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(54) **TRANSPORTING SYSTEM WITH A STATION PROVIDED WITH A MECHANICAL DEVICE FOR CLOSING A CABIN DOOR AND THE METHOD FOR OPERATING SUCH A SYSTEM**

(57) Transporting system for transporting passengers; wherein the system (1) comprises: at least one cabin (3) provided with a door (8) movable between an open and a closed position; at least one boarding and disembarking station (2) provided with a mechanical opening device of the door and a mechanical closing device of the door; wherein the mechanical closing device of the door comprises a first rail (14) and a second rail (15) in series and it is selectively switchable by an ac-

tuator (16) in two configurations, wherein without stopping the cabin: in the first configuration, the first rail is configured to close the door, and the second rail is configured in the neutral position to not actively act on the cabin; in the second configuration, the second rail actively acts on the cabin exiting the first rail and it is configured to initially open the door and then close the door.

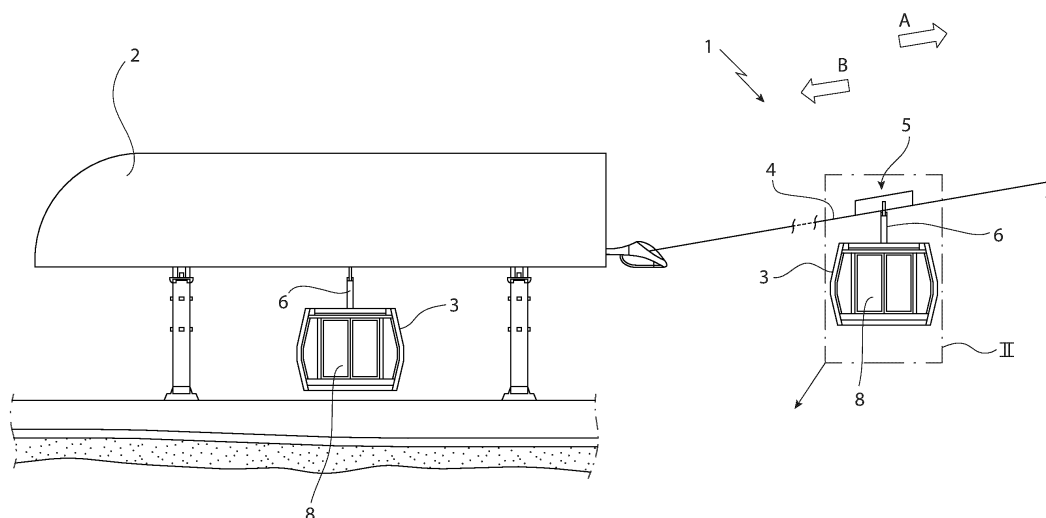


FIG. 1

Description

Cross-reference to related applications

[0001] This patent application claims priority from Italian patent application no. 102023000018357 filed on September 7, 2023, the entire disclosure of which is incorporated herein by reference.

Technical field

[0002] The technical field of reference of the present invention refers to the transporting systems which comprise a plurality of cabins for transporting passengers movable between two terminal stations at the opposite ends of the system. Preferably, but not limitedly, the technical field of reference of the present invention refers to the aerial cable systems. Each cabin comprises a door movable between an open position, for enabling the passengers to board and disembark the station, and a closed position for guaranteeing a safe transportation of the passengers between the stations. In particular, the cabin enters the station with the door in the closed position. During the advancement in the station the door is initially forced in the open position (for enabling the passengers to board and disembark) and then, before leaving the station, the door is guided in the closed position. In such background, the present invention will deal with the problem of how to implement the steps of closing the door so as to solve possible problems of incorrect closing of the door without necessarily requiring the stop of the cabin in the station and the manual intervention.

State of the art

[0003] Transporting systems are currently known which comprise a plurality of cabins for transporting passengers, in which the cabins are movable between two terminal stations at the opposite ends of the system. A preferred non-limiting example of a system of this type is an aerial cable system in which between the terminal stations the cabins are moved one after the other in aerial configuration supported by at least one supporting cable.

[0004] As is known, and according to the present invention, each cabin comprises a plurality of fixed walls and a door movable between an open position, in which the passengers board and disembark, and a closed position for guaranteeing a safe transportation between the stations. The steps of boarding and disembarking occur in the station in the following manner. The cabin enters the station with the door in the closed position. Once the cabin enters the station, the door is (forcedly) moved in the open position, for enabling the boarding and the disembarking. Subsequently, namely before leaving the station, the door is (forcedly or freely by effect of return springs) moved in the closed position. In order to optimize the hourly carrying capacity of the system, the cabins are

not stopped in the station but advance at a reduced speed. The aforementioned operations of opening the door, of boarding and disembarking and of closing the door thus preferably (and according to the present invention) occur with the cabin in movement in the station.

[0005] The opening and the closing of the door in the station preferably (and according to the present invention) occur in an automated manner, namely the intervention of an operator for such purposes is not necessary. According a known mechanical solution for the opening and the closing of the door, which represents the starting point of the present invention, the station is provided with a fixed opening rail and a fixed closing rail in series with respect to each other respectively at the enter and at the exit of the station. Such rails collaborate during the advancement of the cabin with a device supported by the cabin in turn configured to open and close the door. Such mechanical device supported by the cabin, in a known manner, comprises a roller or a cam which by advancing on the rails is moved by effect of the form (ramp or helix) of the rails between an open position in which the door is open and a closed position in which the door is closed. Preferably, at least one spring is provided for forcing the roller, and thus the door, in the closed position. Therefore, entering the station, the roller of the control device of the door integral with the cabin begins to advance along the opening rail which progressively forces the roller and the door towards the open position. In such state (open door) the cabin advances for the section of boarding and disembarking in the station and only subsequently the roller begins to advance on the closing rail. This closing rail, in a manner complementary to the opening rail, is configured to progressively guide the control roller of the door towards the closed position for closing the door before the exit of the station. The mechanical components which enable the aforementioned steps of opening and closing, namely (for example) how the roller of the control device of the door is connected and controls the door, is a well-known subject matter for the skilled person in the art and therefore further constructive details can be omitted herein without compromising the correct understanding of the initial background of the present invention.

[0006] Since in the known practice just described the opening and closing rails are fixed rails, this solution does not result to be flexible in terms of possible increase in the useful time and space in the station for boarding and disembarking. Furthermore, in the known practice just described in case of an incorrect closing of the door, for example in the case where an object results to be stuck between the movable door being closed and the fixed walls of the cabin, it is necessary to stop the cabin for allowing an operator to manually intervene so as to reopen the door and solve this dangerous situation by removing the obstacle.

[0007] WO2022008399 describes a station of an aerial transporting system wherein, besides the fixed rails described in the foregoing, a system which can be actuated

remotely is provided for controlling the opening and the closing of the door also when the cabin is located outside the fixed rails. The solution described in WO2022008399 provides for a further movable opening rail actuated by a first actuator and a further movable closing rail actuated by a second actuator, wherein structurally the two movable rails are placed one over the other for acting on the cabin in a same section of the station depending on the needs. According to the solution described in WO2022008399, if downstream of the fixed closing rail the door results to be incorrectly closed, at the two movable rails, the actuation of the movement of the movable opening rail is controlled for opening the door and removing the obstacle, the actuation of the movement of the movable closing rail is controlled and, if the problem results to be actually solved, the cabin is started again towards the exit from the station. According to WO2022008399 the reopening and the closing of the door is thus performed by two distinct movable rails actuated by two distinct actuators.

Description of the invention

[0008] Starting from such prior art, an object of the present invention is thus to provide a mechanical system alternative to the one described in WO2022008399 for solving the problem of an incorrect closing of the door without requiring the stop of the cabin and the manual intervention of an operator.

