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(54) **AERIAL CABLE TRANSPORTING SYSTEM AND METHOD FOR OPERATING SUCH A SYSTEM**

LUFTKABELTRANSPORTSYSTEM UND VERFAHREN ZUM BETRIEB SOLCH EINES SYSTEMS

SYSTÈME DE TRANSPORT PAR CÂBLE AÉRIEN ET PROCÉDÉ DE FONCTIONNEMENT D'UN TEL SYSTÈME

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Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This patent application claims priority from Italian patent application no. 102022000026529 filed on December 22, 2022.

Technical field

[0002] The reference technical field of this invention relates to the aerial cable transporting system sector. These systems provide multiple transport units for transporting passengers or goods, which are moved, one after the other, in aerial mode along a predefined course by at least one cable. For the purposes of this invention, the forward movement of the transport units along the at least one supporting cable is generated by a hauling cable. Thus, in detail, the reference technical field of this invention relates to aerial cable transporting systems wherein there is a hauling cable and at least one supporting cable. In this context, the present invention will deal with the issue of how to support, understood as maintain in a particular position, the hauling cable during the steps wherein the transport units are stored, for example during the system's stop or during maintenance and inspection wherein the hauling cable is moving without there being vehicles on the line.

State of the art

[0003] Aerial cable transporting systems are widespread today and, thus, are in general well known to a skill person operating in this particular technical sector. In these systems, the passengers, or the goods, are transported along a course in special transport units, for example cabins, chairs, or something else, which will be called "vehicles", for simplicity, below. The path is delimited at the opposite ends by two terminal stations for embarking and disembarking and the vehicles are fed in an aerial configuration one after the other along a first branch from the first station to the second and along a second branch (usually parallel to the first) from the second station to the first. In particular, according to this invention, the term "aerial" refers to cable systems in which the vehicles are moved along at least one supporting cable in a position raised above the underlying ground (i.e., in aerial mode). This invention preferably relates to aerial transport systems with one or with two supporting cables per transport branch. As described above, for the purpose of this invention, the movement of the vehicles between the stations along the at least one supporting cable is generated by a hauling cable to which all the units are selectively coupled or clamped when they travel from one station to another. In contrast, as known, at a station, the vehicles are unhooked from the hauling cable so that they can move forward more slowly in relation to the vehicles moving outside the stations. Again, as known, the hauling cable is arranged in a ring in the terminal stations, which, to this end, house special pulleys, including at least one motorised one, while the at least one supporting cable is basically fixed with ends attached in the terminal stations. The at least one supporting cable is, in fact, only moved between the stations during maintenance. In an aerial cable transporting system of the type described and the subject of this invention, every vehicle is equipped with a trolley with rollers that roll on the at least one supporting cable and a clamp (or equivalent devices) for selectively coupling to the hauling cable.

[0004] An aerial cable transporting system, as just described, is very useful when the shape of the underlying ground, or other surrounding factors, mean conventional movement along the ground is impracticable. For example, such aerial cable systems are used in the case in which the path to be completed involves significant jumps in altitude, including with considerable inclines. This path is typical of ski resort/mountain areas and, in this context, these systems are also called ski lifts. However, this invention and aerial cable systems in general also find advantageous application in urban contexts where ground transport is congested.

[0005] As known, it is often necessary to provide, along the course, fixed intermediate structures as well, between the terminal stations, configured for supporting portions of the supporting cable. One reason to require these fixed intermediate structures may be the excessive distance between the terminal stations so as to prevent arranging the cable in a single bay. Another reason may be the elevation profile of the path if there are significant incline changes. Each fixed intermediate support structure for the supporting cable usually comprises a vertical supporting structure, such as a pylon or a tower, on top of which there are support devices for the supporting cable, known as "shoes". In particular, the shoe comprises a basically "U"-shaped seat for the supporting cable. Along the shoe, the hauling cable, if included, is instead supported by a series of rollers arranged below the seat of the supporting cable.

[0006] During use of the system, the fact that the hauling cable is not subject to strong tension (for the reasons given above) is not a problem. In fact, the hauling cable is in fact supported in its operating position by the clamp of the vehicles that, in turn, are supported in position by the at least one supporting cable. Thus, though not excessively taut, the hauling cable does not give downwards but remains raised in the correct operating position due to the presence of vehicles moving along the at least one supporting cable.

[0007] The problem of incorrect positioning of the hauling cable in relation to the at least one supporting cable, or, in general, the surrounding environment, instead occurs when the system is stopped and the vehicles do not run along the at least one supporting cable and are rested in storage, detached from the hauling cable. The storage is usually found at a terminal station from which they are diverted and reintroduced when required. In the absence

of moving vehicles along the system, and in the absence of suitable supports configured to support the hauling cable operating with the system stopped, the hauling cable tends to assume a position tending strongly downwards ("static arrow") and this configuration has at least two critical issues. The first is the fact that, by law, you must always ensure a minimum distance between the ground and the hauling cable; the second is that, in such a configuration, the wind can generate large dynamic effects in the cable that may lead it to oscillate in such a way as to wind and twist around the at least one supporting cable. To avoid the occurrence of these problems, today it is known to equip the systems with two supporting cables with multiple fixed supports for the hauling cable in the form of V-shaped fixed supports directly coupled to the supporting cables for each transport branch. In particular, the upper ends of the fixed support are respectively attached to the two supporting cables of the transport branch and the throat, or lower vertex, acts as a support for the hauling cable that, thus, cannot be locally lowered beyond this fixed support. This vertex is equipped with a roller and, in this way, including when the system is being used, the moving hauling cable is not damaged by the fixed support.

[0008] This solution, widely used today, is not, unfortunately, without its drawbacks. In fact, the maintenance and/or any repair or replacement of such fixed supports is not an easy operation to execute given the height at which these fixed supports are arranged. In addition, this solution cannot be used in systems with just one supporting cable.

[0009] Thus, there is currently a need to offer an improved solution to the problem of how to support the hauling cable when the system is stopped in a position that is technically suitable. In particular, there is currently a need to offer a solution that may also be used in systems with just one supporting cable and that, in general, makes the maintenance of the devices that perform this function simpler.

[0010] US6363859B1 shows cabins for cable systems, in particular for systems with two cables, wherein the cabins are equipped with devices for automatically locking to the cable.

