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(54) **STRUCTURE FOR SUPPORTING AND MOVING A SHEET OF AN INDUSTRIAL DOOR**

(57) A structure for supporting and moving a sheet for an industrial door, comprises two vertical support up-rights, a towing carriage sliding along each vertical support upright, and a plurality of towed carriages. Each towing carriage and each towed carriage is provided with sheet connection means suitable for connection to a respective transverse sheet-stiffening element, and with upright coupling means suitable to transfer the traction load exerted on the carriage by the respective transverse

stiffening element onto the respective vertical support upright.

The structure further comprises two carriage pulling devices operable to translate vertically, each positionable between the respective vertical support upright and the sheet connection means of the carriages and being suitable to pull the towing carriage at least in the direction from the bottom upwards along the vertical support upright.

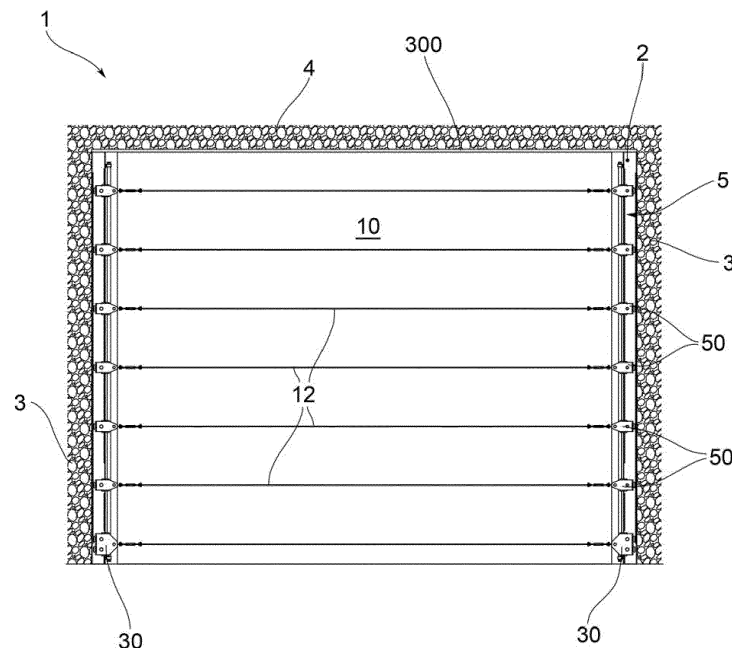


FIG.1

Description

[0001] The present invention relates to industrial doors comprising a movable sheet between an extended closed position and a compacted open position of the industrial door.

[0002] Usually, the sheet is compacted by lifting it upwards.

[0003] In a known embodiment to which the present invention refers, in order to provide the necessary resistance to the force of wind, the fabric is rigidly supported by transverse bars, for example, metal tubes. The ends of these bars are secured to guide carriages that slide vertically along lateral guide uprights. For moving the sheet, the door is provided with a motor that controls in rotation a horizontal shaft extending over the sheet from one side of the door to the other. To this shaft are fixed, so as to be wound or unwound depending on the direction of rotation of the motor, a plurality of horizontally equidistant belts supporting the lower stiffening bar.

[0004] For compacting the sheet, the belts are wound around the horizontal shaft. While lifting the lower bar, the respective guide carriages are supported against the carriages above, towing all or part of the guide carriages upwards until the desired sheet height with respect to the ground is reached.

[0005] When the door has a particularly large width, for example over 5 meters, the bars are not rigid enough and at least the lower bar must be replaced by a beam or a reticular structure.

[0006] Furthermore, large-size doors require that the motor unit, the belt winding shaft, and the shaft end support bearings are also appropriately sized.

[0007] The presence of the horizontal shaft which extends from one side of the door to the other to support the lifting belts significantly affects the bulk in height of the door and limits the space available above it.

[0008] It is also evident that, especially when it has large dimensions, the industrial door described above requires the use of particularly bulky and heavy components. This entails a whole set of disadvantages or drawbacks in the stages of procurement, storage and transport of such components, installing the door and maintenance.

[0009] The object of the present invention is to propose a structure for supporting and moving a sheet of an industrial door able to at least partially overcome the aforementioned disadvantages.

[0010] In particular, an object of the invention is to propose a structure for supporting and moving a sheet having reduced bulk in height.

[0011] Another object of the invention is to propose a structure for supporting and moving the sheet of an industrial door that does not require the use of heavy and bulky handling apparatus even when the door's width is increased.

[0012] Such objects are achieved by a structure for supporting and moving the sheet according to claim 1

and with an industrial door according to claim 17. The dependent claims describe preferred or advantageous embodiments of the invention.

[0013] The features and advantages of the supporting and moving structure according to the invention will, however, become evident from the description hereinafter of their preferred embodiments, provided by way of indicative and non-limiting examples, with reference to the accompanying figures, wherein:

- figure 1 is a front view of an industrial door employing a structure for supporting and moving a sheet according to the invention in a first embodiment and with the sheet fully lowered;
- figure 1a is a view similar to the preceding one but with the sheet partially raised;
- figure 2 is a plan view of the door of figure 1, lacking the sheet;
- figure 3 is a top plan view of a towing carriage;
- figure 3a is a sectional view of an embodiment of a magnetic pulling device for the towing carriage;
- figure 4 is a perspective view of the towing carriage;
- figure 5 is a perspective view of a towed carriage;
- figure 6 is a diagram of the pneumatic control circuit of the pulling devices of the structure of the previous figures;
- figure 7 is a front view of an industrial door employing a structure for supporting and moving a sheet according to the invention, in one variant of embodiment;
- figure 8 is a top plan view of a towing carriage for the door in figure 7; and
- figures 9 and 9a show, in a perspective and plan view, a towed carriage in accordance with a further variant of embodiment.

[0014] In said drawings, at 1 is indicated collectively an industrial door provided with a structure for supporting and moving the sheet according to the present invention.

[0015] The door 1 closes an opening 2, generally rectangular in shape, delimited by two side walls 3 and an upper horizontal wall 4.

[0016] The door 1 comprises a sheet 10 and a structure 5 for supporting and moving the sheet 10.

[0017] Such structure 5 is of a type suitable for progressively compacting the sheet 10 by raising its lower edge so as to progressively increase the distance of the sheet from the ground to the door's maximum opening position wherein the sheet is completely shirred beneath the upper horizontal wall 4 of the opening 2.

[0018] The sheet 10 is furthermore stiffened, i.e. placed in tension, by a plurality of transversal tensioning elements 12 which extend substantially from one side of the sheet 10 to the other. For example, these tensioning elements 12 are positioned in respective pockets - not shown - formed at regular intervals along the entire height of the sheet 10.

[0019] The structure for supporting and moving 5 com-

prises two vertical support uprights 20, each adapted to be secured to a respective side wall 3, or to a special support extending from such wall.

[0020] In one embodiment, each vertical support upright 20 has an "H"-shaped cross-section, i.e. formed by a first wall 202 facing the sheet 10 and oriented perpendicularly to the plane whereon the sheet 10 lies when it is fully extended, by a second wall 204 perpendicular to the first and extending from the median line of the first wall 202, and by a third wall 206 parallel to the first and suitable to anchor the upright to the side wall 3.

[0021] On each upright 20, a towing carriage 30 is slidably mounted.

[0022] Moreover, on each upright 20, towed carriages 50 are slidably mounted. The towed carriages 50 are superposed on each other vertically along each upright 20. The towing carriage 30 is positioned below the lower towed carriage 50.

[0023] The lower towed carriage 50 is engageable by the towing carriage 30 during the ascent phase of the towing carriage 30 along the respective vertical support upright 20.

[0024] In one embodiment, the towed carriages 50 are identical to each other.

[0025] Each towing carriage 30 and each towed carriage 50 are provided with sheet connection means 32 suitable for connecting to one end of a respective transverse tensioning element 12 of the sheet.

[0026] Each towing carriage 30 and each towed carriage 50 is further provided with upright coupling means 34 suitable to transfer the traction load exerted on the carriage by the respective transverse tensioning element 12 onto the respective vertical support upright 20.

[0027] The structure 5 further comprises, for each line of carriages 30, 50 an upright 20, a carriage pulling device 100 operable to translate vertically.

[0028] Each pulling device 100 is suitable to pull the towing carriage 30 at least in the downward-facing direction along the vertical support upright 20.

[0029] Each pulling device 100 is positionable between the respective vertical support upright 20 and the sheet connection means 32.

[0030] According to one aspect of the invention, the entire load exerted on the structure 5 by the sheet 10 through the tensioning elements 12 is absorbed by the towing carriages 30 and the towed carriages 50 and transferred by the carriages to the uprights 20 through the upright coupling means 34.