[0009] The starting point of the present invention is a system for transporting passengers of the type comprising:

- at least one cabin (preferably a plurality of cabins fed one after the other) provided with a door movable between an open position, for allowing a safe boarding and disembarking of the passengers, and a closed position, for allowing a safe transportation of the passengers;
- at least one boarding and disembarking station (preferably at least two terminal stations at the opposite ends of the system) preferably provided with a mechanical opening device of the door and a mechanical closing device of the door; wherein the two devices are preferably configured to act on the cabin during the advancement in the station for progressively forcing the opening of the door and subsequently for controlling and guiding the closing thereof before the exit from the station.

[0010] The elements listed above are known to the person skilled in the art. In particular, it is preferably specified that the steps of opening the door are steps in which the opening is "forced", whereas the closing steps are steps in which the closing is "guided". Such difference is due to the fact that preferably in systems with a closing and opening of mechanical type, at least one spring is present for forcing the door in the closing con-

dition. Therefore, in the absence of external forces, the door tends to the closed position for safety reasons. According to the present invention, the opening and closing devices of the door provided in the station are preferably rails which identify a path, known in the sector as ramp or "manoeuvring helix", for a roller provided in a cabin connected to the door in a known manner. Such roller during the advancement of the cabin moves on the opening and closing rails which identify suitable ascent or descent ramps in which the roller is progressively lifted or lowered with respect to the cabin. Usually, by effect of the closing spring mentioned in the foregoing, the roller is forced in a raised position in which the door is closed and the opening of the door is controlled only by pushing said roller downwards (overcoming the force of the spring). For this reason, the opening rails usually also have an upper rail-side which acts on the roller during the advancement of the cabin for lowering it, whereas the closing rails generally only have a lower rail-side for guiding the ascent (which occurs spontaneously for the closing spring) of the roller and thus the closing of the door. Obviously, an inverted kinematics can be provided in the positions of the control roller of the door of the cabin.

[0011] The configuration of the cabin in movement out of the station is not a limiting object of the present invention. Only preferably the present invention refers to an aerial cable system in which the aforementioned control roller of the door is positioned in an intermediate position of a support arm which from the roof of the cabin develops upwards where it has a (known) coupling device to the cable.

[0012] The main aspect of the present invention concerns the implementation of the steps of closing the door which have to be performed before the cabin leaves the station. In particular, as is indicated in the previous chapters, the problem that the present invention aims to solve is that of being able to better manage a potentially dangerous situation in which the closing of the door results to be incorrect due, for example, to an object remained stuck between the movable door being closed and the fixed walls of the cabin. Already currently specially provided sensors are provided which control the state of the door so as to verify the correct downstream closing of the closing rail. To date, in case of incorrect closing, it is provided to stop the cabin for carrying out a manual intervention or the solution according to WO2022008399 is known with a first movable rail actuated by a first actuator for reopening the door and a second movable rail actuated by a second actuator for reclosing the door.

[0013] Alternatively, and in an inventive manner, the present invention offers as solution that of providing a closing rail of the door in the form of a mechanical closing device selectively switchable (remotely or from the station) in two configurations depending on the needs. The mechanical closing device of the present invention comprises a first rail and a second rail in series with respect to each other and movable in a coordinated manner by one

single actuator for switching from the first configuration to the second configuration and vice versa. The two configurations are such that, without stopping the cabin, it is possible to intervene on the incorrectly closed door so as to reopen it (and thus remove the obstacle) and subsequently reclose it. The first configuration (or of normal use) is the one met by all the cabins when they begin the closing step. In this first configuration, the first rail is configured, namely defines a helix or ramp, to close the door (raise the roller described in the foregoing) and the second rail downstream of the first one is configured in a neutral position, namely defines a helix or ramp which does not actively act on the cabin which advances towards the exit from the station. Such first configuration is thus maintained up to the exit of the station, if the closing of the door results to be correct actually downstream of the closing attempt performed by the first rail. It should be noted that such first attempt is always performed by the first rail.

[0014] Only if the closing of the door results to be incorrect downstream of the first closing attempt performed by the first rail, upon transition from the first to the second rail the present invention provides for controlling (in an automated manner or under a remote action or in the station by an operator) the switching from the first configuration just described to a second configuration in which the second rail this time actively acts on the cabin exiting the first rail. In such second configuration (or position) the ramp of the second rail which first was neutral is now configured, namely defines a helix or ramp which initially reopens the door and subsequently progressively recloses it. Therefore, in this second scenario the closing steps can be described in the following operating steps. Initially, the mechanical closing device of the door is switched in the first configuration so that during the advancement of the cabin along the first rail, the first attempt of closing the door is always performed. If the outcome of this first attempt is positive, the switching to the second configuration is not controlled. If the outcome of this first attempt is not positive, without stopping the cabin upon transition from the first rail to the second rail, the switching of the mechanical closing device of the door to the second configuration is controlled so as to reopen the door in the first section of the second rail and subsequently perform a second attempt of closing the door before the exit of the station. Once the person skilled in the art has been informed of the innovative need to design the second rail with the two positions so as to selectively define a neutral or inactive ramp and an active reopening and subsequently closing ramp, the person skilled in the art can design the suitable profile for the needs and the closing times of the preferred case. In fact, it is not the profile in itself to be the object of the present invention but the possibility to define with the two movable rails in series the two configurations described in the foregoing.

[0015] Preferably, the first rail and the second rail are joined (preferably hinged) together and are movable in a

coordinated manner by one single actuator for selectively switching from the first configuration to the second configuration during the advancement of the cabin. Still more preferably, the input end of the first rail and the output end of the second rail are fixed, whereas the joining point of the rails is movable between a raised position, in which the rails are in the first configuration, and a lowered position, in which the rails are in the second configuration. In this manner, the cabin is guided without interruptions along the two rails.

[0016] Preferably, the system further comprises:

- a first control sensor of the door substantially arranged at the output of the first rail or at the input of the second rail;
- a control unit connected on one side to the first sensor and on the other side to the actuator;

wherein the control unit is configured to control the switching from the first to the second configuration if the first sensor detects an incorrect closing of the door.

[0017] Preferably, the system further comprises a second control sensor of the door substantially arranged at the output of the second rail and connected to the control unit, wherein the control unit is configured to control the stop of the advancement of the cabin if the second sensor detects an incorrect closing of the door.

[0018] Preferably, the cabin comprises an actuating device of the door provided with at least one roller configured to advance along the first and the second rail, the roller being movable between a lowered position in which it controls the opening of the door and a raised position in which the door is closed. In such case, the second rail comprises a lower rail-side and an upper rail-side, in which upon transition from the first to the second configuration the upper rail-side acts on the roller of the cabin exiting the first rail so as to lower it and reopen the door.

List of the figures

[0019] Further characteristics and advantages of the present invention will become clear from the following description of a non-limiting example embodiment thereof, with reference to the figures of the accompanying drawings, wherein:

- Figure 1 is a schematic view of an example of a system in which the innovative mechanical closing system of the cabin door of the present invention can be provided;
- Figures 2 and 3 are enlarged schematic views of the component of the system indicated by II in Figure 1, namely views of an example of the cabin of the system of Figure 1;
- Figure 4 is an enlarged schematic view of the component of the cabin indicated by IV in Figure 3, namely views of a control roller of the door of the cabin which acts against the innovative mechanical

closing system of the cabin door of the present invention;

- Figures from 5 to 8 are schematic views in sequence of the operation of the system when the step of closing the door immediately has a positive outcome and it is not necessary to switch the innovative mechanical closing system of the cabin door of the present invention to the second configuration for reopening the door before closing it again;
- Figures from 9 to 12 are schematic views in sequence of the operation of the system when the first attempt of closing the door does not have a positive outcome and the innovative mechanical closing system of the cabin door of the present invention is switched to the second configuration for reopening the door before closing it again.