Description of the invention

[0011] The starting point for this invention is to provide an aerial cable transporting system of the type comprising:

- a first terminal station and a second terminal station;
- a hauling cable arranged in a ring between the stations to create opposite-direction transport branches;
- at least one supporting cable (in particular, one or two supporting cables) for each transport branch between the stations;
- a plurality of vehicles configured to run in aerial configuration between the terminal stations supported by the at least one supporting cable and hauled by the hauling cable.

[0012] The hauling cable is preferably moved by a motorised pulley housed within one of the stations. Inside the station, as known, the vehicles are not coupled to the hauling cable (nor supported by the at least one supporting cable) so that they can advance more slowly than the vehicles that travel between the stations. To this end, each vehicle is preferably equipped with a clamp (or equivalent device) that entering and leaving the station is respectively opened and closed (automatically, as known, with sprung levers that act against fixed abutments in the station) to selectively release and couple with the hauling cable. This clamp is well known to the person skilled in the art and, thus, other details are not necessary. The way the vehicles are moved inside the station (for example, using motorised wheels) is also known. It is also known that, at one station, there is a storage towards which the vehicles are diverted while they move forward in the station and where they are housed when the system is stopped. In the first stages of restarting the system, the vehicles are moved from the storage (for example, with the motorised wheels mentioned above) up to the station where, at its exit, they will be clamped to the hauling cable to run towards the opposite station. To move on the at least one supporting cable between the stations and on special tracks in the station, each vehicle is equipped with a trolley with rollers configured to roll on the at least one supporting cable between the stations and on the dedicated tracks in the station.

[0013] As mentioned in the section describing the prior art, it is necessary to provide for support devices configured to support the hauling cable in a correct position when the system is stopped, i.e., a suitably raised position, so as not to encounter the problems described and, thus, basically corresponding to the position that it assumes when the system is being used near the at least one supporting cable. According to the prior art, for systems with two supporting cables, fixed support devices are provided in the form of "V"-shaped fixed supports coupled to the supporting cables along the two transport branches. For the purposes of this invention, the system's "stop" not only refers to phases in which the vehicles are in storage at night but also during inspection and other phases in which the vehicles are, simply, not on the line.

[0014] In contrast, according to the main aspect of this invention, these fixed supports are no longer necessary and, in general (even for systems with just one supporting cable per branch), they have been replaced with innovative support devices configured to support the hauling cable when the system is stopped when these support devices are not fixed but mobile along the at least one supporting cable. The term "to support" means what is described above, i.e., keeping the hauling cable in a

suitably raised position so as to avoid the problems mentioned and that basically corresponds to the position that it assumes when the system is being used, when it is, in fact, kept raised by the clamps of the vehicles that travel along the two transport branches defined by the at least one supporting cable.

[0015] These mobile support devices for the hauling cable are housed in a storage when the system is being used (preferably the same storage described above that accommodates the vehicles during stoppage) and are fed along the supporting cables when the vehicles return to the storage so that, when all the vehicles are stored, all the mobile support devices have reached their operating position along the branches. In this way, the hauling cable gradually changes from being supported by the vehicles to the mobile support devices. When all the vehicles are stored, the mobile support devices have reached their operating position and the hauling cable can be stopped, thus stopping the system. In this position, with a stopped hauling cable, the mobile devices will support the hauling cable until the next phase of using the system, wherein the mobile support devices gradually restart along the branches of the supporting cables to reach the storage and the vehicles are reintroduced to the transport branches. In this way, the hauling cable gradually changes from being supported by the mobile support devices to the vehicles.

[0016] According to the above, it is possible to easily perform the maintenance of mobile support devices because, when the system is being used, these are housed in the storage and, thus, can be easily reached.

[0017] Preferably, every mobile support device comprises a trolley provided with rollers for rolling on the at least one supporting cable. Still more preferably, the trolley of the mobile support device is of exactly the same type as the trolleys that enable the vehicles to advance along the at least one supporting cable and on the station tracks. If there is just one supporting cable, the rollers are arranged in a single row; if there are two supporting cables, the rollers are arranged in two corresponding rows.

[0018] Each mobile support device preferably comprises a clamp for selectively coupling to the hauling cable in which this clamp is exactly the same type present on the vehicles for their selective coupling to the hauling cable exiting and entering the stations.

[0019] Preferably, and especially in the case of systems with just one supporting cable, each mobile support device may comprise a counterweight configured to bring the mobile device's centre of mass below the supporting cable. The counterweight may, preferably, be provided at the end of a support arm that extends downwards from the trolley. This arm may, preferably, be exactly the type that connects the cabins of the vehicles to the corresponding trolley. In other words, in this preferred embodiment of the invention, each mobile support device corresponds to the vehicle of the system in which the transport unit was removed (seat or cabin or other) and, thus, the components that are the same used both for the vehicles and for the mobile support devices are strongly optimised. As mentioned, if there is just one supporting cable, it is a good idea to provide a counterweight in place of the transport unit to balance the device in relation to the supporting cable. If local regulations allow it, even the counterweight could be the transport unit itself, obviously without passengers since intended to be stopped on the line when the system is stopped. In this case, this invention would be adapted according to a method in which to bring the cabins with passengers to stop, they are called to the station to empty the system and after (or gradually with the emptying) some empty vehicles (for example one in every four) are introduced on the line to act as a support device for the hauling cable as described above.

List of drawings

[0020] Additional features and advantages of this invention will be clear from the description that follows of a non-limiting embodiment, with reference to the attached figures, in which:

- Figure 1 schematically shows a portion of an aerial cable transporting system that may be improved with this invention;
- Figure 2 shows the enlarged view of the portion identified with the reference II in Figure 1;
- Figures 3A-10B schematically show different operational steps of a system according to this invention;
- Figure 11 shows a construction example of a mobile support device of the hauling cable according to this invention.

Description of an embodiment of the invention

[0021] With reference to the accompanying figures, Figure 1 schematically shows a portion of an aerial cable transportation system globally denoted with the reference number 1 and that can be improved thanks to this invention. In this non-limiting example, the aerial cable system 1 comprises cables (indicated in Figure 1, in general, with the reference number 2) and a first terminal station 14, for embarking and disembarking passengers, can be seen. This example comprises two parallel transport branches that define an ascent branch 30 and a descent branch 31 of the system. The arrows A and B in Figure 1 indicate the advancing directions of the ascent 30 and descent 31 branches. Figure 1 represents one of the multiple vehicles 3 present in the system that run, one after the other, along both the ascent and descent branches. In the representation in Figure 1, a first vehicle 3 is located at the station 14 inside of which it is detached from the cables 2. The second vehicle 3 shown in Figure 1 is running along the ascent branch and is arranged between the station 14 and a first fixed intermediate support structure 15 in the form of a pylon 16. The function of the pylons 16 arranged between the stations

is to divide the cables into separate bays. In the example in Figure 1, each vehicle 3 comprises a cabin 17, a trolley 19 coupled to the cables 2, and a suspension arm 18 that connects the cabin 17 to the trolley 19. Finally, in Figure 1 you can see how at the top of the pylon 16 there is a shoe assembly 4 for supporting the cables 2 with an inlet portion 5 and an outlet portion 6.