[0031] The carriage pulling devices 100, on the other hand, are not subject to any traction force and are free to perform only the carriage lifting function. In particular, as will be described with reference to some practical examples of embodiment, the pulling devices are not subjected to frictional forces derived from the traction load of the sheet.

[0032] Returning now to the vertical support uprights 20, the first vertical wall 202 defines, from the part facing the side wall 3, a carriage support surface 202' orthogonal

to the direction of the traction force exerted by the transverse sheet-tensioning elements 12.

[0033] In one embodiment, the upright coupling means 34 comprise at least one coupling wheel 342 arranged so as to roll along the carriage support surface 202'.

[0034] Preferably, each carriage 30, 50 is provided with at least one pair of coupling wheels 342, coaxial and parallel to each other. For example, the two wheels 342 of the pair of wheels are separated from the second vertical wall 204 of the upright 20.

[0035] In one embodiment, the towing carriage 30 is provided with two pairs of coupling wheels 342, vertically superposed on each other, so as to increase the load distribution from the carriage 30 to the upright 20.

[0036] In one embodiment, each towing carriage 30 and each towed carriage 50 are also provided with at least one pair of anti-rotation members 36 arranged to skim without contact the opposite sides of the second vertical wall 204 of the upright 20.

[0037] These anti-rotation members 36 are therefore not active during the normal sliding of the carriages, as there is play between them and the second vertical wall 204. However, in the case of strong transverse load on the sheet, for example due to strong gusts of wind, the anti-rotation members 36 limit the rotation of the carriages around the vertical sliding axis, thus containing the sliding frictions along the upright 20.

[0038] In one embodiment, the anti-rotation members comprise a pair of opposing wheels 362 parallel to the second vertical wall 204.

[0039] In one embodiment, each towing carriage 30 and each towed carriage 50 comprises a pair of parallel side plates 38. These plates 38 are parallel to the second vertical wall 204 of the upright 20.

[0040] In one embodiment, the first vertical wall 202 of the upright 20 and at least one part of the second vertical wall 204 are interposed between the two plates 38.

[0041] The two side plates 38 are integral with each other, e.g. by means of a junction element 40.

[0042] In one embodiment, the junction element 40 connects the end portions of the plates 38 which extend towards the sheet 10 beyond the first vertical wall 202.

[0043] For example, the junction element 40 is in the form of a pin which, in addition to performing the function of connecting the plates 38, constitutes an element of the sheet connection means 32.

[0044] In one embodiment, the side plates 38 have, at least superiorly, respective upper bent portions 382 facing each other so as to form a horizontal support surface for the carriage above.

[0045] Also, in an embodiment further described hereinafter, the bent portions 382 of the plates 38 of the towing carriage 30 form an abutment element by which the pulling device pulls the towing carriage at least from the bottom upwards.

[0046] In one embodiment, the plates 38 of the towing carriage also have similar bent lower portions 384, whereby the pulling device pulls the towing carriage also

downwards.

[0047] In one embodiment, the bent portions 382, 384 have a gap 382' which accommodates a respective edge of the first vertical wall 202 of the upright 20. Such geometric coupling between the bent portions and the first vertical wall permits the tilting of the carriages to be limited with respect to a horizontal axis orthogonal to the side plates 38.

[0048] In one variant of embodiment illustrated in figures 9, 9a, relating to a towed carriage but the same technical arrangement is equally applicable to a towing carriage, any jamming of the carriage due to tilting with respect to a horizontal axis orthogonal to the side plates 38 is avoided by the use of at least one second pair of rolling anti-rotation members 36a arranged so as to skim without contact over the side of the first vertical wall 202 of the upright 20 facing the sheet.

[0049] Also, these second rolling anti-rotation members 36a are therefore not active during the normal sliding of the carriages, as there is play between them and the first vertical wall 202.

[0050] In one embodiment, the second rolling anti-rotation members 36a comprise at least one pair of second opposing wheels 362a, preferably two pairs superposed in height, with an axis parallel to the first vertical wall 202.

[0051] For example, such second opposing wheels 362a are supported by parallel side plates 38.

[0052] In this embodiment, the second rolling anti-rotation members 36a may then replace the geometric coupling between the bent portions 382 and the first vertical wall 202 described above.

[0053] In an embodiment illustrated in figures 1-6, each carriage pulling device 100 comprises a tubular element 102 extending substantially for the entire height of the industrial door. This tubular element is suitable to be installed alongside a respective vertical support upright 20.

[0054] For example, the tubular element 102 is supported by the first vertical wall 202 of the respective vertical upright 20, for example by means of two end collars 104 bracketed to the first vertical wall.

[0055] The tubular element 102 defines an inner chamber 106. The inner chamber 106 preferably extends substantially for the entire length of the tubular element 102.

[0056] A towing element 108 is housed in the inner chamber 106. The towing element 108 is operable to translate axially within the inner chamber 106.

[0057] An outer slide 110 is operatively connected to the towing element 108. The outer slide 110 is suitable to slide along the tubular element 102 following the translation of the towing element 108.

[0058] The outer slide 110 is configured to support the towing carriage 30 at least in the ascent phase.

[0059] In one embodiment, the outer slide 110 has an upper end portion with a transverse footprint such as to abut against the upper bent portions 382 of the parallel side plates 38 of the towing carriage 30.

[0060] In one embodiment, the outer slide 110 also has a lower end portion with a transverse footprint such as

to abut against the lower bent portions 384 of the parallel side plates 38 of the towing carriage 30.

[0061] In other words, in a preferred embodiment, the outer slide 110 is confined between the bent portions 382, 384 of the towing carriage 30. Consequently, the translation of the slide 110 results in a corresponding translation of the towing carriage 30.

[0062] In one embodiment, the inner chamber 106 forms the chamber of a cylinder fluidically connectable to a control circuit, for example a pneumatic circuit operating with compressed air.

[0063] The towing element 108 is in the form of a rodless piston which may translate into the inner chamber 106 under the action of a control fluid, such as compressed air.

[0064] Therefore, in one embodiment, the control circuit comprises a compressed air generator 112 and an operable solenoid valve 114 so as to send pressurized air at least into the ascent portion 106' of the inner chamber 106 which, when pressurized, pushes the piston upwards, and discharges the other descent portion 106" of the inner chamber 106.

[0065] In one embodiment, the solenoid valve 114 is operable to send pressurized air also into the descent portion 106" of the inner chamber which, when pressurized, pushes the piston downwards.

[0066] In one embodiment, the control circuit further comprises, along the tubes connecting the solenoid valve 114 to the cylinder 102, flow regulators 116 suitable to permit an adjustment of the piston's ascending and descending speeds, and hence of the towing carriage 30.

[0067] In a preferred embodiment, the rodless piston 108 is a magnetic or ferromagnetic piston. The outer slide 110 is made of a magnetic and/or ferromagnetic material so as to be pulled in translation by the magnetic piston without direct physical contact.

[0068] In a preferred embodiment, the tubular element 102 has a circular cross-section, and the magnetic piston 108 is coaxial to the tubular element and is of a substantially cylindrical shape. The outer slide 110 is of a substantially annular shape coaxial to the magnetic piston 108.

[0069] Examples for making a magnetic pulling device are described in WO2014115096A2.

[0070] In one embodiment, the magnetic piston 108 comprises at least one central magnetic element 1082 and two end polar expansions 1084. The central magnetic element 1082 has substantially a radial magnetization, i.e. it has a first polarity at least on one of its outer annular portions. The end polar expansions 1084 have a second polarity, opposite the first, at least on one of their outer annular portions.

[0071] In other words, the magnetic piston 108 is, relative to the longitudinal axis, a tripolar unit of the South-North-South or North-South-North type.

[0072] In one embodiment, the outer slide 110 comprises at least one outer magnetic unit 1102 of a substantially annular shape coaxial to the internal magnetic

piston unit 108. This external magnetic unit 1102 comprises an annular magnetic element 1104 and a cylindrical polar expansion 1106. The annular magnetic element 1104 surrounds the central magnetic element 1082; the cylindrical pole expansion 1106 surrounds the annular magnetic element 1104 and ends with end flanges 1108 surrounding the end polar expansions 1084. The annular magnetic element 1104 is radially magnetized and has the second polarity on an inner annular portion thereof. The end flanges 1108 have the first polarity at least on an annular portion thereof facing towards the end polar expansions 1084.

[0073] In one embodiment, the annular magnetic element 1104 has an axial extension substantially equal to that of the central magnetic element 1082 and is radially magnetized so as to generate, between said central magnetic element 1082 and the annular magnetic element 1104, a magnetic field with mainly radial lines of force which tend to radially attract the two elements.

[0074] In one embodiment, the cylindrical polar expansion 1106, in contact with the outer surface of the annular magnetic element 1104, has an axial extension greater than that of the annular magnetic element 1104, so that the end flanges 1108, facing radially inwardly, are axially spaced from the side walls of the annular magnetic element 1104. Thus, the polarization of these end flanges 1108 opposes that of the inner surface of the annular element 1104 and opposes that of the end polar expansions 1108.

