a connecting element (134) fixed on the lower surface of the carrying member (110); and

a pair of first supporting members (133) connected to the connecting element (134) and adapted to support the first set of magnetic racks (131) and the second set of magnetic racks (132) respectively.

4. The conveyor (100) of Claim 3, wherein the first set of magnetic racks (131) and the second set of magnetic racks (132) are arranged to be inclined in opposite directions with respect to the second direction (Y) on the respective first supporting members (133).

5. The conveyor (100) of Claim 4, wherein the first set of magnetic racks (131) is inclined to form a predetermined angle θ with the second set of magnetic racks (132), and

wherein the predetermined angle θ corresponds to half of an inclination angle of a magnetic pole generated by the second magnetic engagement portion (210) with respect to the second direction (Y).

6. The conveyor (100) of Claim 3, wherein the conveyor (100) further comprises a third magnetic engaging portion (140) arranged on the connecting element (134) and adapted to interact with the second magnetic engaging portion (210) on the guide rails (220).

7. The conveyor (100) of Claim 3, wherein the conveyor (100) further comprises a pair of second supporting members (121) fixed on the lower surface of the carrying member (110), and

wherein the plurality of rollers (120) are mounted on the respective second supporting members (121) such that a second height (H2) from a lower end of the connecting element (134) to a bottom of the magnetic engagement portion (210) is greater than a first height (H1) of the second magnetic engagement portion (210).

8. The conveyor (100) of Claim 1, wherein the conveyor (100) further comprises

a pair of third supporting members (122) fixed on the respective second supporting members (121); and

a limiting member (123) mounted in the respective third supporting members (122) and adapted to limit the movement of the conveyor (100) on the guide rails (220).

9. A conveying system (200) comprising:

a conveyor (100) according to any of Claims 1-8; and

guide rails (210) adapted to guide the plurality of rollers (120) to move the conveyor (100) in the first direction (X);

a driving shaft (230) arranged between the guide rails (210) and adapted to be driven to rotate in a third direction (R); and

a second magnetic engaging portion (210) comprising a plurality of magnetic gear arranged on the driving shaft (230) and adapted to rotate with the rotation of the driving shaft (230), to generate a magnetic field.

10. The conveying system (200) of Claim 9, further comprising a motor (M)

adapted to drive the driving shaft (230).

11. A manufacturing method of a conveyor (100) comprising:

providing a carrying member (110) adapted to carry an object to be conveyed;

arranging a plurality of rollers (120) under the carrying member (110), the plurality of rollers (120) being adapted to be guided to move along guide rails (220) in a first direction (X); and

arranging a first magnetic engaging portion (130) to extend from a lower surface of the carrying member (110) to a position near to the guide rails (220) in a second direction (Y) normal to the first direction (X) and adapted to interact with a second magnetic engaging portion (210) on the guide rails (220), to generate a driving force for driving the conveyor (100) in the first direction (X).