[0022] Figure 2 shows the enlarged view of the portion identified with the reference II in Figure 1. In this figure, you can see how the system 1 comprises a supporting cable 2 and a hauling cable 13. In any case, for the purposes of this invention, the system could also comprise two supporting cables. Figure 2 shows a trolley 19 provided with rollers 20 for rolling on the supporting cable 2. The reference number 25 indicates the clamp for selectively coupling the hauling cable 13. As known, the inlet and outlet portions of the station comprise devices that act against the clamp to open it at the inlet, so as to detach the vehicle 3 form the hauling cable 13, and to close it at the outlet, so as to attach the vehicle 3 by the hauling cable 13. The shoe 4 is only partially visible in Figure 2. As can be seen in Figure 2, along the shoe 4, the supporting cable 2 is housed in special U-shaped seats on the upper end of the shoe 4 while the hauling cable 13 is housed along a series of rollers 21 placed lower down. As known, by transiting the shoe, the clamp locally raises the hauling cable. So as not to have to stretch the hauling cable excessively, it is necessary to equip the system with devices that are able to support the hauling cable, i.e., keep it raised when the system is stopped when, in the absence of vehicles 3, the cable 13 would assume a position too low down compared to the supporting cable/s. Figures 3a and 3b show precisely this situation to avoid in which all the vehicles 3 are stored 32 and there are no devices able to keep the cable 13 basically in line with the supporting cable 2 as, instead, occurs when the system is used due to the presence of the vehicles 3 along the branches. The reference number 33 indicates the second terminal station. Figures 4a and 4b show precisely that situation that represents the starting point to describe the innovative support devices 10 of the hauling cable that, according to this invention, are mobile along the supporting cable 2. In Figures 4a and 4b, you can see how, when the system is being used, the mobile support devices 10 are placed in storage 32 where it is possible to easily do maintenance. At the start of system stoppages, the vehicles 3 that transit in the station 14 are diverted (in a known way) and gradually sent to the storage 32. A "hole" is thus created in the first section of the ascent branch 30 as can be seen in Figures 5a and 5b. Figures 6A and 6B show the subsequent steps wherein more and more vehicles 3 are diverted to the storage 32. The absence of these vehicles 3 along the branch 30 would lead to there being a bigger and bigger hole for supporting the hauling cable 13 that, instead, according to this invention is filled by feeding the first mobile support devices 10, which replace the vehicles 3 in their function of supporting the hauling cable, in the ascent branch 30. Regarding the number of devices 10 needed, for example, it is possible to include one device 10 for every four vehicles. These mobile support devices 10 are, thus, gradually moved from the storage 32 to the station 14 and from the station 14 sent along the branch 30. One example of how these mobile support devices 10 are supported by the supporting cable 2 and how they are coupled to the hauling cable 13 will be shown in Figure 11. Figures 7a and 7b show subsequent steps in which no vehicle 3 is present on the ascent branch 30 and the hauling cable 13 fortunately does not droop down, as can be seen in Figure 3A, but remains raised thanks to mobile support devices 10 that run and are present along the ascent branch 30. In this figure, the section of hauling cable 13 of the descent branch 31 is still supported by the vehicles 3. Figures 8a, 9a, 8b, and 9b show subsequent steps in which the few vehicles 3 not in storage 32 are arriving in the station 14 at the end of the descent branch 31 and the support devices 10 have started working in this descent branch 31. Figures 10a and 10b show the final step of this process wherein the hauling cable 13 can be stopped. As can be seen, all the vehicles 3 are in storage 32 and all the support devices 10 are in their operating position in which they will remain until the system starts up again. At start up, it will be enough to drive the hauling cable 13 that will gradually make the support devices 10 arrive in the station 14 where they will be diverted towards the storage 32. At the same time, the vehicles 3 will be gradually sent by the storage 32 to the station 14 and, from there, along the branch 30 of the system. At the end of transit, it will be returned to the configuration in Figures 4a and 4b with the vehicles 3 moving along both branches 30 and 31.

[0023] Finally, Figure 11 shows a construction example of a mobile support device 10 according to this invention. In this example, a system with a supporting cable 2 is shown and the support device 10 comprises a trolley 11 with rollers 35 for rolling on the supporting cable 2, a clamp 36 for selective coupling to the hauling cable 13, a suspension arm 37 on one side coupled to the trolley 11 and on the other side provided with a counterweight 38 for bringing the centre of mass of the device 10 in line below the supporting cable 2. As clearly emerges, the device 10 is thus wholly similar to the suspension of the vehicles 3 that circulate in the same system (Figure 2) i.e., there is the same clamp 36 (thus, the coupling and release at the outlet and inlet of the station is performed without problems), the same trolley 11, and the same suspension arm 37. In other words, in this example, the mobile support device 10 corresponds to a vehicle 3 from which the transport unit is removed and to which the counterweight 38 is coupled. Even the drive levers of the clamp 36 are, thus, the same included in the system vehicles. In the case of two supporting cables, the trolley of the device 10 may be a trolley known to the person skilled in the art and used to make the vehicles advance in systems of this type.

[0024] It is clear that modifications may be made to the

invention described herein in relation to the example shown in the figures. The main aspect, in fact, of this invention lies in the innovative support device for the hauling cable that is mobile along the at least one supporting cable. In this sense, other embodiments are possible in relation to that in Figure 11 with different ways of running along the at least one supporting cable, in place of the trolley shown, and other ways of keeping the hauling cable in the place of the clamp shown.