[0075] Due to the cylindrical configuration and the magnetization of the magnetic piston 108 and the outer slide 110, and due to the circular cross-section of the tubular guide element 102, the internal magnetic piston 108 is practically "suspended", that is, in equilibrium with the forces inside the tubular guide element 102. In this way, the contact and rubbing friction of the two magnetic units with the tubular guide element is minimal, resulting in an advantage with regard to pulling efficiency.

[0076] Note that the inner and outer polar expansions 1084, 1108 perform primarily the function of flow conveyors of the magnetic field. In fact, the lines of force of the magnetic fields generated by the inner and outer magnetic units which are not radially directed and which would therefore be lost, are "captured" by the polar expansions and also directed in a radial direction. The concatenation of the lines of force between the two magnetic groups is thus maximized by the polar expansions, so that the flow of magnetic field dispersed in the environment and thus unusable is reduced to a minimum. This also contributes to increasing the pulling efficiency.

[0077] In one possible embodiment, the central magnetic element 1082 is obtained by using at least two identical permanent cylindrical magnets 1086 magnetized axially and an intermediate cylindrical polar expansion 1088 placed between one permanent magnet and the other, such permanent cylindrical magnets 1086 being oriented with adjacent poles of the same sign.

[0078] In one embodiment, the central magnetic ele-

ment 1082 and the end polar expansions 1084 are axially connected by means of a threaded bar.

[0079] In one embodiment, in order to improve the sliding of the magnetic piston and the outer slide on the respective surfaces of the tubular guide element, the contact surfaces of the piston and slide with the tubular guide element are covered with respective sliding rings with a low friction coefficient.

[0080] In one variant of embodiment illustrated in figures 7 and 8, each pulling device 500 comprises a pulling member 502 integral to the towing carriage 30.

[0081] The towing member 502 is fixed to a wire or a cable 504. The wire or cable 504 is connected to a winch 506 suitable to be positioned above the industrial door for winding/unwinding the wire or cable 504.

[0082] For example, the towing member comprises a cross member welded to the two side plates 38 of the towing carriage 30. In this case, the bent upper portions 382 of the two plates serve to form an abutment plane for the above towing carriage 50.

[0083] The winch 506 is operable in rotation by a motor apparatus 508.

[0084] In one embodiment, each winch 506 has its own motor apparatus 508. In this way, the two pulling devices, although synchronized, may be moved independently of each other.

[0085] According to one embodiment, the sheet connection means 32 includes a tie-rod 322 suitable for connecting to one end of a sheet-tensioning rope, belt or cable 12.

[0086] In accordance with one aspect of the invention, the structure for supporting and moving the sheet described above is particularly suitable for use in combination with sheet-tensioning elements made of ropes, belts or other elements without stiffness or having a much lower stiffness compared to the metal bars or tubes currently used.

[0087] Such tensioning elements, in fact, allow the pulling devices to translate in height also in a non-perfectly synchronized manner.

[0088] Tensioning elements made with ropes, belts or cables are elements that work in traction which instead do not pose resistance to compression and pose little resistance to torsion.

[0089] In one embodiment, each tensioning element 12 at rest, i.e. not subject to the force of the wind, is subjected to the load required to give the sheet the desired geometry in the presence of wind. It should be noted in this regard that, preferably, tie-rods and tensioning elements 12 do not yield axially since they are not elastic.

[0090] In other words, in the absence of wind, the sheet 10 lies in a plane perpendicular to the floor with the tensioning elements 12 lying in their seats and forming a curve facing downward; in the presence of wind, the curves drawn by the tensioning elements rotate in a plane parallel to the floor, giving the sheet the shape of a sail.

[0091] The tensioning elements 12, at rest, are then subjected to a suitable pre-tensioning, sized according

to the displacement that is desired to be provided to the sheet in the presence of wind.

[0092] Such pre-tensioning is however chosen in such a way that, in the absence of wind or very low wind, the traction force exerted on the carriages does not generate particularly significant frictions for sliding along the respective uprights.

[0093] The pulling devices described above permit the tensioning elements to move in height only by acting on their ends, without needing to employ intermediate lifting belts supported by a horizontal shaft extending above the door along its whole width.

[0094] In one embodiment, the supporting and moving structure according to the invention further comprises a sheet-supporting horizontal cross member 300 suitable to be fixed to the wall 4, which upwardly limits the opening of the industrial door and is configured to be fixed to an upper edge of the sheet of the industrial door.

[0095] However, this horizontal cross-section has an impact on the dimensions of the lower door relative to the horizontal winding shaft of the sheet's lifting belts and the related control and support devices.

[0096] An industrial door using the structure for supporting and moving the sheet described above has many advantages.

[0097] The horizontal shaft for winding/unwinding the sheet lifting belts, the related motor, the support bearings of the shaft end, and the lifting belts are eliminated, resulting in advantages with regard to bulk, production costs, storage, transportation, installation and maintenance.

[0098] Bar tensioning elements or metal pipes may be replaced with ropes, belts, or cables, which are much lighter, economical and much less bulky to store and transport.

[0099] The structure, particularly in the case of pneumatic drive devices, is very clean and light, while being robust enough to withstand the loads to which the sheet is subjected.

[0100] To the embodiments of the structure for supporting and moving the sheet of an industrial door according to the invention, those skilled in the art may, to satisfy contingent needs, make modifications, adaptations and replacements of some elements with others that are functionally equivalent, without departing from the scope of the following claims. Each of the features described as belonging to a possible embodiment may be implemented independently from the other described embodiments.

Claims

1. Structure for supporting and moving a sheet of an industrial door, comprising:

- two vertical support uprights, each suitable to be fixed to a wall that delimits the opening in-

tended to be closed by the industrial door;

- a towing carriage slidable along each vertical support upright;

- a plurality of towed carriages slidable along each vertical support upright, said towed carriages being superposed on each other vertically along each upright, the lower towed carriage being engageable by the towing carriage in the rising phase of the towing carriage along the respective vertical support upright, each towing carriage and each towed carriage being provided with sheet connection means suitable for connection to a respective transverse sheet stiffening element, and with upright coupling means suitable to transfer onto the respective vertical support upright the traction load exerted on the carriage by the respective transverse stiffening element;

- two carriage pulling devices operable to translate vertically, each positioned between the respective vertical support upright and the sheet connection means of the carriages and being suitable to pull the towing carriage at least in the direction from the bottom upwards along the vertical support upright.

2. Structure according to claim 1, further comprising a horizontal sheet support cross member suitable to be fixed to the wall that upwardly limits the opening of the industrial door and configured to be fixed to an upper edge of the sheet of the industrial door.

3. Structure according to any of the preceding claims, wherein each vertical support upright forms a first vertical wall defining a carriage support surface orthogonal with respect to the direction of the traction force exerted by the transverse sheet stiffening elements, and wherein said upright coupling means comprise at least one wheel arranged so as to roll along said carriage support surface.

4. Structure according to the preceding claim, wherein each vertical support upright forms a second vertical wall perpendicular to the first vertical wall, and wherein each towing carriage and each towed carriage is provided with at least one pair of anti-rotation members arranged so as to skim over the sides opposite said second vertical wall without contact.

5. Structure according to any of the preceding claims, wherein each towing carriage and each towed carriage comprise a pair of parallel side plates whose ends facing the sheet are connected by a plate junction element.

6. Structure according to the preceding claim, wherein the sheet connection means comprise said plate junction element.

7. Structure according to claims 5, 6 or 3, wherein each carriage pulling device is positioned between the first vertical wall and the sheet connection means.
8. Structure according to any of the preceding claims, wherein each carriage pulling device comprises a tubular element that extends substantially over the whole height of the industrial door and that is suitable to be installed alongside a respective vertical support upright, said tubular element defining an inner chamber in which is housed a towing element operable to translate axially in said inner chamber, and an outer slide operatively connected to said towing element so as to slide along the tubular element following the translation of the towing element, said outer slide being configured to abut against the towing carriage at least in the rising phase.

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9. Structure according to the preceding claim, wherein said inner chamber forms the chamber of a cylinder fluidically connectable to a control circuit, and wherein said towing element is in the form of a rodless piston susceptible to translate inside of said chamber under the action of a control fluid.

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10. Structure according to the preceding claim, wherein said rodless piston is a magnetic piston, and wherein the outer slide is made of a magnetic and/or ferromagnetic material so as to be towed in translation by the magnetic piston without direct physical contact.

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11. Structure according to the preceding claim, wherein the tubular element has a circular cross section, the magnetic piston is coaxial to the tubular element and is of a substantially cylindrical shape, and wherein the outer slide is of a substantially annular shape coaxial to the magnetic piston.