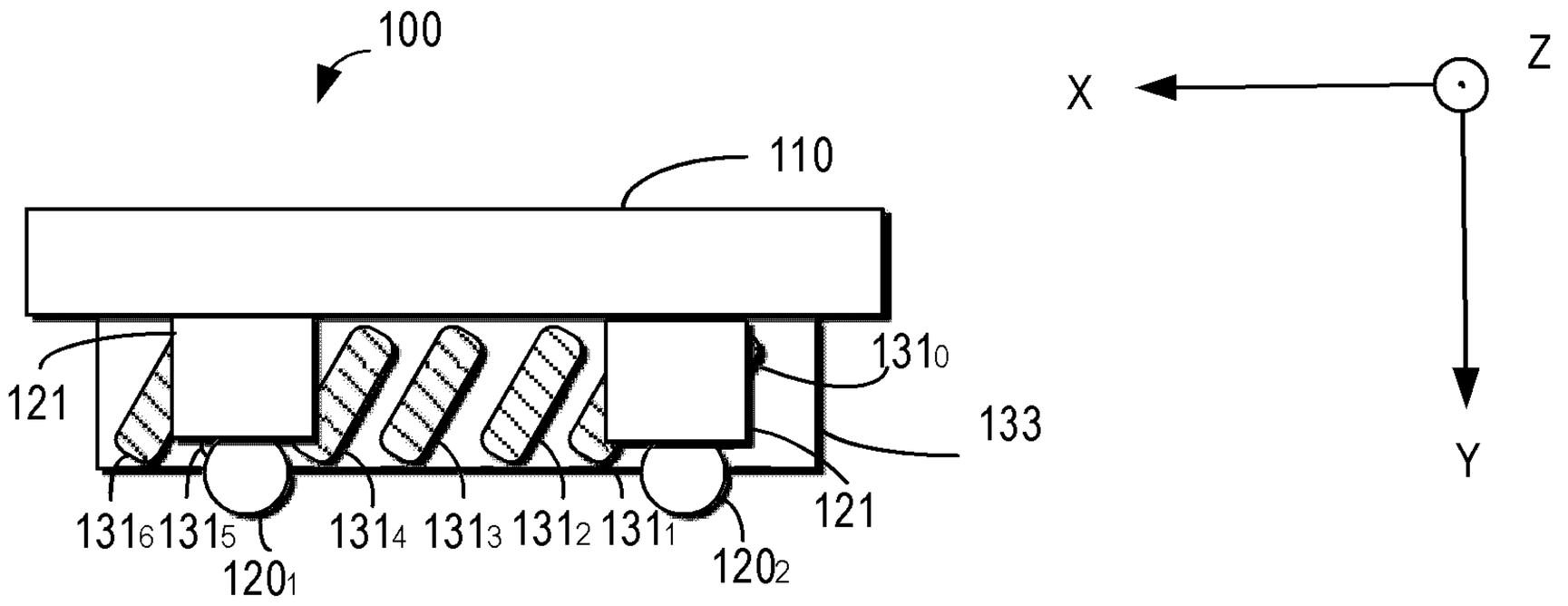

100
110
121
131_0
133
131_6 131_5 131_4 131_3 131_2 131_1
120_1
120_2
121
X
Z
Y

FIG. 1A

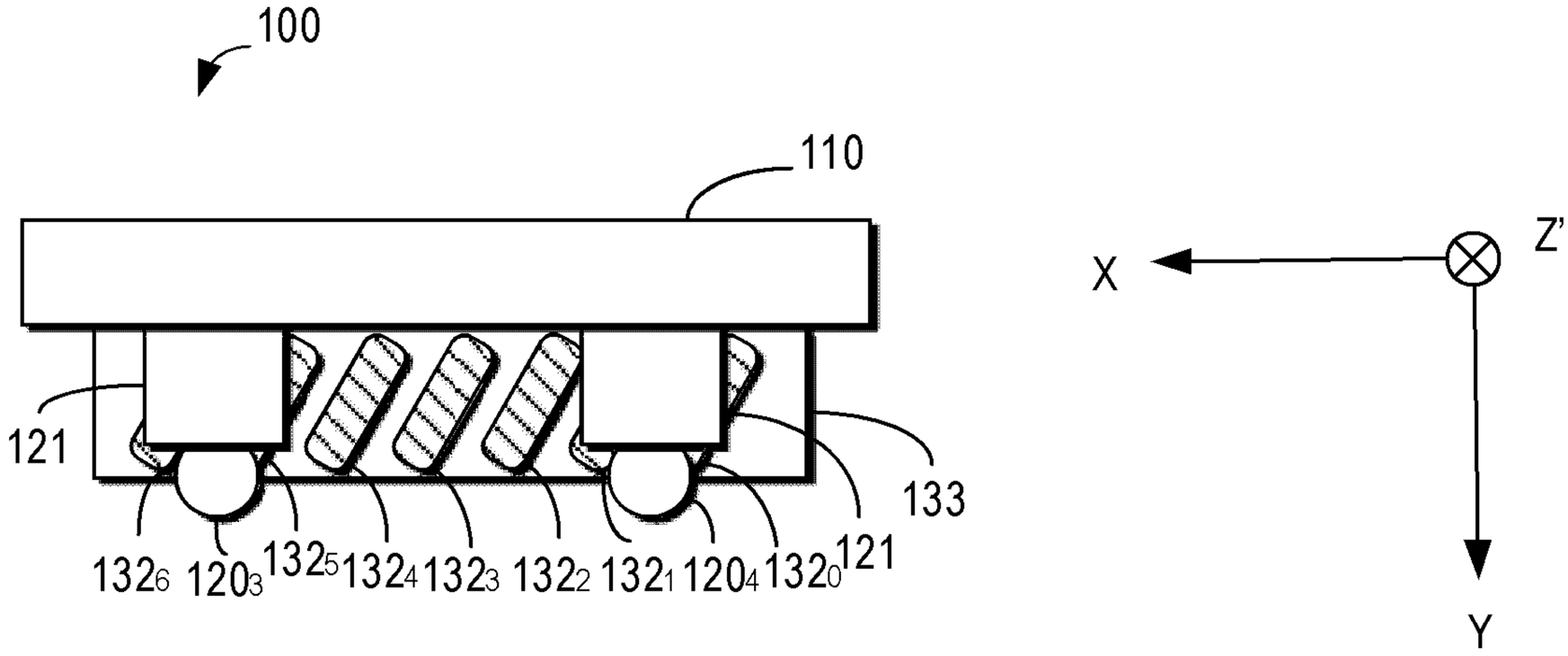

100
110
121
133
132_6 120_3 132_5 132_4 132_3 132_2 132_1 120_4 132_0