Claims

1. An aerial cable transporting system (1) for transporting of passengers and/or cargo, wherein the system comprises:

- a first terminal station (14) and a second terminal station (33);
- a hauling cable (13) arranged as a ring between the stations (14, 33) to create two branches (30, 31) of opposite transport direction;
- at least a supporting cable (2) for each transport branch (30, 31) between stations (14, 33);
- a plurality of vehicles (3) for transporting passengers and/or goods configured to run along the transport branches (30, 31) in aerial configuration between the stations (14, 33) supported by the at least one supporting cable (2) and hauled by the hauling cable (13);
- a plurality of support devices (10) configured to support the hauling cable (13) during the stop of the system when vehicles (3) are not running along the transport branches (30, 31);

characterized by the fact that:

- a storage (32) is provided for selectively storing the support devices (10) during the use of the system and vehicles (3) during the stop of the system;
- the supporting devices (10) are movable along the transport branches (30, 31) between the stations (14, 33) supported by the at least a supporting cable (2).

2. The system as claimed in claim 1, wherein devices for moving to and from the storage (32) are provided for selectively storing vehicles (3) and support devices (10) from a station (14) to the storage (32) and for feeding from the storage (32) to the station (14) vehicles (3) and support devices (10).

3. The system as claimed in any of the preceding claims, wherein each support device (10) comprises a clamp (36) configured to couple to the hauling cable (13) between the stations (14, 33).

4. The system as claimed in claim 3, in which each vehicle (3) comprises a clamp (25) configured to couple to the hauling cable (13) between stations (14, 33); the clamps of the vehicles (25) and the clamps (36) of the supporting devices (10) being of the same kind.

5. The system as claimed in any one of the preceding claims, wherein each support device (10) comprises a trolley (11) having rollers (35) for rolling on the at least a supporting cable (2).

6. The system as claimed in claim 5, wherein each vehicle (3) comprises a trolley (19) equipped with rollers (20) for rolling on the at least a supporting cable (2); the trolleys (19) of the vehicles (3) and the trolleys (11) of the supporting devices (10) being of the same kind.

7. The system as claimed in any of the preceding claims, wherein each support device (10) comprises a counterweight (38).

8. The system as claimed in claim 7, wherein each support device (10) comprises a suspension arm (37) that extends downward from the trolley (11); the counterweight (38) being coupled to the lower end of the suspension arm (37).

9. The system as claimed in claim 8, wherein each vehicle (3) comprises a transport unit (17) and a suspension arm (18) that connects a transport unit (17) to the trolley (19); the suspension arms (18) of the vehicles (3) and the suspension arms (37) of the support devices (10) being of the same kind.

10. A method for operating an aerial cable transport system for transporting passengers and/or cargo; wherein the method comprises the steps of:

(a) providing a system (1) as claimed in claim 1;

wherein to change from the system use configuration, in which the vehicles (3) run along the transport branches (30 31) in an aerial configuration between stations (14, 33) supported by the at least one supporting cable (2) and hauled by the hauling cable (13), to the system stop configuration, wherein the vehicles (3) are stored into storage (32), the method provides the step of:

(b) progressively storing the vehicles (3) to storage (32) and at the same time progressively feeding along the transport branches (30, 31) the supporting devices (10) until all vehicles are at storage (32) and all supporting devices (10) are in place along the branches (30, 31) and the hauling cable (13) is stopped;

wherein to move from the system stop configuration, in which the vehicles (3) are stored in storage (32), to the system use configuration, in which the vehicles (3) run along the transport branches (30, 31) in an aerial configuration between stations (14, 31) supported by the at least one supporting cable (2) and hauled by the hauling cable (13),
the method provides the step of:
(c) progressively storing by hauling cable (13) activation all supporting devices (10) into the storage (32) and at the same time progressively feeding the vehicles (3) along the transport branches (30, 31) from the storage (32).

Patentansprüche

1. Luftseilbahntransportsystem (1) zum Transportieren von Passagieren und/oder Fracht, wobei das System umfasst:

- eine erste Endstation (14) und eine zweite Endstation (33);
- ein Zugseil (13), das als ein Ring zwischen den Stationen (14, 33) angeordnet ist, um zwei Zweige (30, 31) mit entgegengesetzter Transportrichtung zu bilden;
- zumindest ein Tragseil (2) für jeden Transportzweig (30, 31) zwischen Stationen (14, 33);
- eine Mehrzahl von Fahrzeugen bzw. Vehikeln (3) zum Transportieren von Passagieren und/oder Gütern, die konfiguriert sind, entlang der Transportzweige (30, 31) in Luftkonfiguration zwischen den Stationen (14, 33) zu verlaufen, und zwar getragen durch das zumindest ein Tragseil (2) und gezogen durch das Zugseil (13);
- eine Mehrzahl von Tragvorrichtungen (10), die konfiguriert sind, das Zugseil (13) während des Stopps des Systems zu tragen, wenn keine Vehikel (3) entlang der Transportzweige (30, 31) verlaufen;

gekennzeichnet durch die Tatsache, dass

- ein Lager bzw. ein Verstauraum (32) zum selektiven Lagern bzw. Verstauen der Tragvorrichtungen (10) während der Nutzung des Systems und der Vehikel (3) während des Stopps des Systems bereitgestellt ist;
- die Tragvorrichtungen (10) entlang der Transportzweige (30, 31) zwischen den Stationen (14, 33) bewegbar sind, und zwar getragen durch das zumindest eine Tragseil (2).

2. System nach Anspruch 1, wobei Vorrichtungen zum Bewegen zu und von dem Lager (32), um Vehikel (3) und Tragvorrichtungen (10) selektiv von einer Station (14) zu dem Lager (32) zu lagern, und zum Zuführen von dem Lager (32) zu der Station (14) von Vehikeln (3) und Tragvorrichtungen (10) bereitgestellt sind.

3. System nach einem der vorhergehenden Ansprüche, wobei jede Tragvorrichtung (10) eine Klemme (36) umfasst, die konfiguriert ist, mit dem Zugseil (13) zwischen den Stationen (14, 33) zu koppeln.

4. System nach Anspruch 3, wobei jedes Vehikel (3) eine Klemme (25) umfasst, die konfiguriert ist, mit dem Zugseil (13) zwischen den Stationen (14, 33) zu koppeln; wobei die Klemmen der Vehikel (25) und die Klemmen (36) der Tragvorrichtungen (10) von der gleichen Art sind.

5. System nach einem der vorhergehenden Ansprüche, wobei jede Tragvorrichtung (10) eine Laufkatze (11) mit Rollen (35) zum Rollen auf dem zumindest einen Tragseil (2) umfasst.