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12. Structure according to any of claims 1 to 7, wherein each towing device comprises a towing member integral to the towing carriage, a cable to which said towing member is fixed, and a winch suitable to be positioned above the industrial door for the winding/unwinding of said cable.

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13. Structure according to the preceding claim, comprising a motor apparatus to control the rotation of the winch.

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14. Structure according to any of claims 5 to 13, wherein the side plates have, at least superiorly, respective bent portions facing each other so as to form a horizontal support surface for the carriage above.

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15. Structure according to claims 8 and 14, wherein the outer slide is suitable to abut against said bent portions.
16. Structure according to any one of claims 3 to 15, wherein each towing or towed carriage is provided with at least one second pair of rolling anti-rotation members arranged so as to skim over the side of the first vertical wall of the upright facing the sheet without touching it.
17. Industrial door, comprising a sheet, transverse sheet-tensioning elements that extend between the vertical sides of the sheet, and a structure for supporting and moving said sheet according to any of the preceding claims.
18. Industrial door according to the preceding claim, wherein the transverse sheet-tensioning elements are ropes, belts or cables.

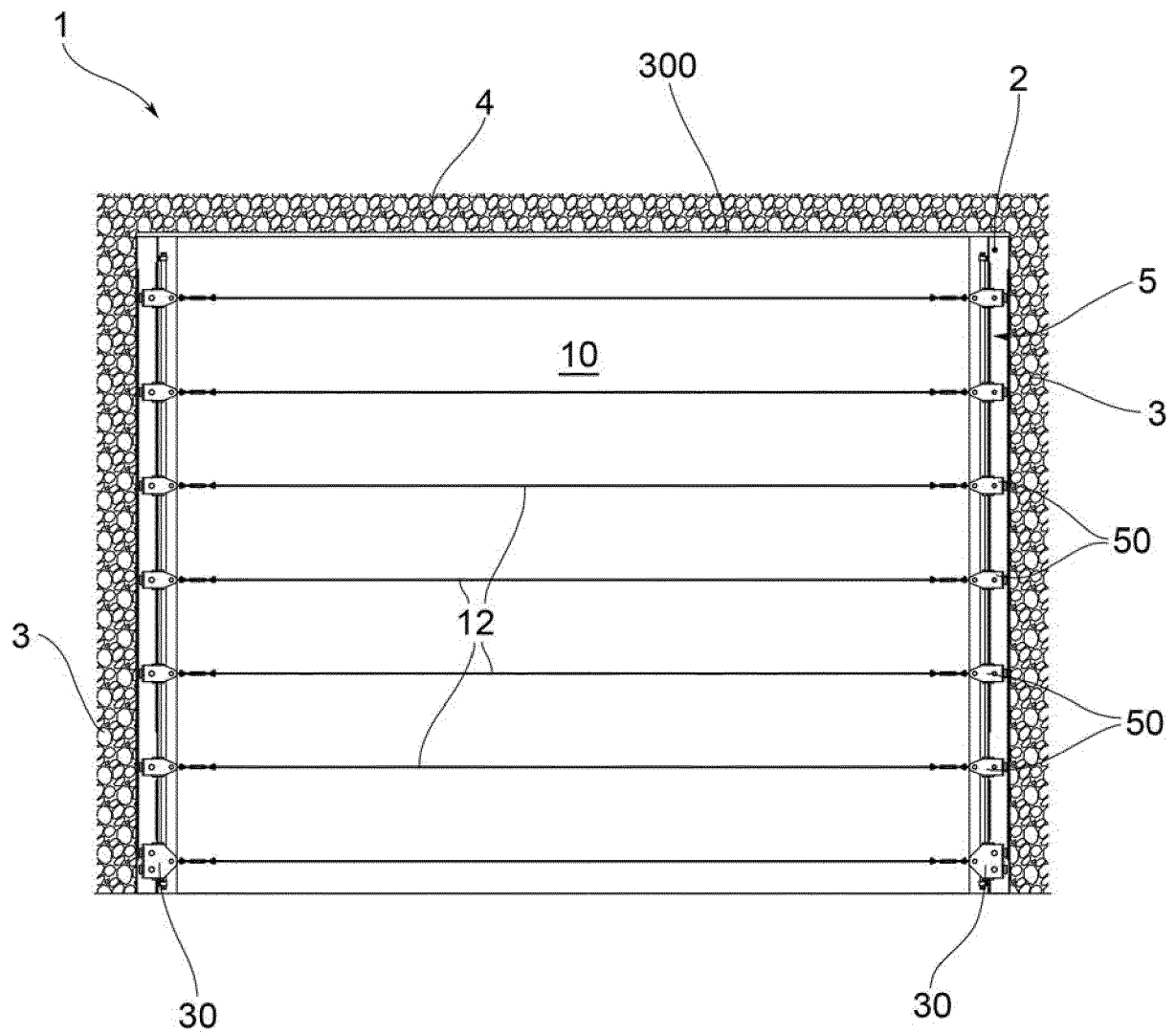
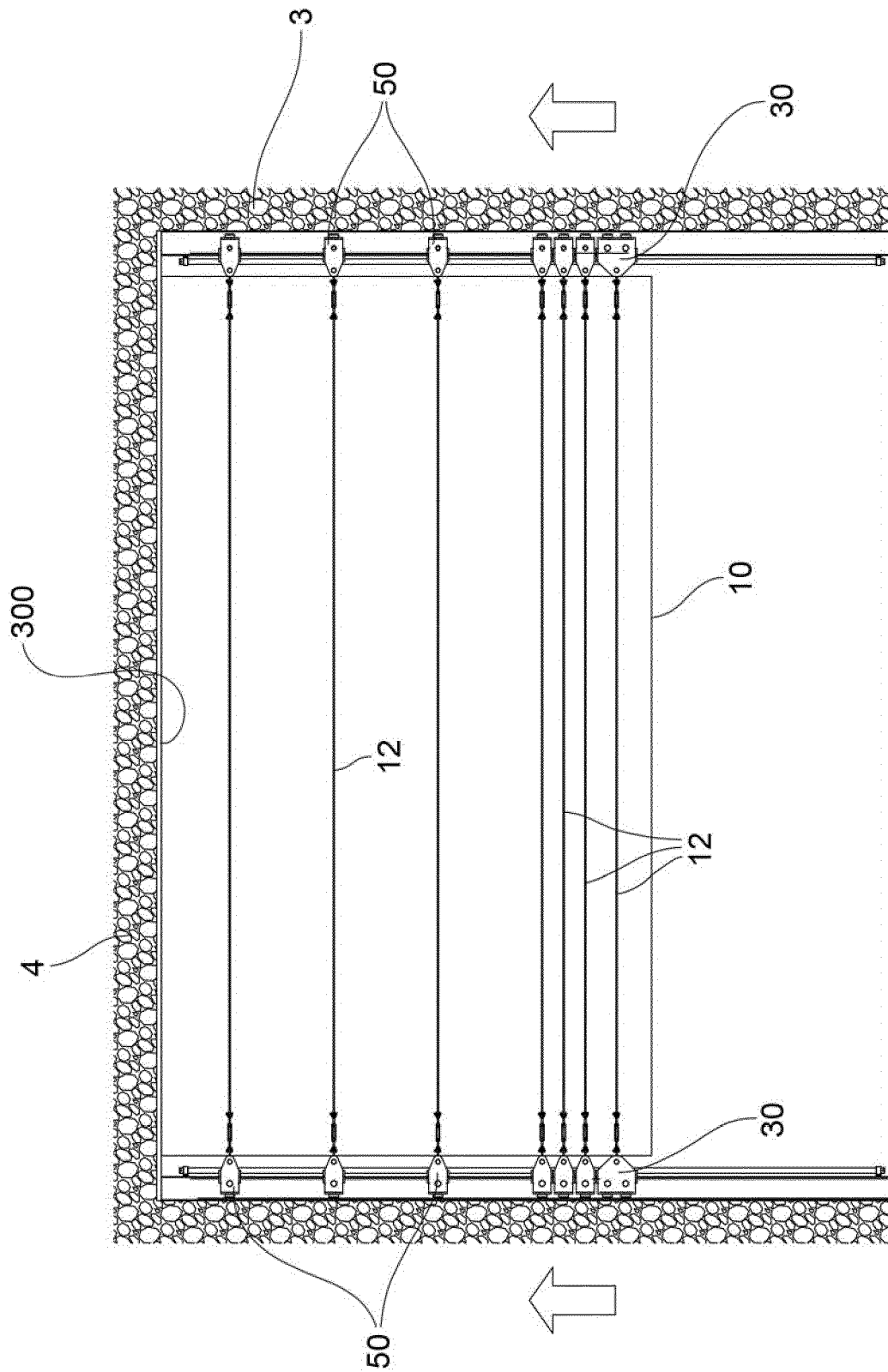