121
X
Z'
Y

FIG. 1B

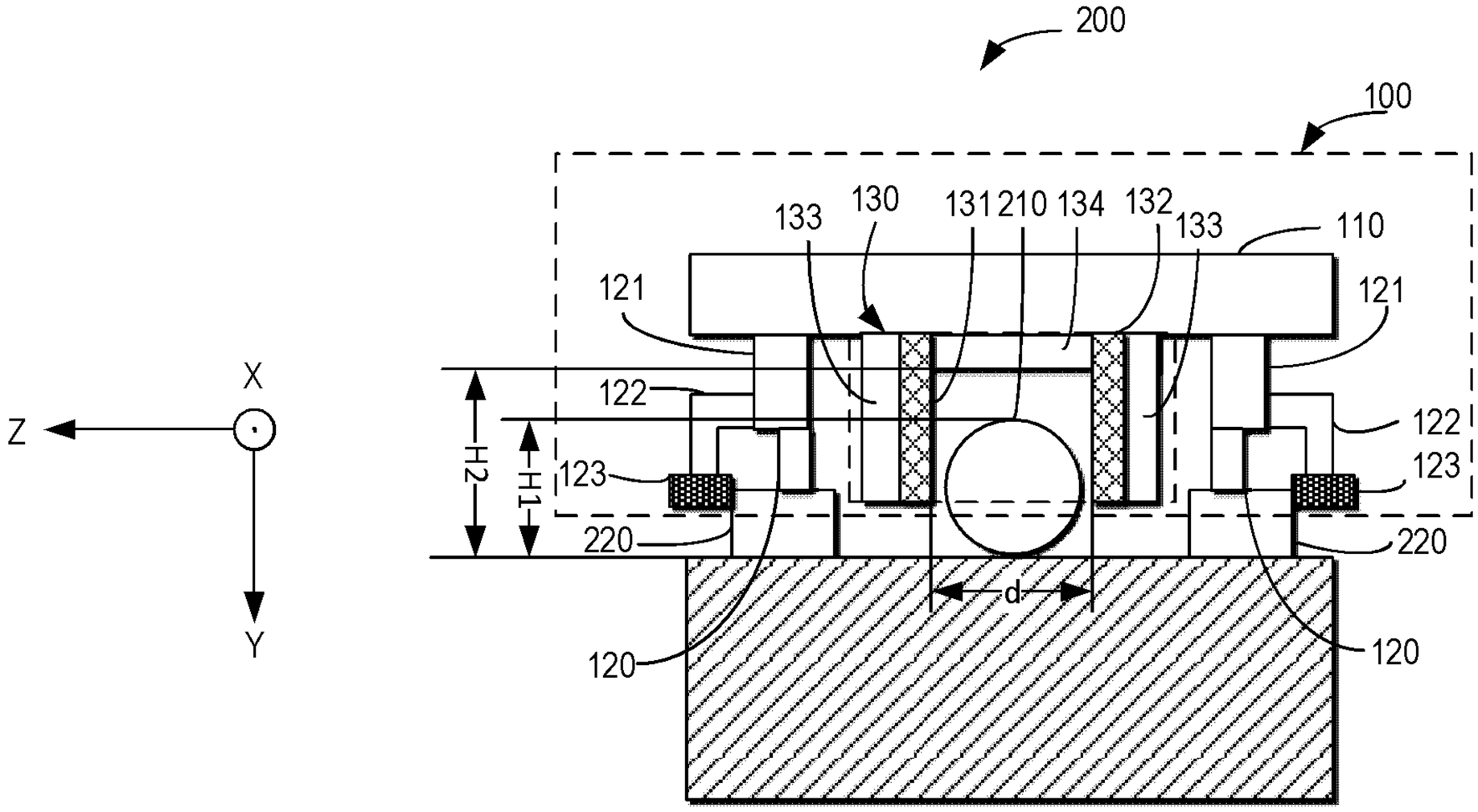

200
100
133
130
131
210
134
132
133
110
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121
122
122
123
123
H2
H1
220
220
d
120
120
X
Z
Y