6. System nach Anspruch 5, wobei jedes Vehikel (3) eine Laufkatze (19) umfasst, die mit Rollen (20) zum Rollen auf dem zumindest einen Tragseil (2) ausgestattet ist; wobei die Laufkatzen (19) der Vehikel (3) und die Laufkatzen (11) der Tragvorrichtungen (10) von der gleichen Art sind.

7. System nach einem der vorhergehenden Ansprüche, wobei jede Tragvorrichtung (10) ein Gegengewicht (38) umfasst.

8. System nach Anspruch 7, wobei jede Tragvorrichtung (10) einen Aufhängungsarm (37) umfasst, der sich von der Laufkatze (11) nach unten erstreckt; wobei das Gegengewicht (38) mit dem unteren Ende des Aufhängungsarms (37) gekoppelt ist.

9. System nach Anspruch 8, wobei jedes Vehikel (3) eine Transporteinheit (17) und einen Aufhängungsarm (18) umfasst, der eine Transporteinheit (17) mit der Laufkatze (19) verbindet; wobei die Aufhängungsarme (18) der Vehikel (3) und die Aufhängungsarme (37) der Tragvorrichtungen (10) von der gleichen Art sind.

10. Verfahren zum Betreiben eines Luftseilbahntransportsystems zum Transportieren von Passagieren und/oder Fracht; wobei das Verfahren die Schritte umfasst:

(a) Bereitstellen eines Systems (1) nach Anspruch 1;

wobei zum Wechseln von der Systemverwendungskonfiguration, in der die Vehikel (3) entlang der Transportzweige (30, 31) in einer Luftkonfiguration

zwischen Stationen (14, 33) verlaufen, und zwar getragen durch zumindest ein Tragseil (2) und gezogen durch das Zugseil (13), in die Systemstoppkonfiguration, in der die Vehikel (3) in einem Lager bzw. einem Verstauraum (32) gelagert bzw. verstaut sind, das Verfahren die Schritte bereitstellt:

(b) schrittweises Lagern bzw. Verstauen der Vehikel (3) im Lager (32) und gleichzeitig schrittweises Zuführen der Tragvorrichtungen (10) entlang der Transportzweige (30, 31), bis alle Vehikel im Lager (32) sind und alle Tragvorrichtungen (10) entlang der Zweige (30, 31) platziert sind und das Zugseil (13) gestoppt ist;
wobei zum Bewegen von der Systemstoppkonfiguration, in der die Vehikel (3) im Lager (32) gelagert sind, in die Systemverwendungskonfiguration, in der die Vehikel (3) entlang der Transportzweige (30, 31) in einer Luftkonfiguration zwischen Stationen (14, 31) verlaufen, und zwar getragen durch das zumindest eine Tragseil (2) und gezogen durch das Zugseil (13), das Verfahren den Schritt bereitstellt:
(c) schrittweises Lagern bzw. Verstauen, durch Aktivierung des Zugseils (13), aller Tragvorrichtungen (10) in dem Lager (32) und gleichzeitiges schrittweises Zuführen der Vehikel (3) entlang der Transportzweige (30, 31) aus dem Lager (32).

Revendications

1. Système de transport par câble aérien (1) pour le transport de passagers et/ou de marchandises, le système comprenant :

- une première station terminale (14) et une deuxième station terminale (33) ;
- un câble de traction (13) disposé en anneau entre les stations (14, 33) pour créer deux branches (30, 31) de directions de transport opposées ;
- au moins un câble de support (2) pour chaque branche de transport (30, 31) entre les stations (14, 33) ;
- une pluralité de véhicules (3) de transport de passagers et/ou de marchandises configurés pour circuler le long des branches de transport (30, 31) dans une configuration aérienne entre les stations (14, 33), supportés par le ou les câbles de support (2) et tractés par le câble de traction (13) ;
- une pluralité de dispositifs de support (10) configurés pour supporter le câble de traction (13) pendant l'arrêt du système lorsque les véhicules (3) ne circulent pas le long des branches de transport (30, 31) ;

caractérisé par le fait que :

- un stockage (32) est prévu pour stocker sélectivement les dispositifs de support (10) pendant l'utilisation du système et les véhicules (3) pendant l'arrêt du système ;
- les dispositifs de support (10) sont mobiles le long des branches de transport (30, 31) entre les stations (14, 33), supportés par au moins un câble de support (2).

2. Système selon la revendication 1, dans lequel des dispositifs de déplacement vers et depuis le stockage (32) sont fournis pour stocker sélectivement des véhicules (3) et des dispositifs de support (10) d'une station (14) vers le stockage (32) et pour transférer du stockage (32) vers la station (14) des véhicules (3) et des dispositifs de support (10).

3. Système selon l'une quelconque des revendications précédentes, dans lequel chaque dispositif de support (10) comprend une pince (36) configurée pour être accouplée au câble de traction (13) entre les stations (14, 33).

4. Système selon la revendication 3, dans lequel chaque véhicule (3) comprend une pince (25) configurée pour s'accoupler au câble de traction (13) entre les stations (14, 33) ; les pinces des véhicules (25) et les pinces (36) des dispositifs de support (10) étant du même type.

5. Système selon l'une quelconque des revendications précédentes, dans lequel chaque dispositif de support (10) comprend un chariot (11) comportant des rouleaux (35) destinés à rouler sur le ou les câbles de support (2).

6. Système selon la revendication 5, dans lequel chaque véhicule (3) comprend un chariot (19) équipé de rouleaux (20) pour rouler sur le ou les câbles de support (2) ; les chariots (19) des véhicules (3) et les chariots (11) des dispositifs de support (10) étant du même type.

7. Système selon l'une quelconque des revendications précédentes, dans lequel chaque dispositif de support (10) comprend un contrepoids (38).

8. Système selon la revendication 7, dans lequel chaque dispositif de support (10) comprend un bras de suspension (37) qui s'étend vers le bas depuis le chariot (11) ; le contrepoids (38) étant accouplé à l'extrémité inférieure du bras de suspension (37).

9. Système selon la revendication 8, dans lequel chaque véhicule (3) comprend une unité de transport (17) et un bras de suspension (18) qui relie une unité

de transport (17) au chariot (19) ; les bras de suspension (18) des véhicules (3) et les bras de suspension (37) des dispositifs de support (10) étant du même type.