FIG.1



FIG.2



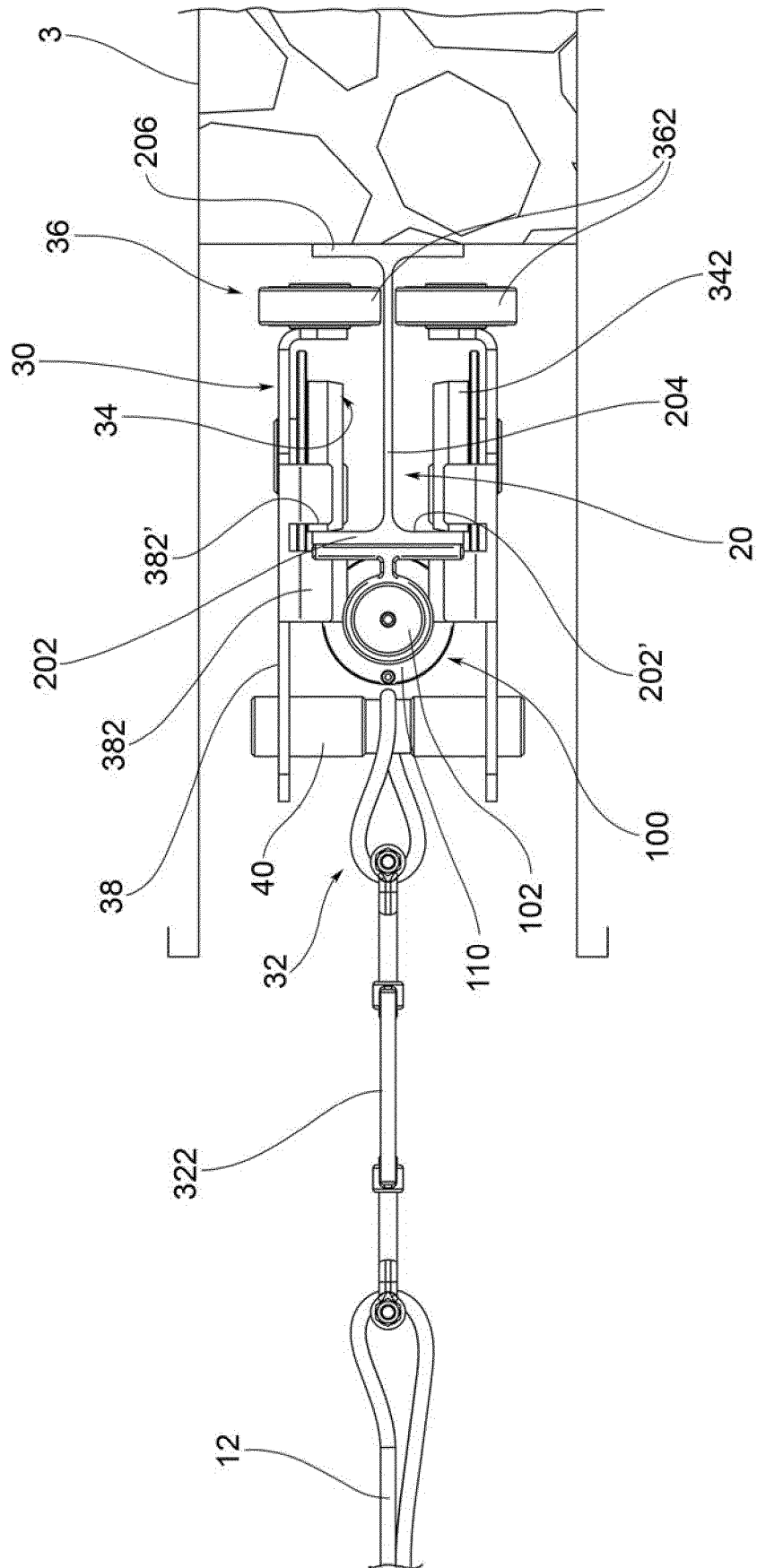


FIG.3

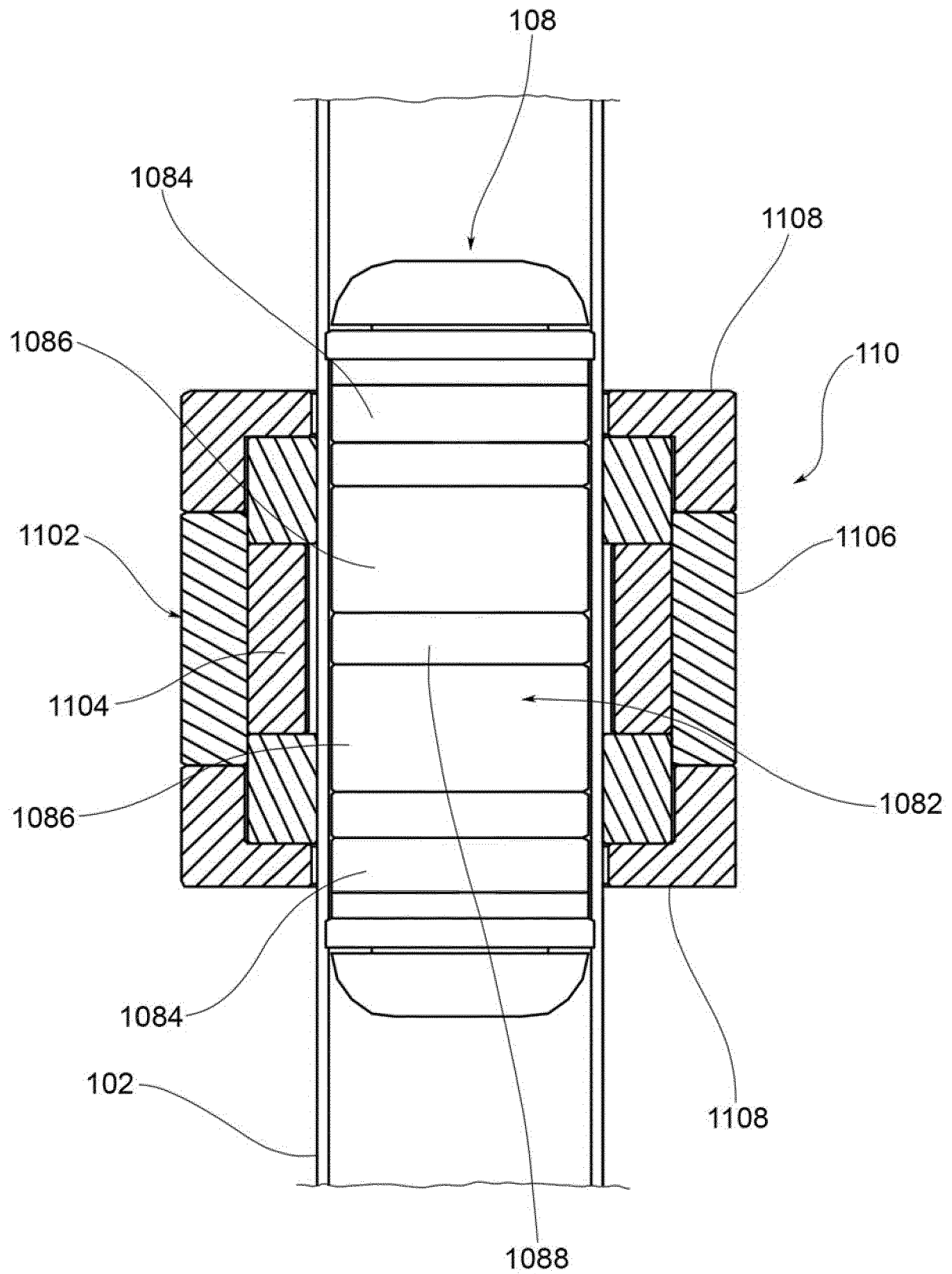


FIG.3a

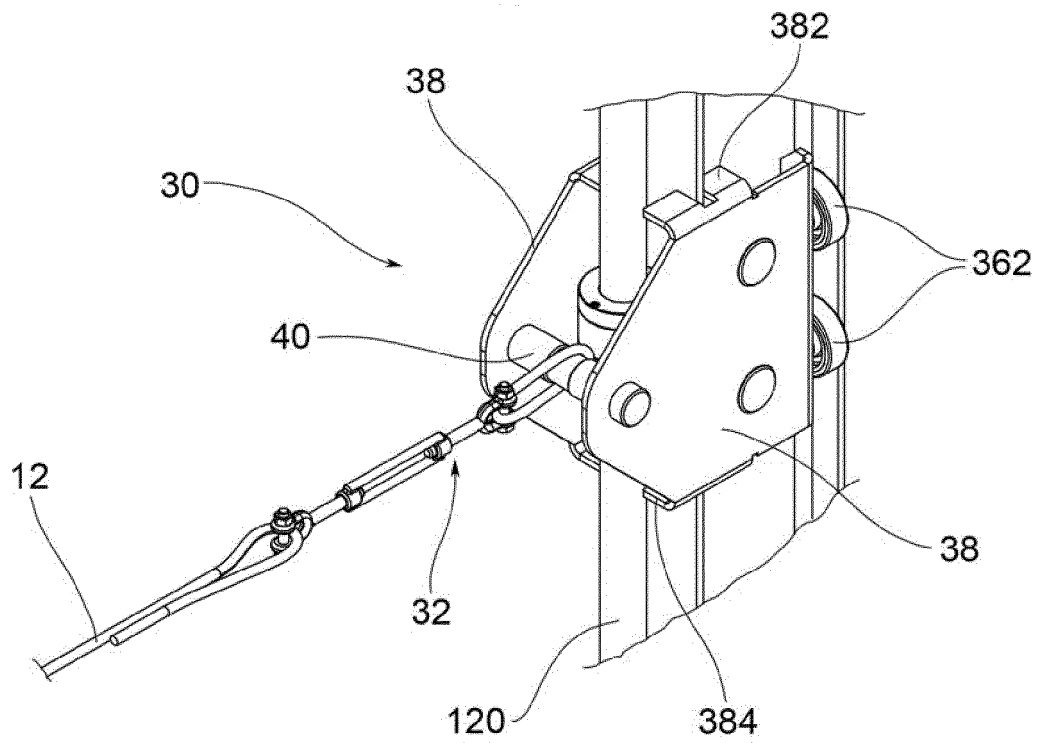


FIG. 4

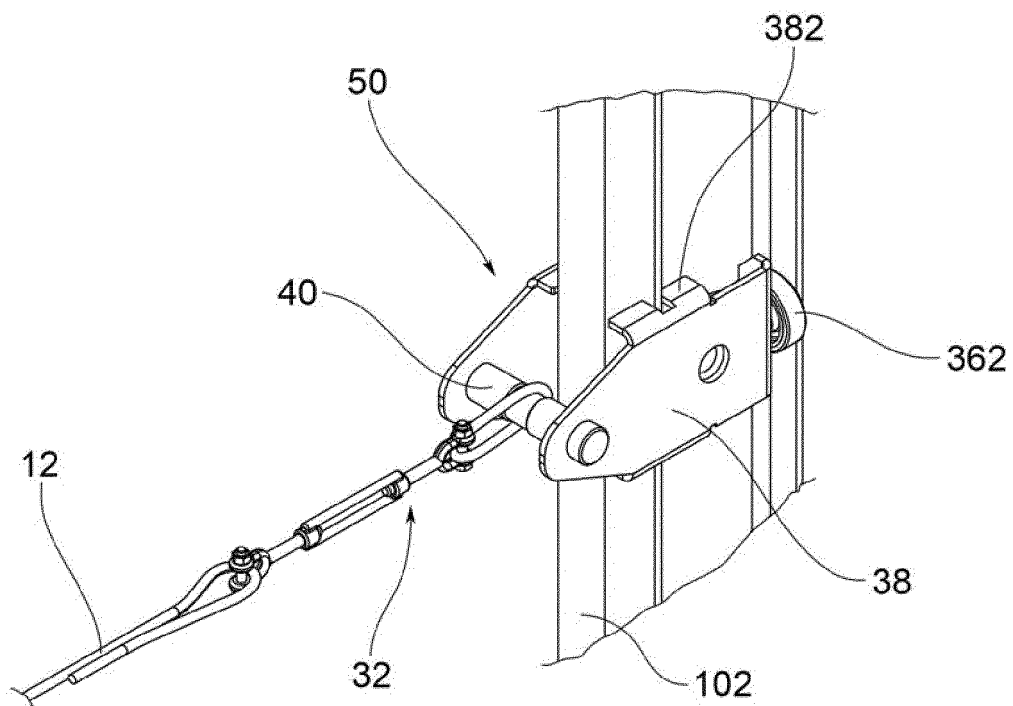


FIG. 5

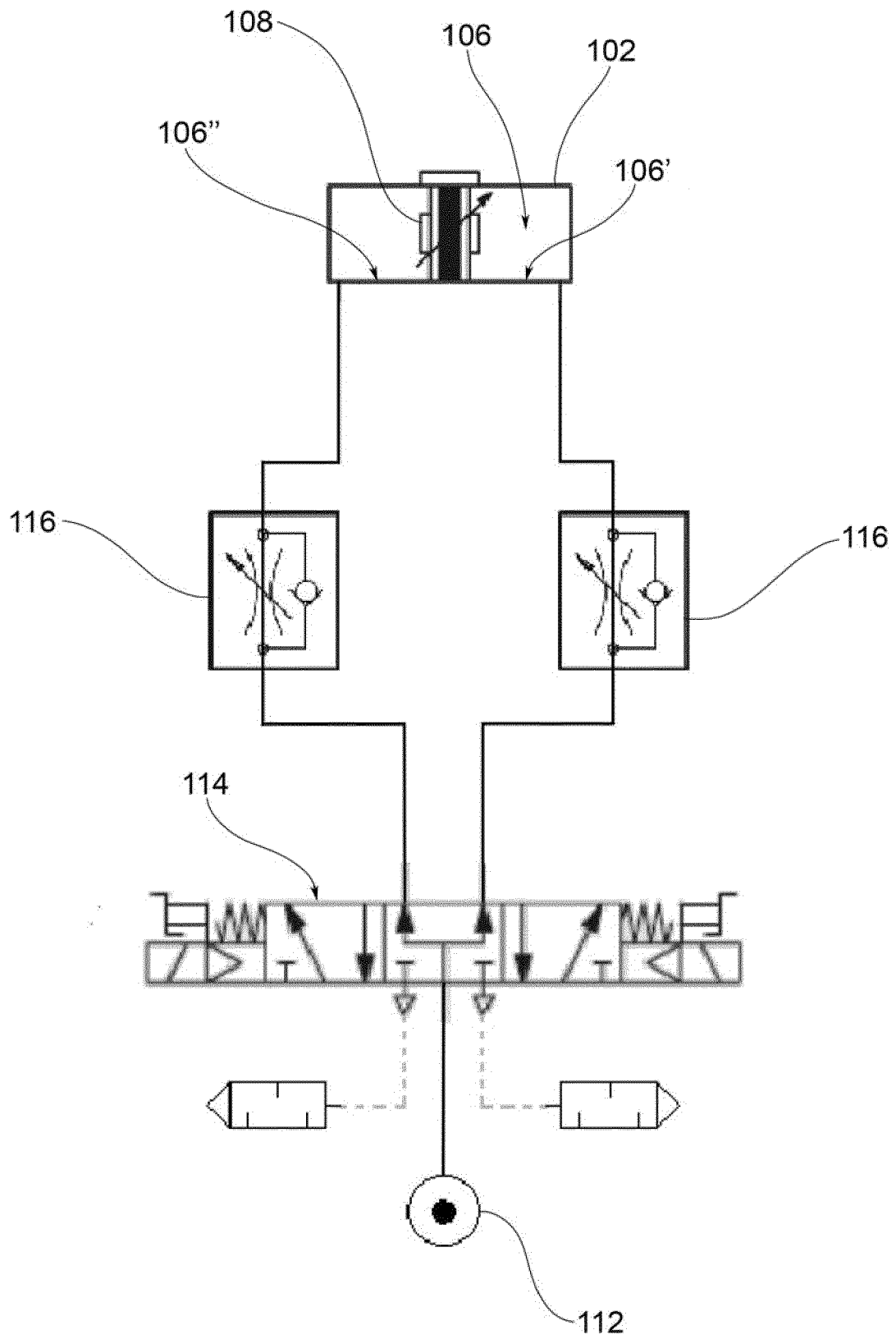


FIG.6

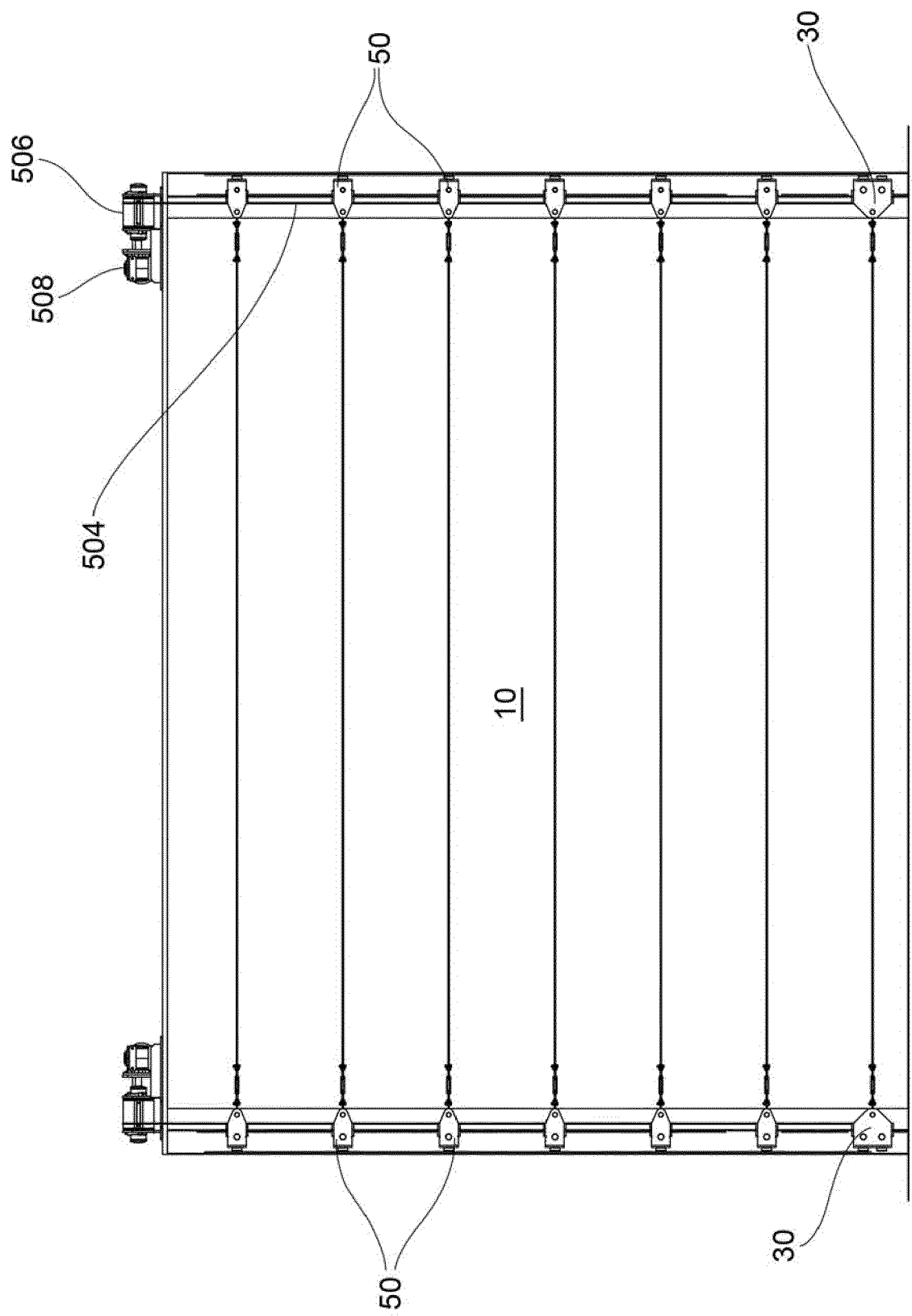


FIG. 7

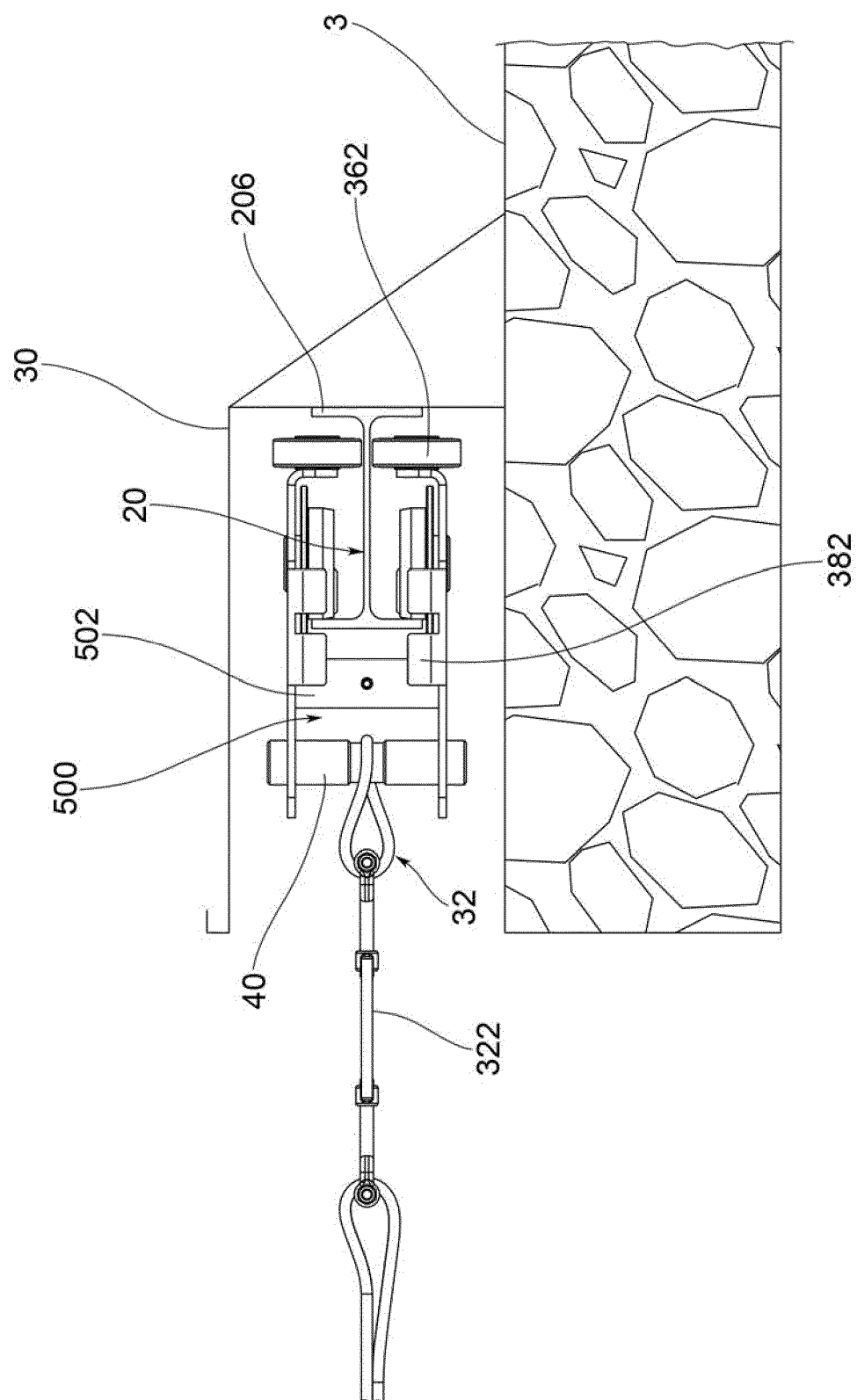


FIG. 8

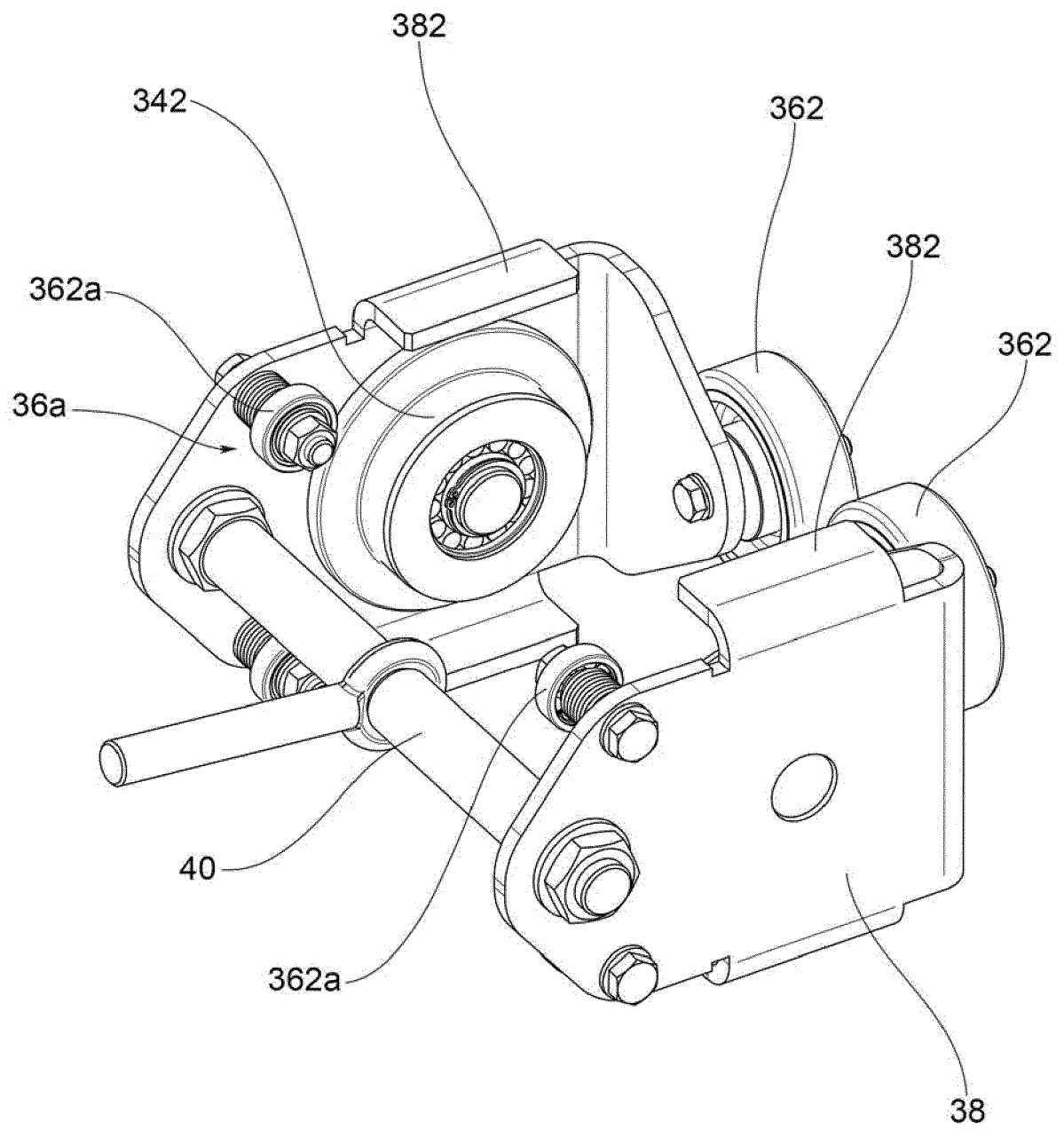


FIG.9

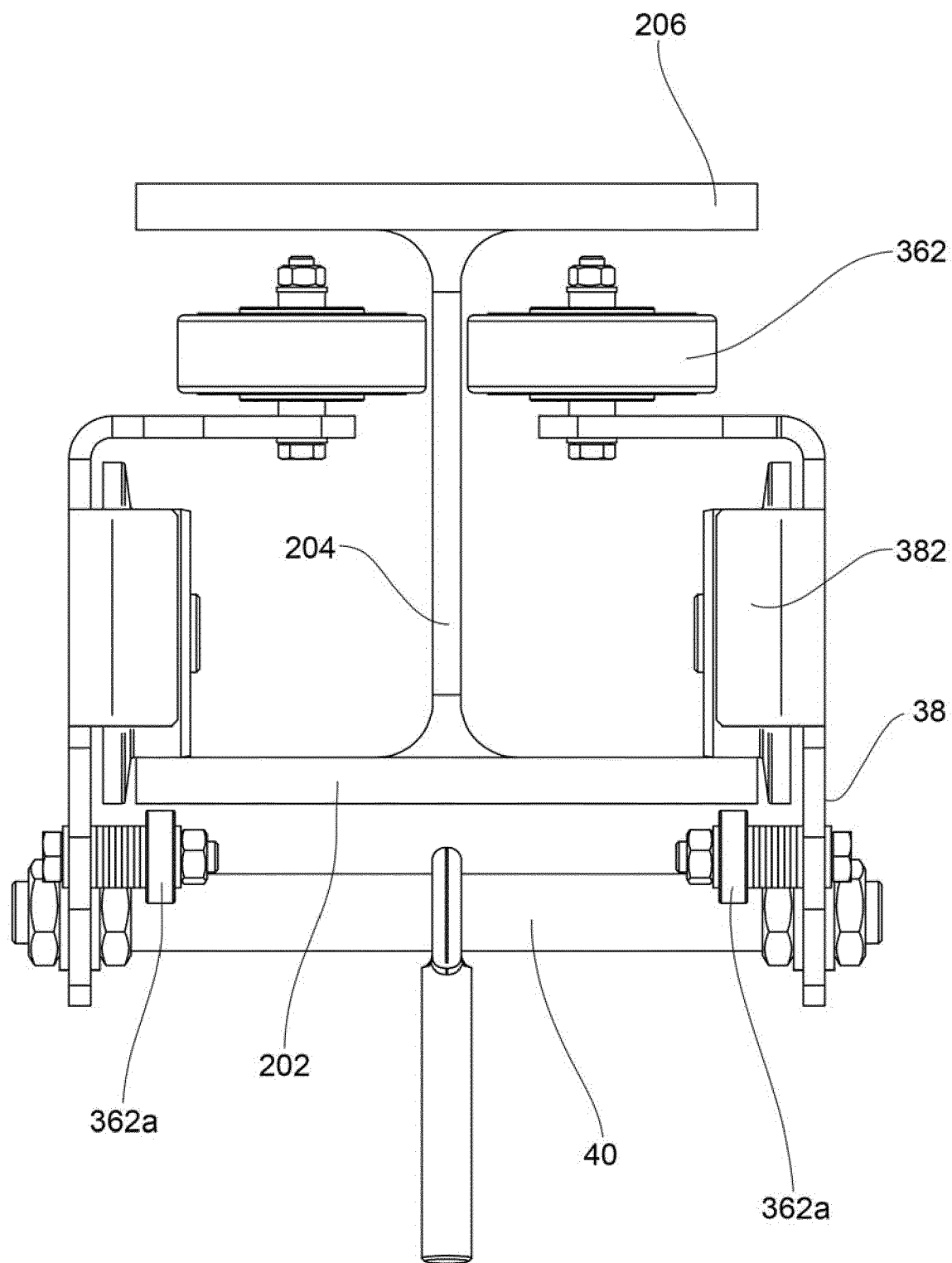


FIG.9a



EUROPEAN SEARCH REPORT

 Application Number
 EP 17 17 0912

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 636 835 A2 (MALKOWSKI ZENON [PL]) 11 September 2013 (2013-09-11)	1,12,13,17	INV. E06B9/06