FIG. 2

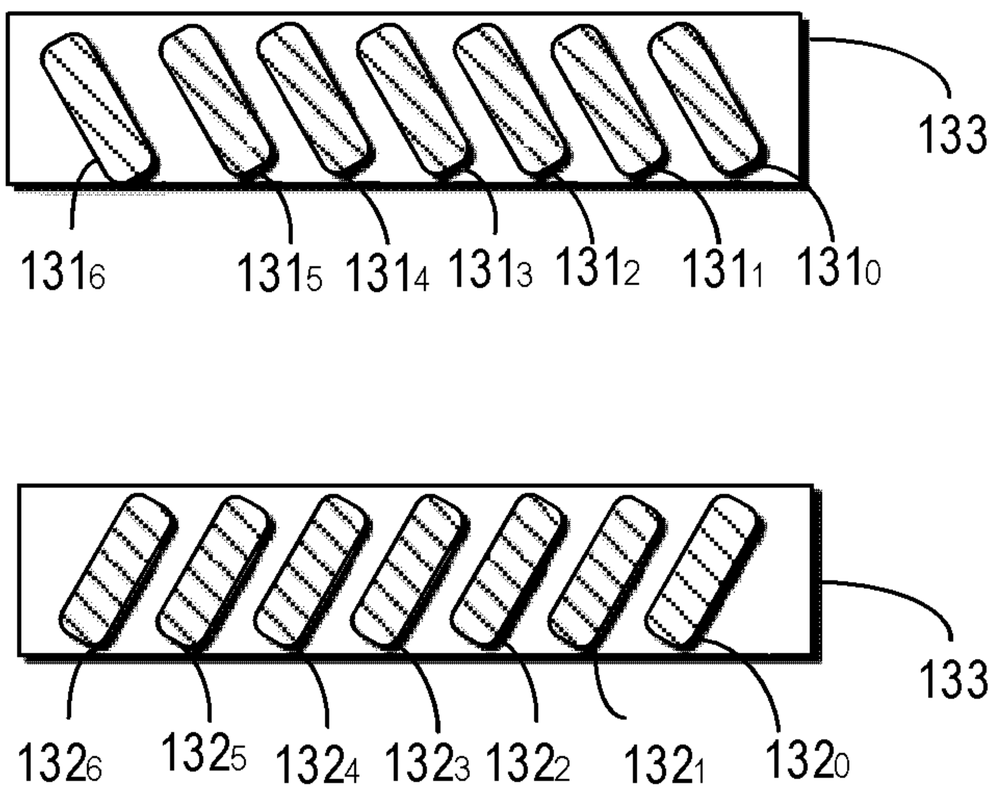

133
131_6
131_5
131_4
131_3
131_2
131_1
131_0
132_6
132_5
132_4
132_3
132_2
132_1