Description of an embodiment of the invention

[0020] Referring to the accompanying figures, Figure 1 shows a schematic view of a portion of an example of a transporting system in which the innovative mechanical closing system of the cabin door can be provided according to the present invention. In particular, Figure 1 shows a portion of an aerial cable system 1 and it is visible in a station 2, in which the passengers can board and disembark, and two cabins 3, of which one in the station 2 and one on the outside of the station 2, respectively. The cabin 3 on the outside of the station 2 is supported in aerial mode by a cable 4 which is coupled by means of a clamp 5. A support arm 6 is present connected on one side to the roof of the cabin 3 and connected on the opposite side to the clamp 5. As is known, in the station the cabin becomes unconstrained from the cable and advances more slowly on specially provided guiding rails (visible only in part in Figures 5-12 with reference numeral 7). The arrows A and B in Figure 1 indicate the two travel directions of the system. Along the direction A the cabin leaves the station 2 and along the direction B the cabin enters the station. The cabin 3 is provided with a door 8 (in this example having two translating door wings 9). As is known, on the outside of the station the door 8 is closed, whereas along a section of the station the door 8 is open so as to enable the boarding and the disembarking before being closed again.

[0021] Figures 2 and 3 are enlarged schematic views of the component of the system indicated by II in Figure 1, namely views of an example of a cabin 3 for the system of Figure 1. Such figures allow a better view of the translating door wings 9 (as non-limiting example of the door 8), the fixed walls 10 of the cabin 3 and of the details of the arm 6 supporting the clamp 5 and a guiding roller 13 of the cabin 3. The roller 13 in the station guides the cabin 3 along the guiding rails 7 supporting the cabin when unconstrained from the cable 4. These cabins are known and Figure 4 is an enlarged schematic view of the component of the cabin indicated by IV in Figure 3. In particular, Figure 4 shows a control roller 11 which is movable

between a raised position (the one shown) and a lowered position. Reference numeral 12 in Figure 4 identifies a spring configured to force the roller 11 in the raised position. Both such roller 11 and the spring 12 are known, and it is also known that the roller 11 in the two described positions controls the opening and the closing of the door 8, namely in this example the sliding of the door wings 9. This roller 11 in the station advances first along an opening rail and subsequently along a closing rail in which such rails identify ramps for respectively progressively lowering the roller 11 (for controlling the opening of the door 8) and progressively bringing the roller 11 back in the raised position (in which the door 8 is closed). Owing to such mechanical structural elements, such solution is defined as an automated mechanical control of the opening and closing of the door 8 of the cabin 3.

[0022] The following figures are schematic views in sequence which show the operation of the system during the steps of closing the door which have to be performed before the exit of the station. As mentioned in the chapter of general description of the invention, in an innovative manner a closing rail of the door in the form of a mechanical device is provided selectively switchable (remotely or from the station) to two configurations depending on the needs. As is visible in Figures 5-12, the mechanical closing device of the present invention comprises a first rail 14 and a second rail 15 in series with respect to each other and movable in a coordinated manner by one single actuator 16 for switching from a first configuration (Figures 5-8) to a second configuration (Figures 9-12) and vice versa. The two configurations are such that, without stopping the cabin 3, it is possible to intervene on the incorrectly closed door 8 so as to reopen it and subsequently reclose it. In this example, the first and the second rail 14, 15 are directly connected to each other by means of a hinge 20 which enables the joining point to be moved between a raised position (Figures 5-8) and a lowered position (Figures 9-12). The second rail 15 comprises both a lower rail-side 17 and an upper rail-side 18 (fixed with respect to each other) so that, when the second configuration is actuated, the roller 11 entering the second rail 15 is lowered and the door 8 is reopened. As for the details of the steps, initially all the cabins 3 advancing along the direction A reach the input of the first rail 14 with the door wings 9 open and the roller 11 in a forcedly lowered position. Such step is visible in Figure 5. At this point, the roller 11 finds the first rail 14 in the first configuration which defines a ramp which progressively leads the roller 11 in the raised position for closing the door wings 9. Figure 6 shows the moment when the cabin 3 advancing along the direction A ends the first rail 14 and as assumed the door wings 9 are correctly closed. The verification of such correct closing can be made by a sensor or by a person in charge in the station. In this condition of correct closing of the door 8 the roller 11 switches from the first rail 14 to the second rail 15 which (according to the first configuration) defines a "neutral" ramp for the roller 11, namely does not act on it for

overcoming the force of the spring 12 but only guides it in advancement along the rail-side 17. Figure 7 shows the entering of the roller 11 in the second rail 15 and Figure 8 the exit of the roller 11 from the second rail. As is shown, in the first configuration along the entire second rail the door 8 maintains its position of correct closing.

[0023] Figure 9 shows a step in which at the output of the first rail 14 (which being in the first configuration attempts to close the door 8) the door 8 does not result to be correctly closed and the door wings 9 leave an opening space 19 between them. In this situation, generated for example by an object stuck between the door wings 9 being closed, the switching from the first to the second configuration is controlled, namely (in this example) the lowering of the hinge 20 which joins the two rails 14 and 15. By effect of this lowering, as is visible in Figure 10, the upper rail-side 18 of the second rail 15 acts against the roller 11 lowering it from the position which it had reached exiting the first rail 14 and by so doing it controls the reopening of the door wings 9. In the second configuration, the active step of the second rail 15 is not completed here, but continues during the advancement along the direction A because in this second configuration the second rail 15 defines a ramp which again attempts to close the door 8 progressively lifting the roller 11. Figure 11 shows the progressive step of closing the door 8. The fact of completely reopening the door 8 should lead to the removal of the obstacle previously causing the incorrect closing and therefore at the end of the second rail 15 the cabin 3 shows the door correctly closed as schematized in Figure 12. For safety, a second control of the state of the door is provided (for example by means of a second sensor) at the end of the second rail 15. If the correct closing of the cabin is confirmed, the cabin exits the station, and the closing system having double rails in series is brought back to the first configuration. If the problem of incorrect closing is present also at the end of the second rail, the (preferably automated) stop of the advancement of the cabin can be provided.

[0024] Finally, preferably, springs can be provided for forcing the rails in the first configuration.

[0025] It is highlighted that the embodiment of the present invention shown in the figures is a preferential but non-limiting example and that therefore modifications can be made to such example as long as within the scope of protection defined by the appended claims.

Claims

1. System for transporting passengers; wherein the system (1) comprises:

- at least one cabin (3) provided with a door (8) movable between an open and a closed position;
- at least one boarding and disembarking station (2) provided with an opening device of the door

(8) and a mechanical closing device of the door (8);

characterized in that

the mechanical closing device of the door (8) comprises a first rail (14) and a second rail (15) in series and it is selectively switchable by an actuator (16) in two configurations without stopping the cabin (3); wherein

- in the first configuration, the first rail (14) is configured to close the door (8), and the second rail (15) is configured in the neutral position to not actively act on the cabin (3);
- in the second configuration, the second rail (15) actively acts on the cabin (3) exiting the first rail (14) and it is configured to initially open the door (8) and then close the door (8).

2. System as claimed in claim 1, wherein the first rail (14) and the second rail (15) are joined together and are movable in a coordinated manner to selectively switch from the first configuration to the second configuration during the advancement of the cabin (3).

3. System as claimed in claim 2, wherein the input end of the first rail (14) and the output end of the second rail (15) are fixed, the joining point (20) of the rails being movable between a raised position, wherein the rails (14, 15) are in the first configuration, and a lowered position, wherein the rails (14, 15) are in the second configuration.

4. System as claimed in any of the preceding claims, wherein the system (1) further comprises:

- a first control sensor of the door (8) arranged substantially at the output of the first rail (14);
- a control unit connected on one side to the first sensor and on the other side to the actuator (16);

wherein the control unit is configured to control the switching from the first to the second configuration if the first sensor detects an incorrect closing of the door (8).