10. Procédé d'exploitation d'un système de transport par câble aérien pour le transport de passagers et/ou de marchandises ; le procédé comprenant les étapes de :

(a) fourniture d'un système (1) selon la revendication 1 ;

dans lequel, pour passer de la configuration d'utilisation du système, dans laquelle les véhicules (3) circulent le long des branches de transport (30, 31) dans une configuration aérienne entre les stations (14, 33) supportés par le ou les câbles de support (2) et tractés par le câble de traction (13), à la configuration d'arrêt du système, dans laquelle les véhicules (3) sont stockés dans un stockage (32), le procédé comprend l'étape de :

(b) stockage progressif des véhicules (3) dans le stockage (32) et parallèlement, introduction progressive le long des branches de transport (30, 31) des dispositifs de support (10) jusqu'à ce que tous les véhicules soient dans le stockage (32) et que tous les dispositifs de support (10) soient en place le long des branches (30, 31) et que le câble de traction (13) soit arrêté ;
dans lequel, pour passer de la configuration d'arrêt du système, dans laquelle les véhicules (3) sont stockés dans le stockage (32), à la configuration d'utilisation du système, dans laquelle les véhicules (3) circulent le long des branches de transport (30, 31) dans une configuration aérienne entre des stations (14, 31), supportées par au moins un câble de support (2) et tractées par le câble de traction (13), le procédé comprenant l'étape de :
(c) stockage progressif par activation par le câble de traction (13) de tous les dispositifs de support (10) dans le stockage (32) et parallèlement, introduction progressive des véhicules (3) le long des branches de transport (30, 31) depuis le stockage (32).