132_0
X
Z
Y

FIG. 3A

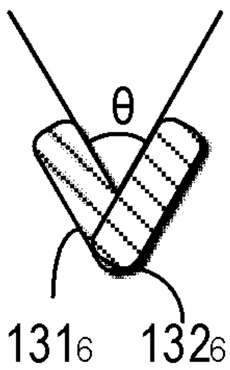

θ
131_6
132_6

FIG. 3B

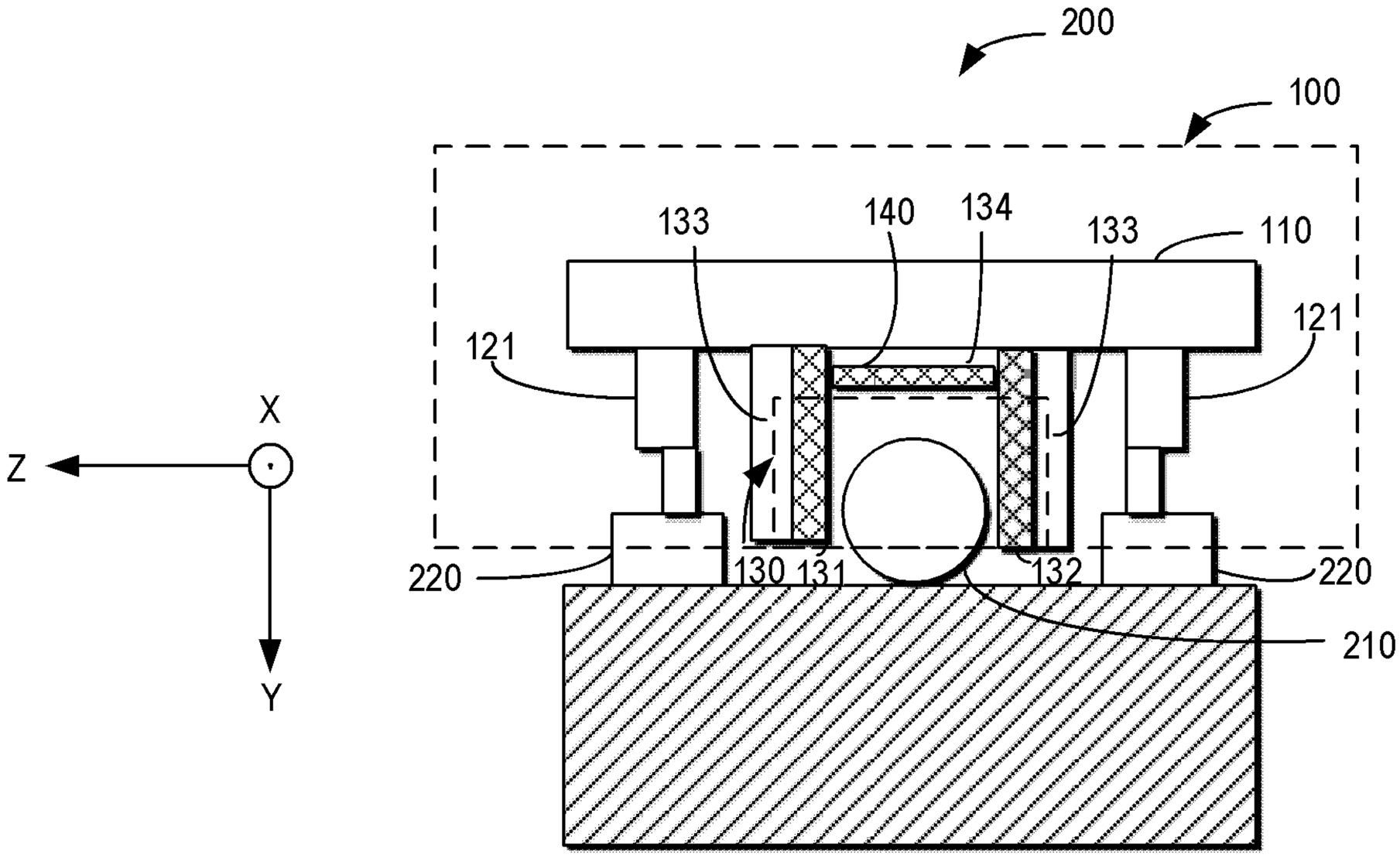