5. System as claimed in claim 4, wherein the system further comprises a second control sensor of the door (8) arranged substantially at the output of the second rail (15) and connected to the control unit, wherein the control unit is configured to control the stop of the advancement of the cabin (3) if the second sensor detects an incorrect closing of the door (8).

6. System as claimed in any of the preceding claims, wherein the second rail (15) comprises a lower rail-side (17) and an upper rail-side (18), wherein upon

transition from the first to the second configuration the upper rail-side (18) acts on the cabin (3) exiting the first rail (14) to open the door (8).

7. System as claimed in any of the preceding claims, wherein the cabin (3) comprises an actuating device of the door (8) provided with at least one roller (11) configured to advance along the first rail (14) and second rail (15), the roller (11) being movable between a lowered position wherein it controls the opening of the door (8) and a raised position wherein the door (8) is closed.

8. System as claimed in any of the preceding claims, wherein the system (1) is an aerial cable system.

9. Method of operation of a system for transporting passengers; wherein the method comprises the steps of:

- (a) providing a system according to claim 1;
(b) closing the door of the cabin before the exit from the station;

characterized in that step (b) of closing the door of the cabin before the exit from the station comprises the steps of:

- (c) setting the mechanical closing device of the door in the first configuration;
(d) advancing the cabin along the first rail to make a first attempt to close the door;
(e) verifying at the exit of the first rail the outcome of the first attempt to close the door;
(f) in case of incorrect closing of the door, without stopping the cabin setting the mechanical closing device of the door to the second configuration so as to reopen the door;
(g) advancing the cabin along the second rail to make a second attempt to close the door.

10. Method as claimed in claim 9, wherein the method also comprises the steps of:

- (h) verifying at the exit of the second rail the outcome of the second attempt to close the door;
(i) in case of incorrect closing of the door, stopping the cabin before the exit of the station.