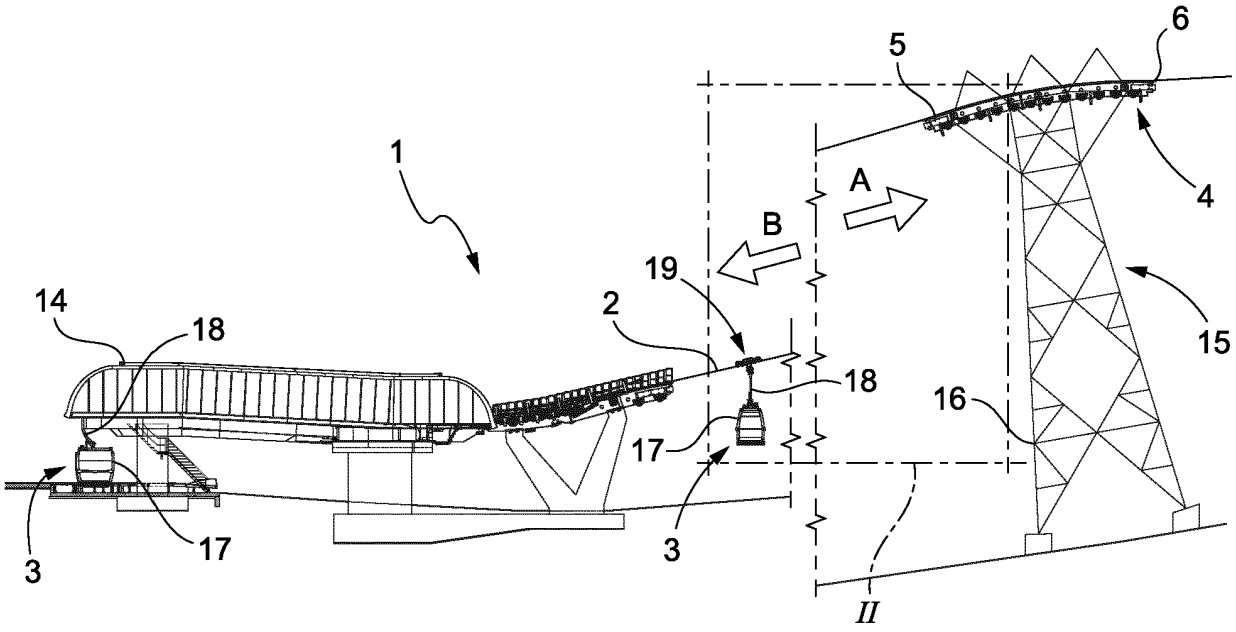

FIG. 1

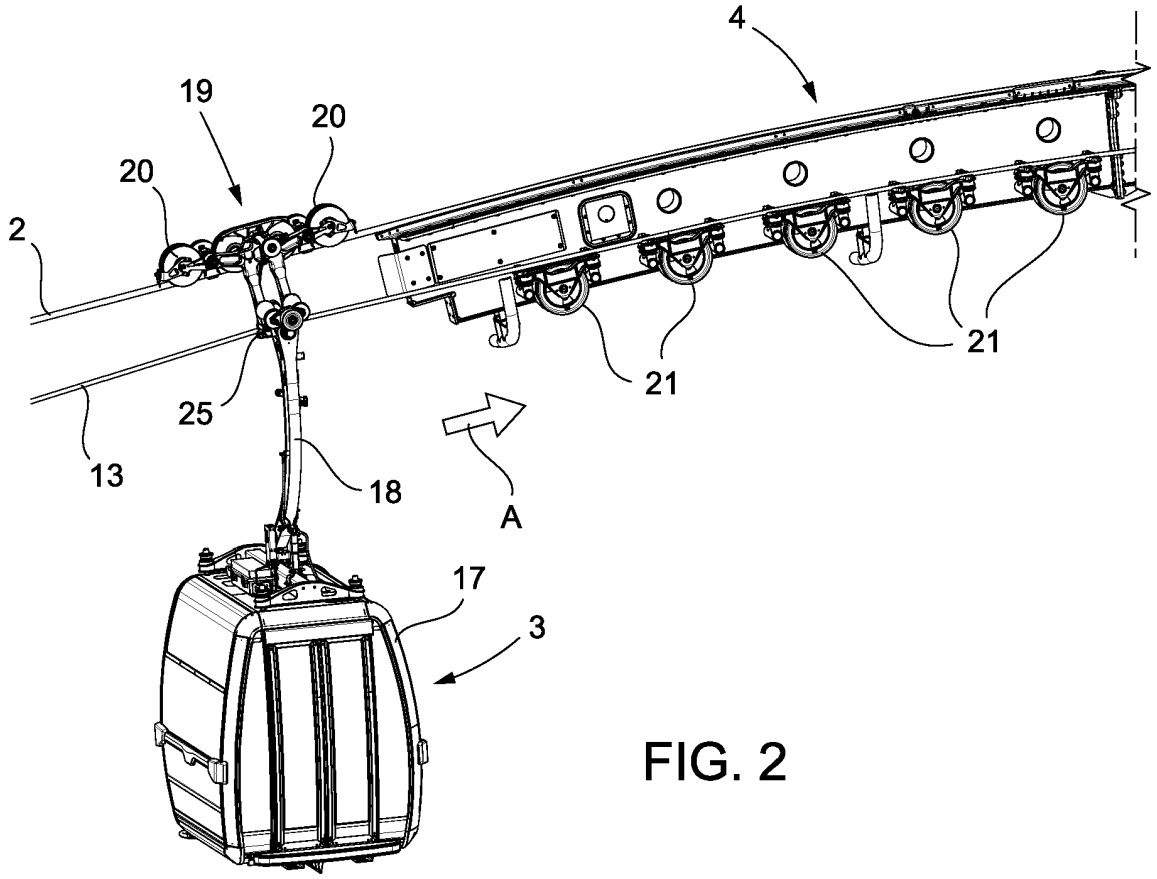

FIG. 2

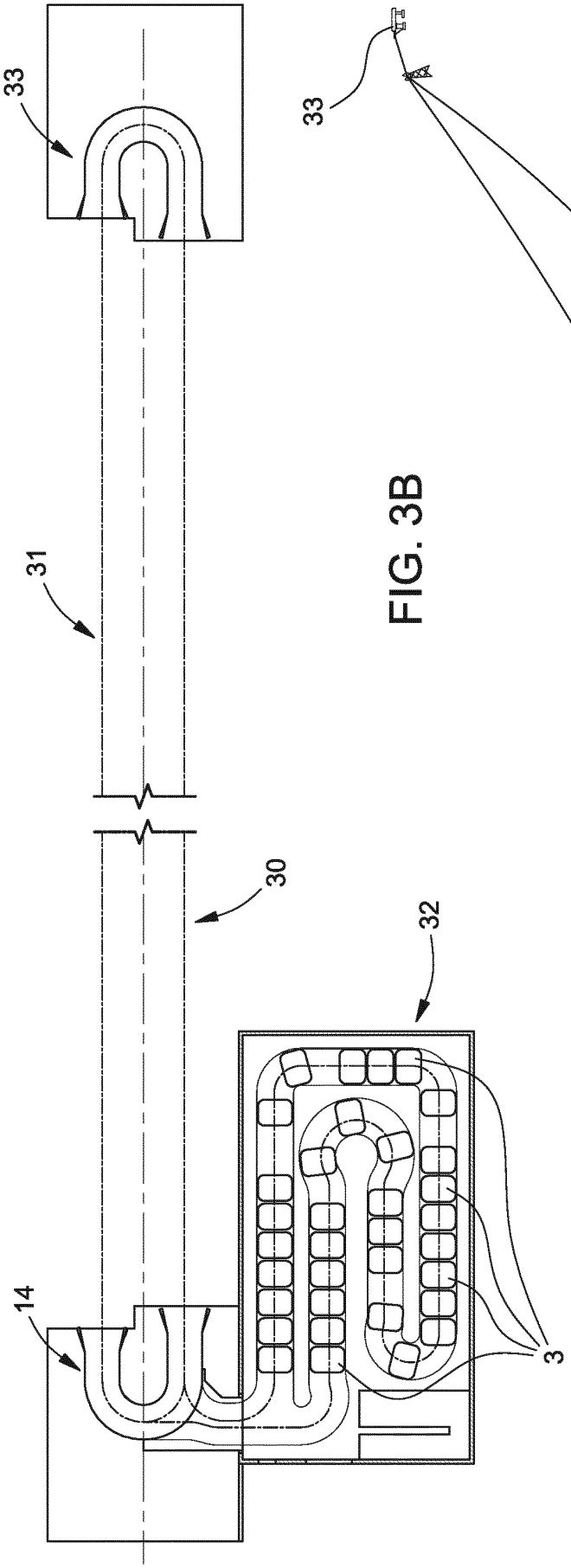

FIG. 3B