FIG. 4

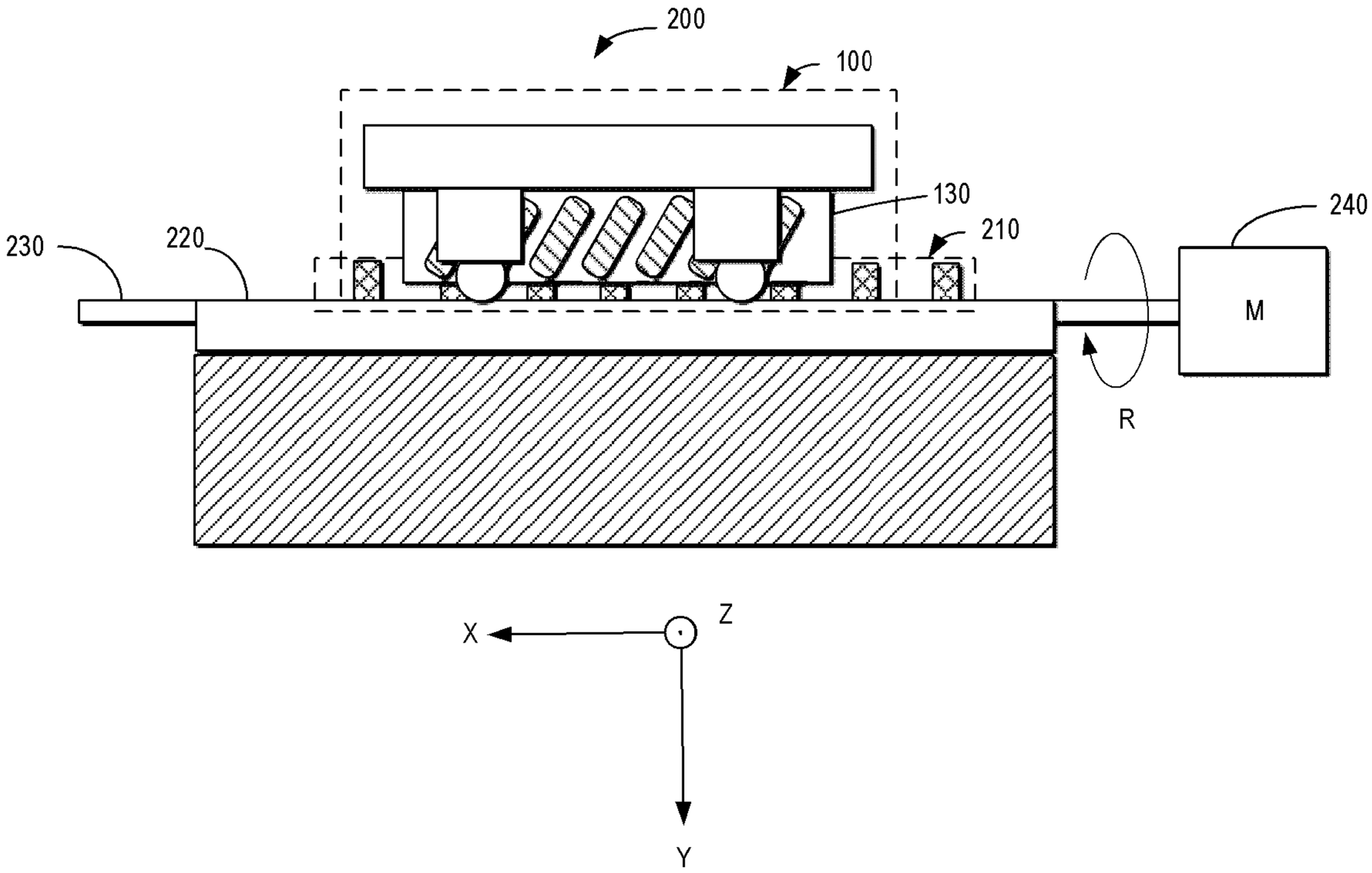

200
100
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240
230
220
M
R
X
Z
Y