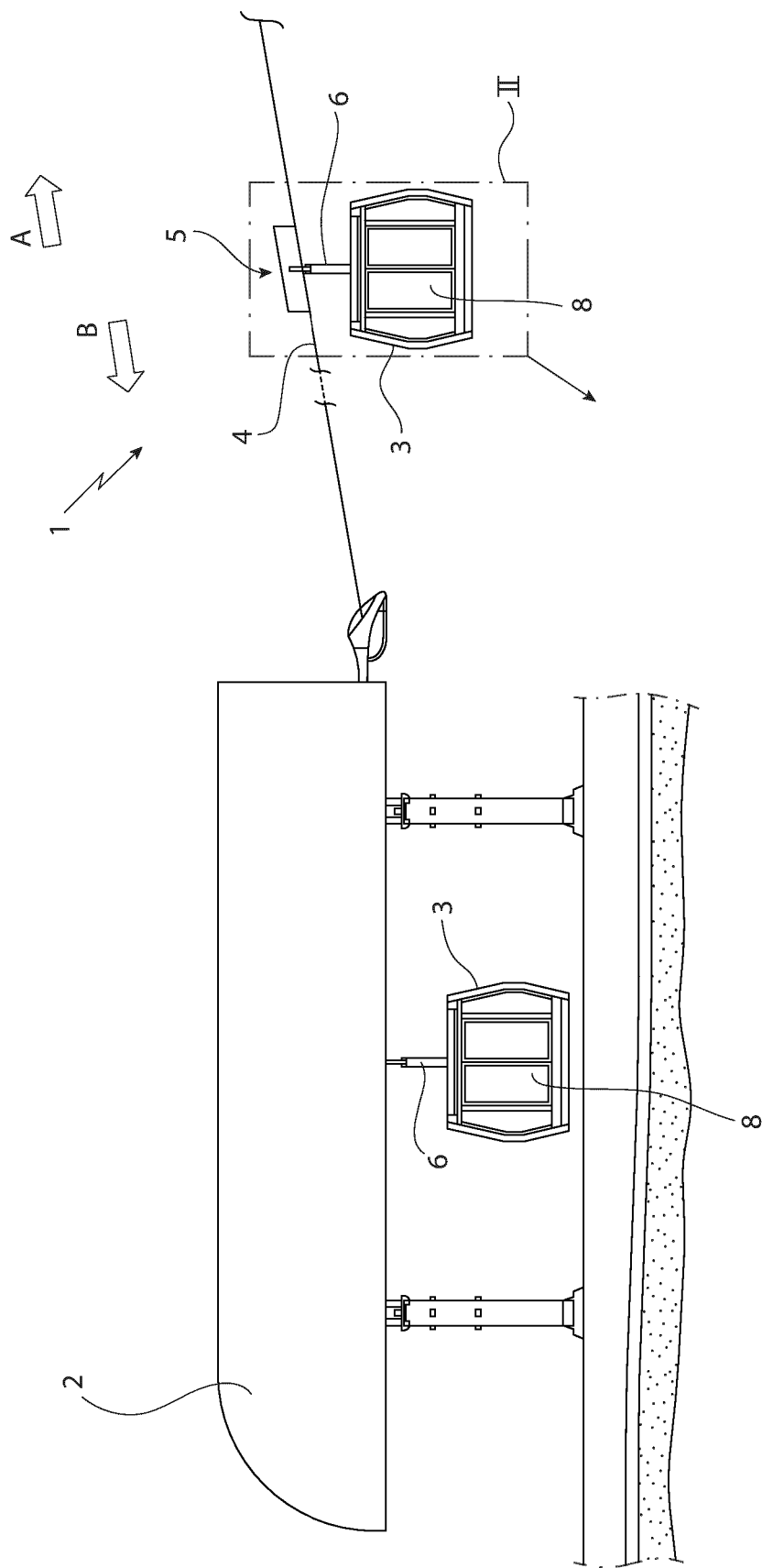


FIG. 1

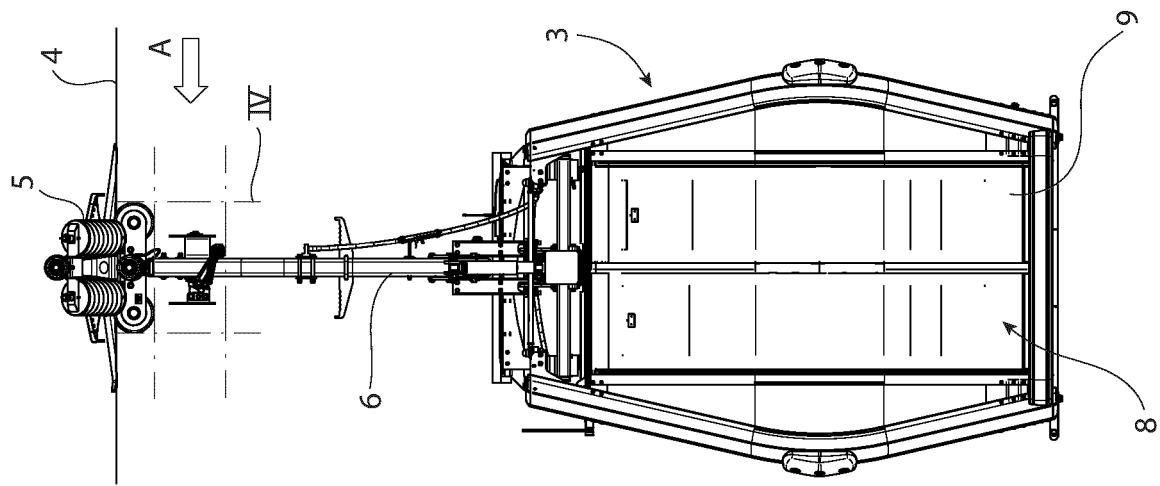


FIG. 3

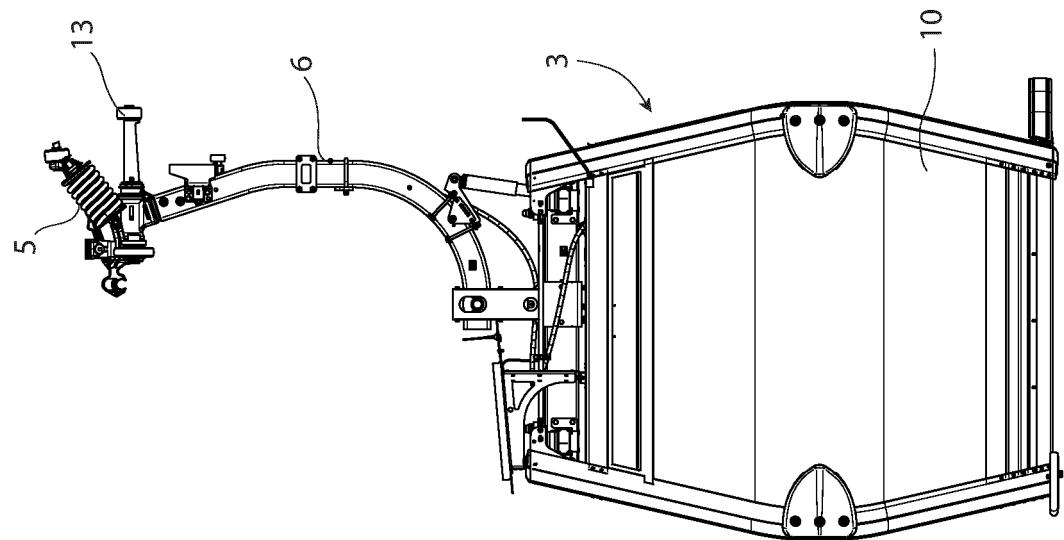


FIG. 2

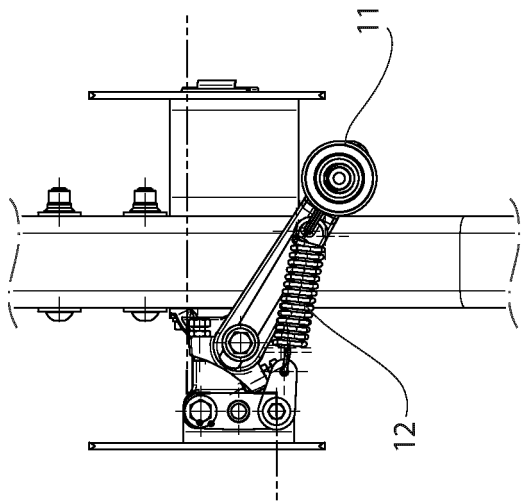