Y	* figures 5-10 *	2,18	E05D15/26
A	* column 4, line 30 - column 5, line 6 * * paragraph [0001] *	4-6,14-16	E06B9/58 E05F15/51
X	GB 2 306 995 A (SHAW STANLEY ROBIN [GB]) 14 May 1997 (1997-05-14)	1,3,7,12,13	ADD. E06B9/13
Y	* figures 1-4 *	2,8-11	
A	* pages 1,3,5 *	4-6,14,15	
Y	US 4 718 471 A (KRAEUTLER BERNARD [FR]) 12 January 1988 (1988-01-12) * figure 2 * * column 1, line 5 - line 23 * * column 2, line 3 - line 18 *	2	
Y	EP 1 692 365 B1 (GIANUS SPA [IT]) 21 November 2012 (2012-11-21) * figure 2 * * paragraphs [0001], [0011], [0015], [0022], [0023], [0026], [0028], [0031] *	8-11	TECHNICAL FIELDS SEARCHED (IPC) E06B E05D E05F
Y	US 6 035 918 A (KRAEUTLER BERNARD [FR]) 14 March 2000 (2000-03-14) * figure 1 * * column 1, line 63 - column 2, line 13 *	18	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 29 September 2017	Examiner Tänzler, Ansgar
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

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

EP 17 17 0912

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

29-09-2017

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Patent document cited in search report		Publication date	Patent family member(s)		Publication date
EP 2636835	A2	11-09-2013	DK	2636835 T3	24-08-2015
			EP	2636835 A2	11-09-2013
			ES	2544941 T3	07-09-2015
			PL	219724 B1	31-07-2015

GB 2306995	A	14-05-1997	NONE		

US 4718471	A	12-01-1988	CA	1269680 A	29-05-1990
			DE	3585140 D1	20-02-1992
			EP	0181260 A2	14-05-1986
			ES	296320 U	01-08-1987
			FR	2572767 A1	09-05-1986
			JP	H0563595 B2	10-09-1993
			JP	S61172983 A	04-08-1986
			US	4718471 A	12-01-1988

EP 1692365	B1	21-11-2012	CA	2546356 A1	09-06-2005
			CN	1886572 A	27-12-2006
			EP	1692365 A1	23-08-2006
			US	2007131359 A1	14-06-2007
			WO	2005052300 A1	09-06-2005

US 6035918	A	14-03-2000	DE	69309385 D1	07-05-1997
			DE	69309385 T2	06-11-1997
			EP	0591050 A1	06-04-1994
			FR	2696498 A1	08-04-1994
			US	5477902 A	26-12-1995
			US	6035918 A	14-03-2000

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2014115096 A2 [0069]