FIG. 5A

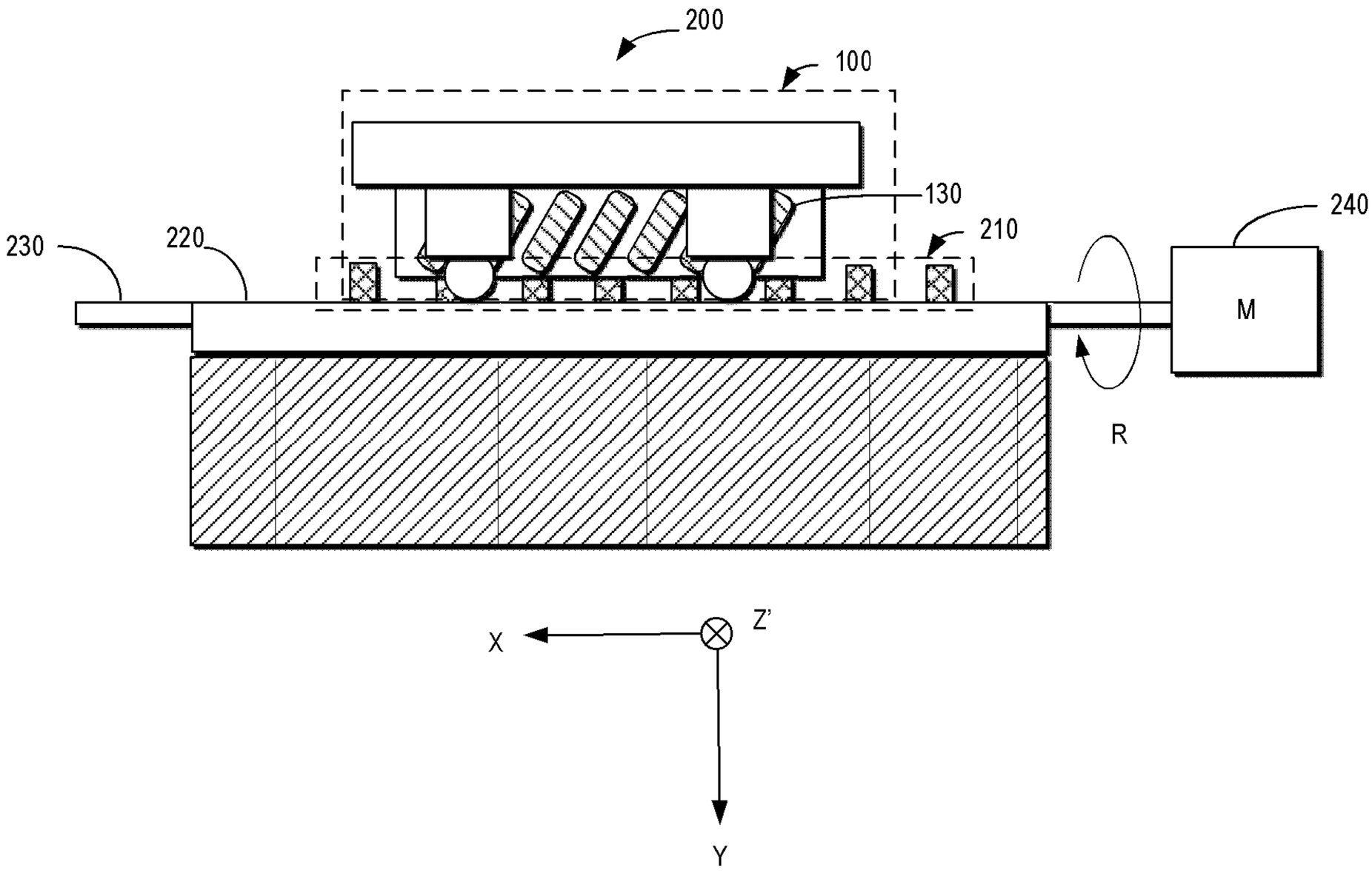

200
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240
230
220
M
R
X
Z'
Y

FIG. 5B

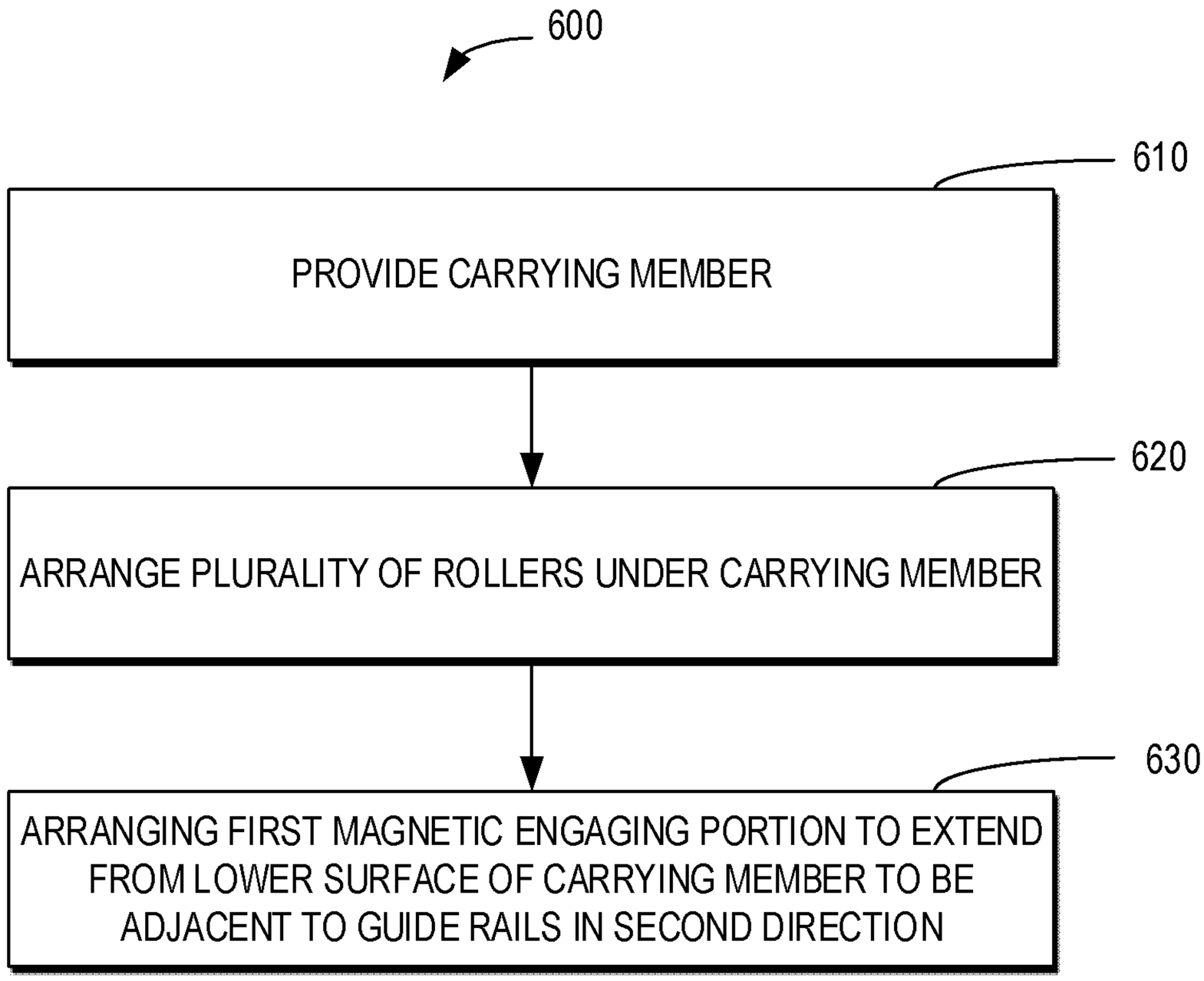

600
610
PROVIDE CARRYING MEMBER
620
ARRANGE PLURALITY OF ROLLERS UNDER CARRYING MEMBER
630
ARRANGING FIRST MAGNETIC ENGAGING PORTION TO EXTEND FROM LOWER SURFACE OF CARRYING MEMBER TO BE ADJACENT TO GUIDE RAILS IN SECOND DIRECTION

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2019/120267

A. CLASSIFICATION OF SUBJECT MATTER

B65G 54/02(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNPAT, WPI, EPODOC, CNKI: convey+, roller?, wheel?, guid+, rail?, track?, magne+, side?, shaft+, rotat+, gear?, rack?

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 110035965 A (ABB SCHWEIZ AG.) 19 July 2019 (2019-07-19) paragraphs [0039]-[0041] of description, figures 4A-5B	1-11
Y	CN 105899447 A (ROBERT BOSCH G.M.B.H.) 24 August 2016 (2016-08-24) paragraphs [0035]-[0046] of description, figures 1-3	1-11
A	CN 105151803 A (ABB TECHNOLOGY AG.) 16 December 2015 (2015-12-16) all document	1-11
A	WO 2018145214 A1 (ATS AUTOMATION TOOLING SYSTEMS INC.) 16 August 2018 (2018-08-16) all document	1-11
A	JP H10287233 A (MITSUBISHI JUKOGYO K.K.) 27 October 1998 (1998-10-27) all document	1-11
A	EP 1013574 A1 (MINEBEA CO., LTD.) 28 June 2000 (2000-06-28) all document	1-11

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
06 August 2020	**24 August 2020**
Name and mailing address of the ISA/CN **National Intellectual Property Administration, PRC** **6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing** **100088** **China** Facsimile No. **(86-10)62019451**	Authorized officer **FENG,Xunwei** Telephone No. **86-10-53961132**

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2019/120267

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