FIG. 4

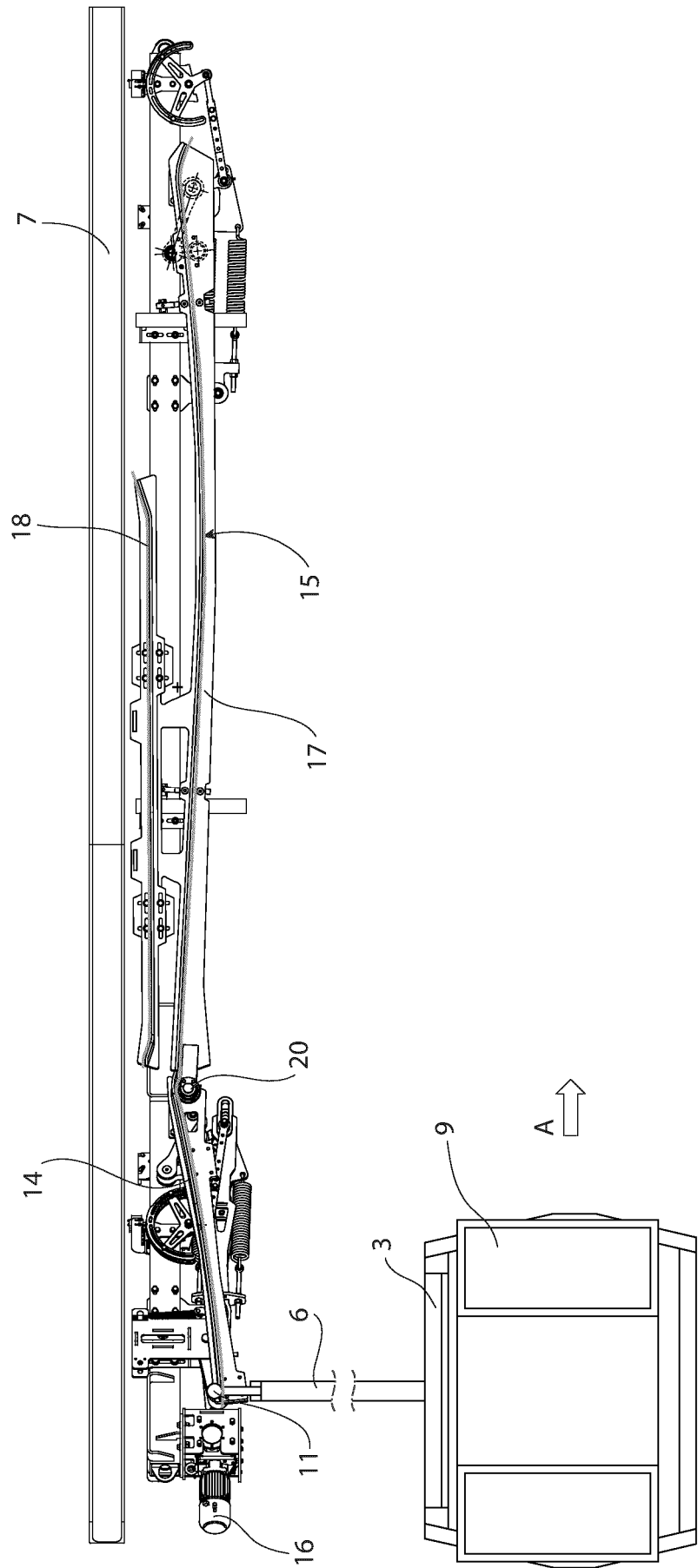


FIG. 5

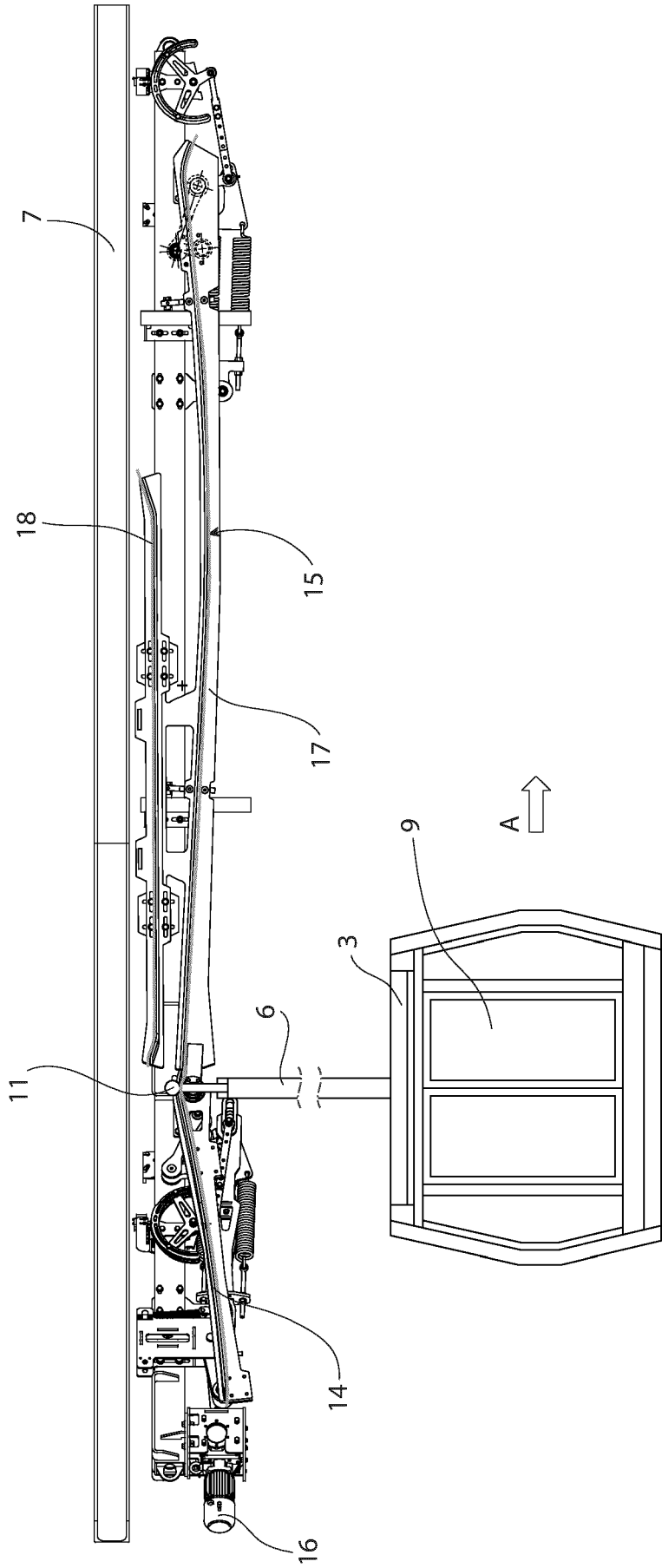


FIG. 6

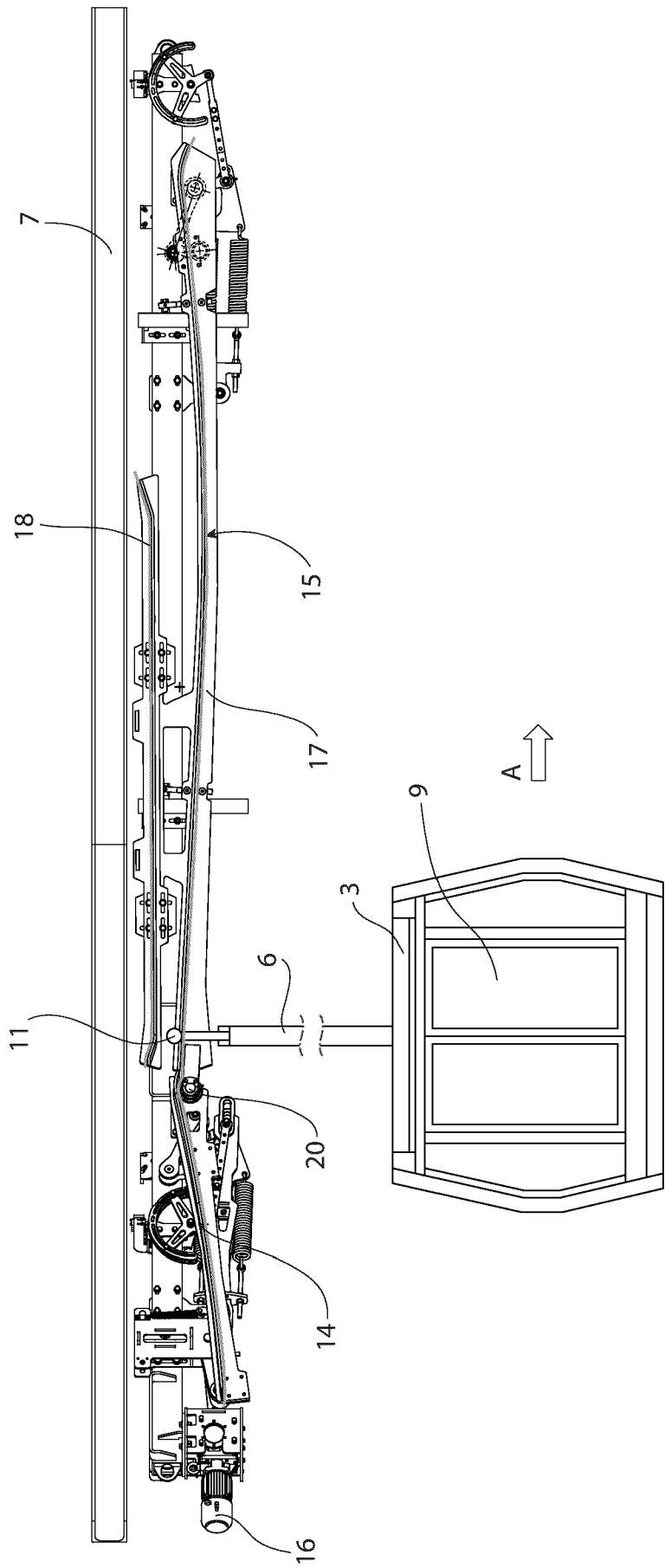


FIG. 7

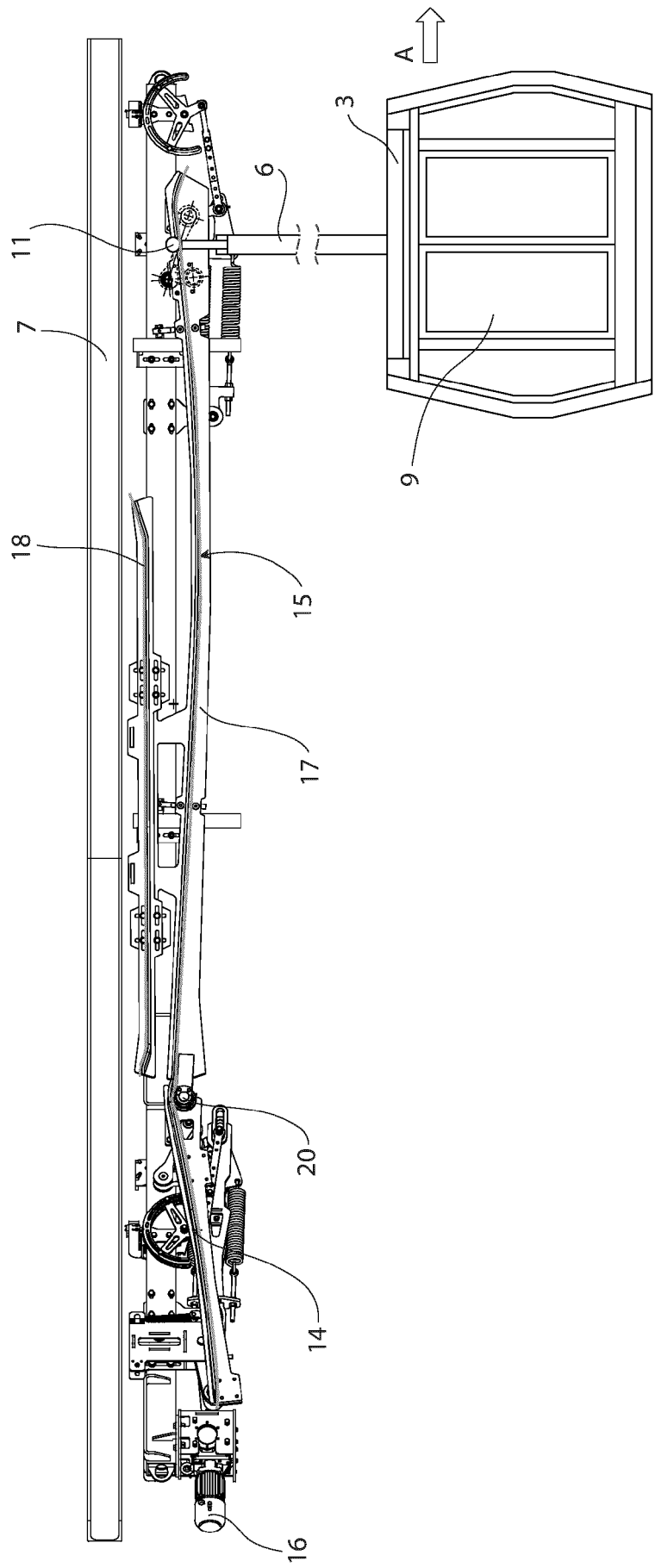


FIG. 8

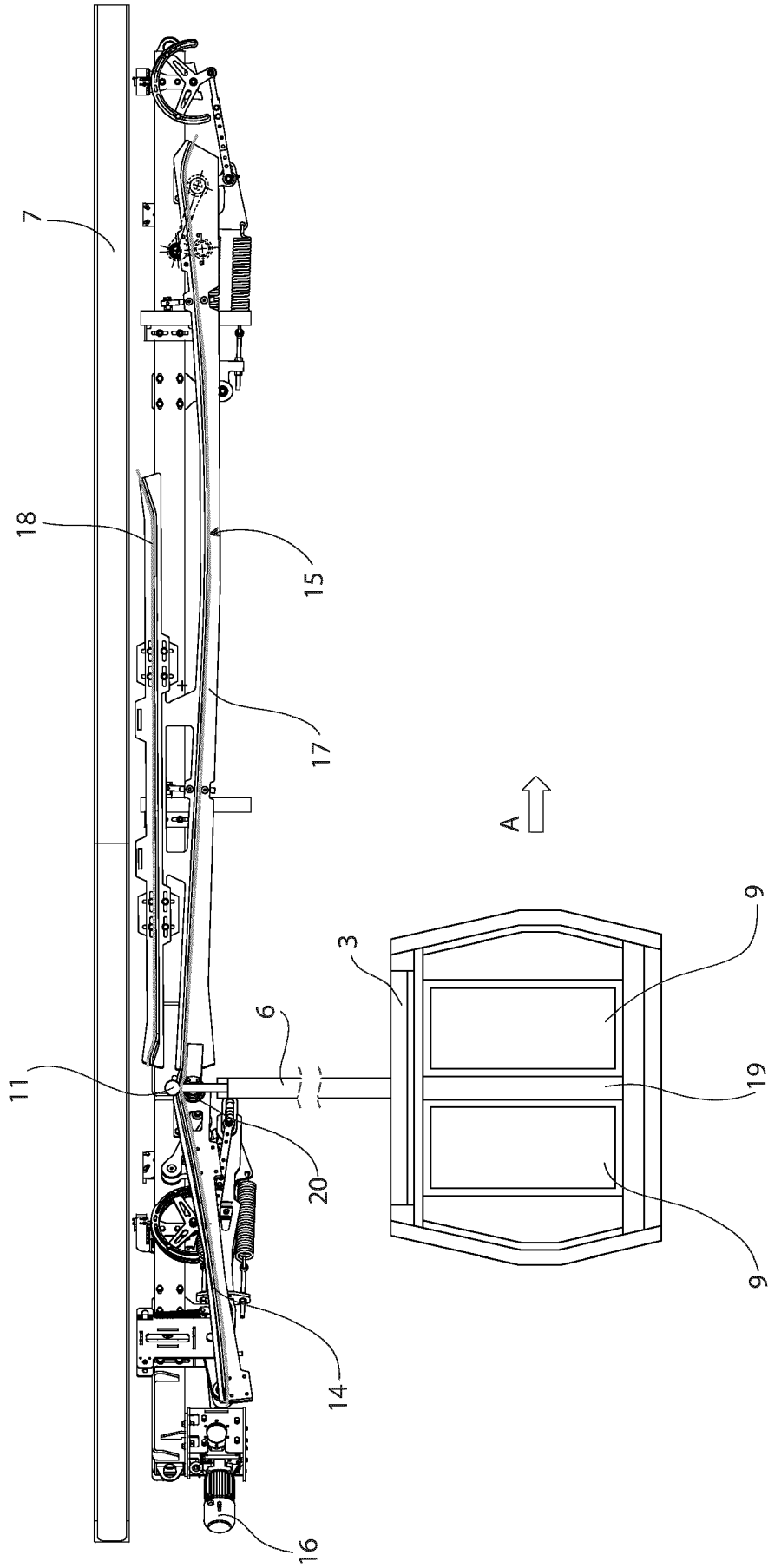


FIG. 9

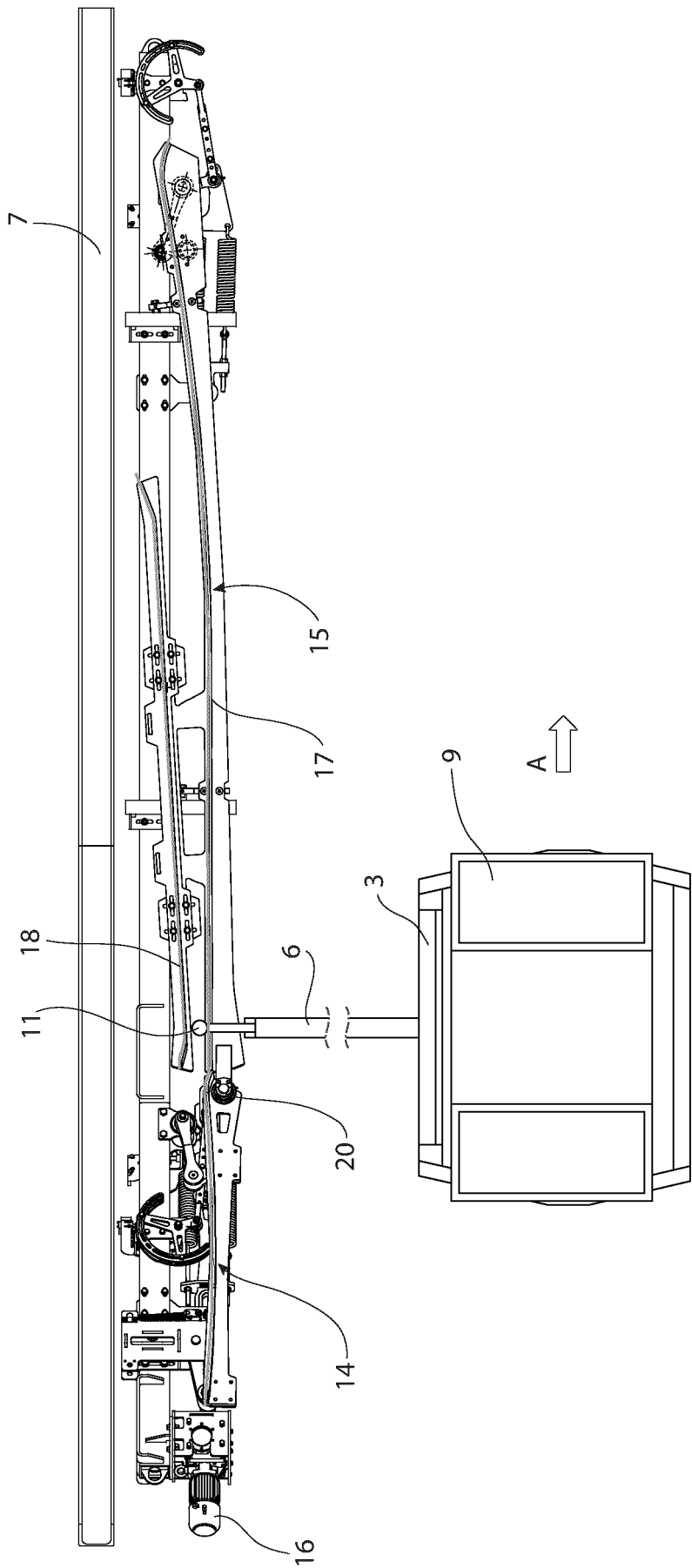


FIG. 10

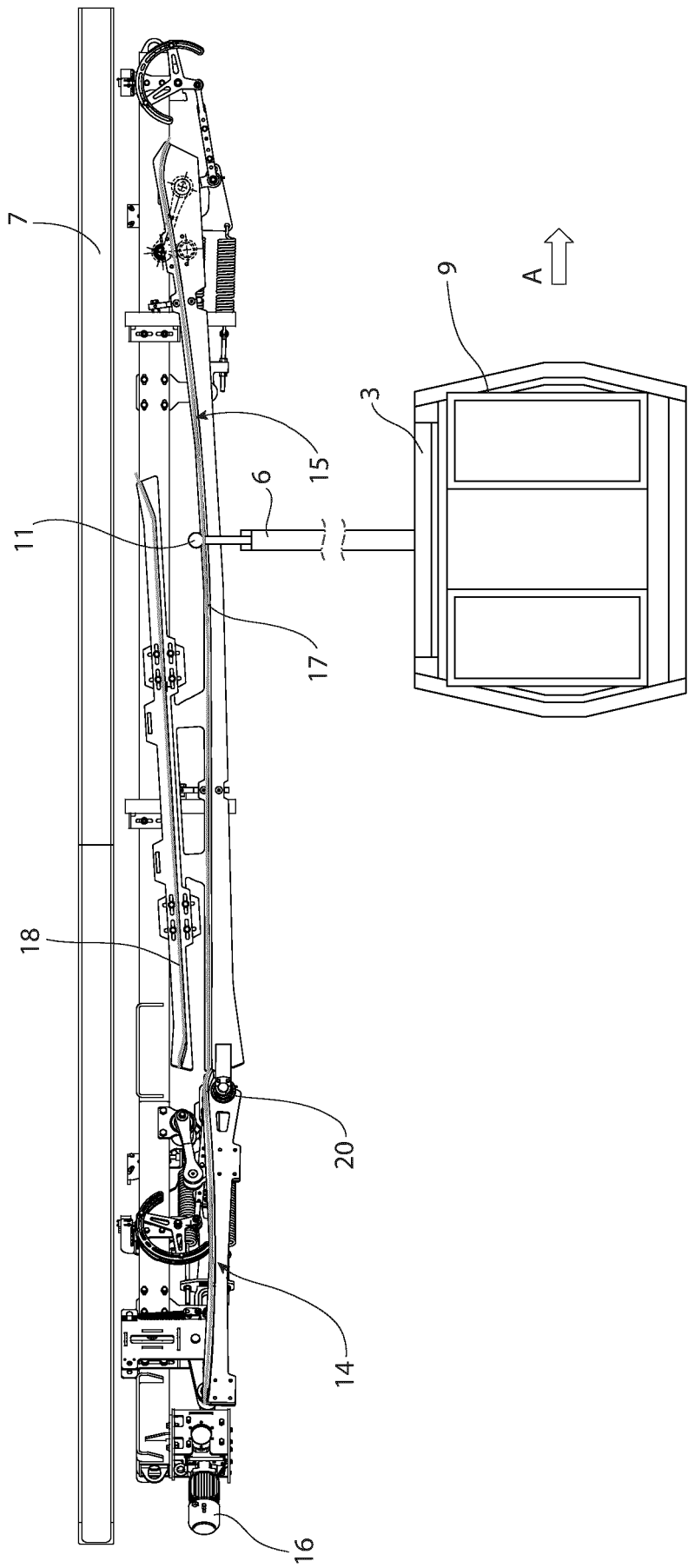


FIG. 11

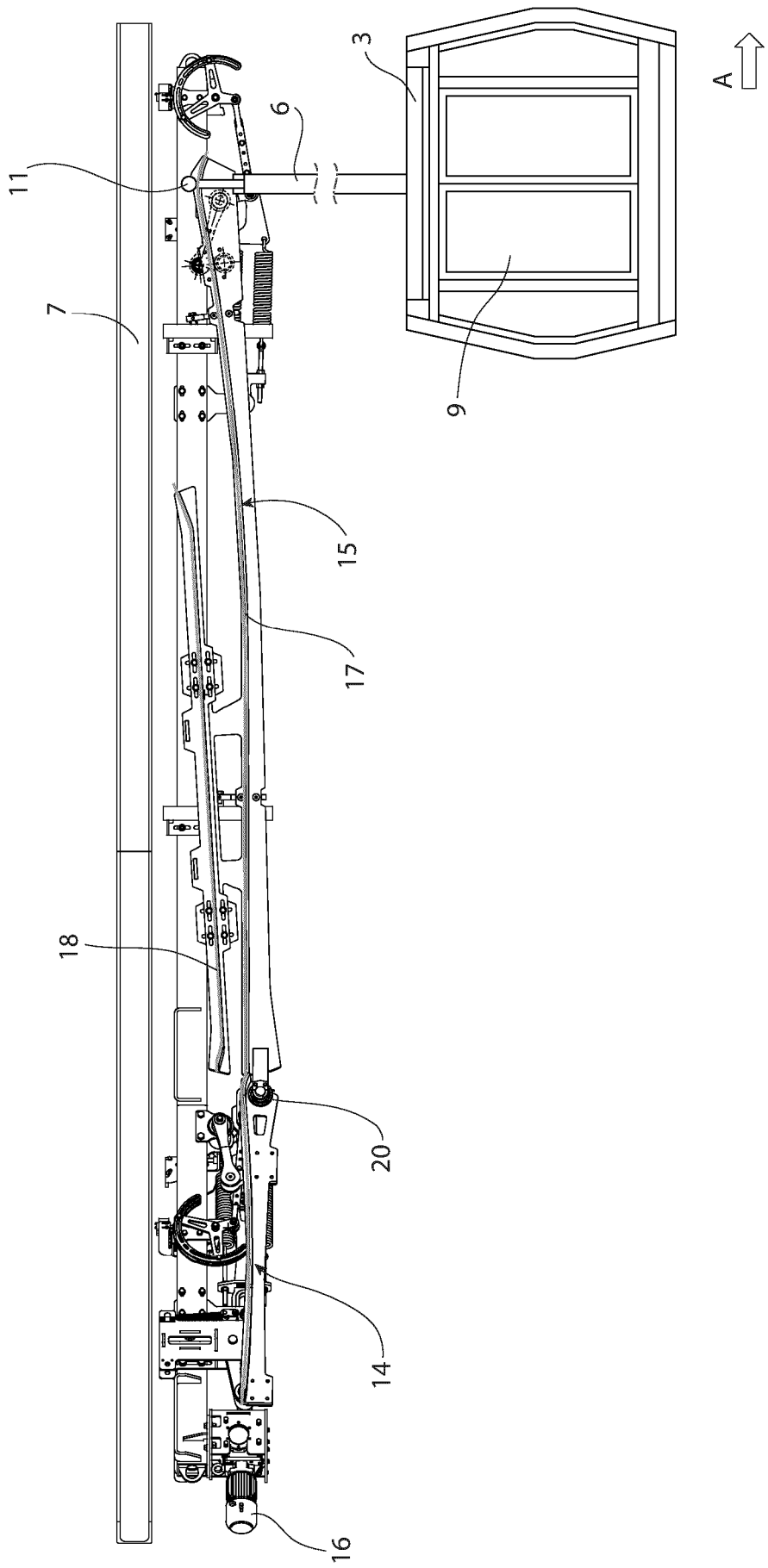


FIG. 12



EUROPEAN SEARCH REPORT

Application Number

EP 24 19 8599

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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