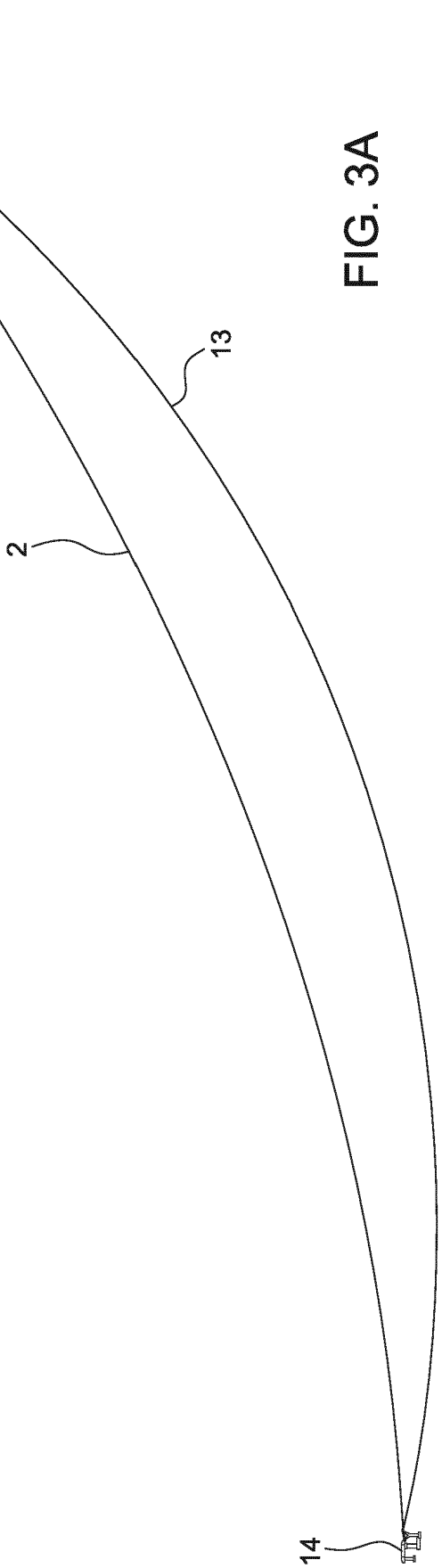

FIG. 3A

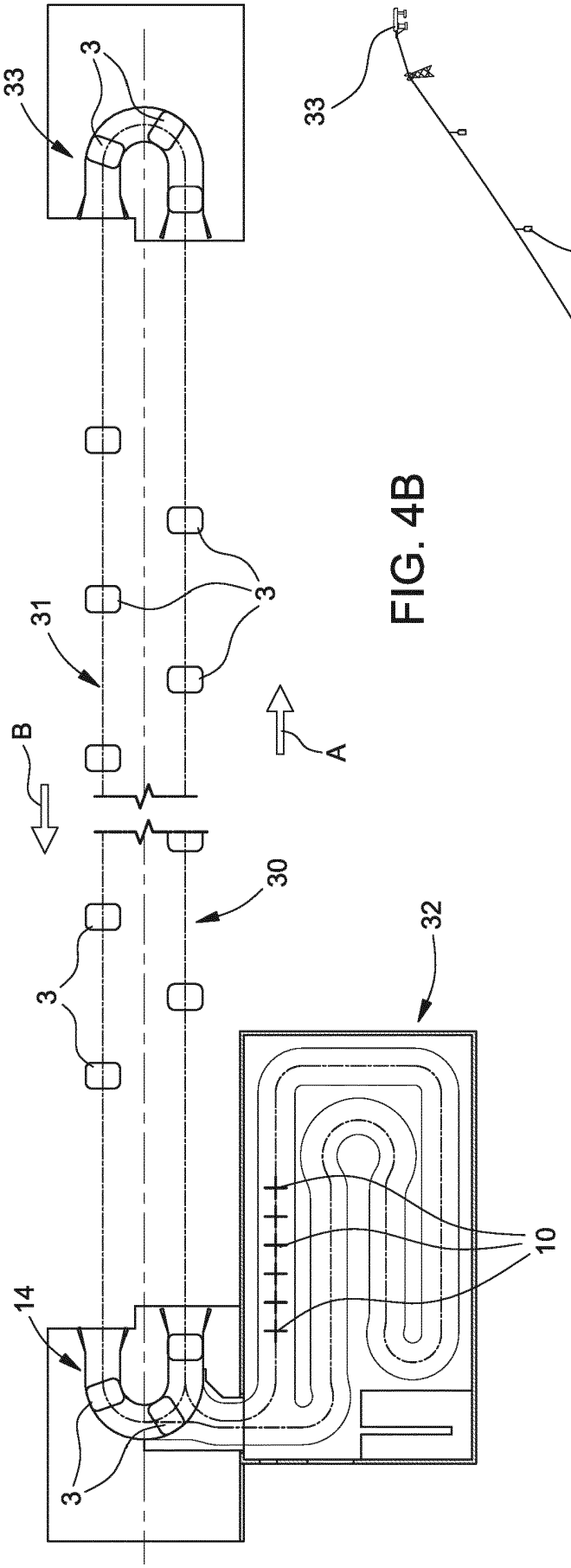

FIG. 4B

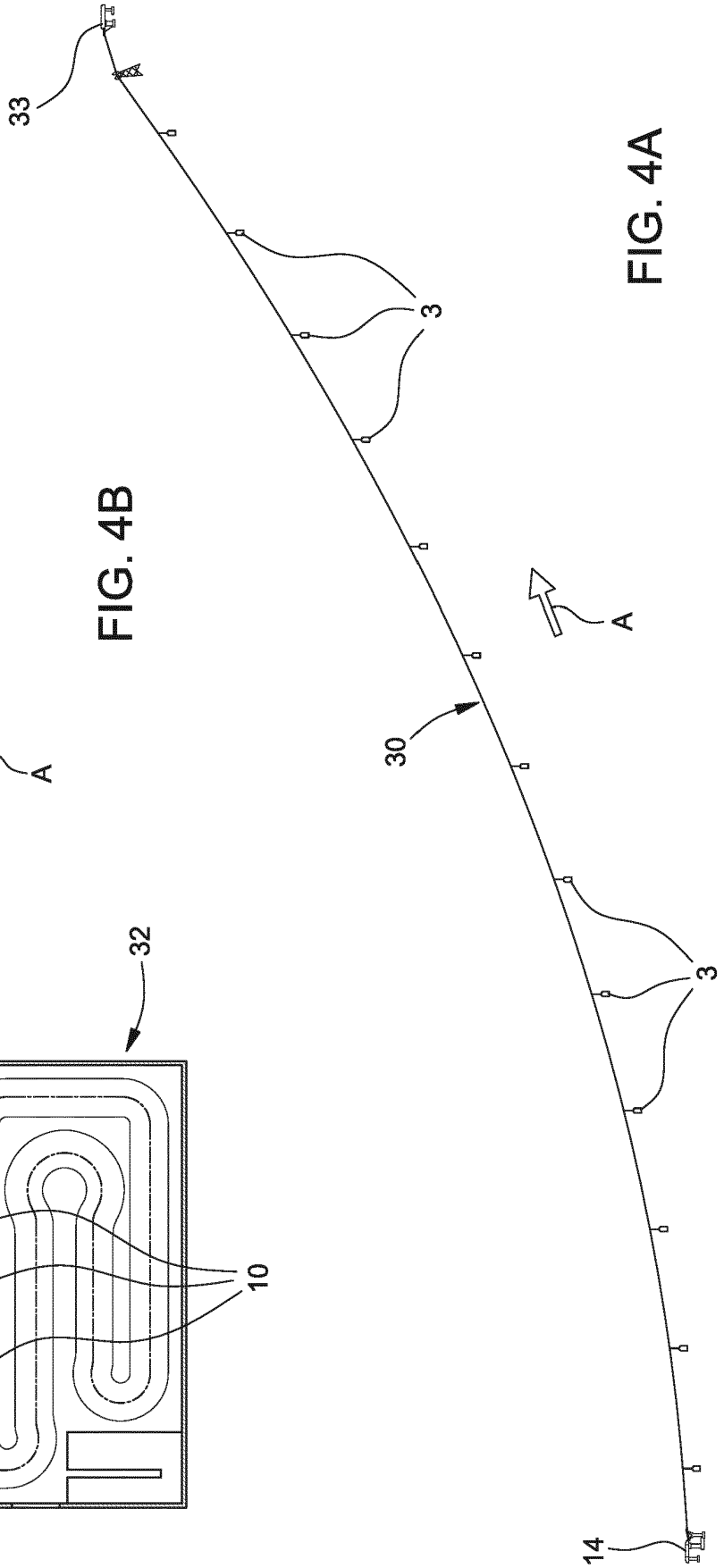

FIG. 4A

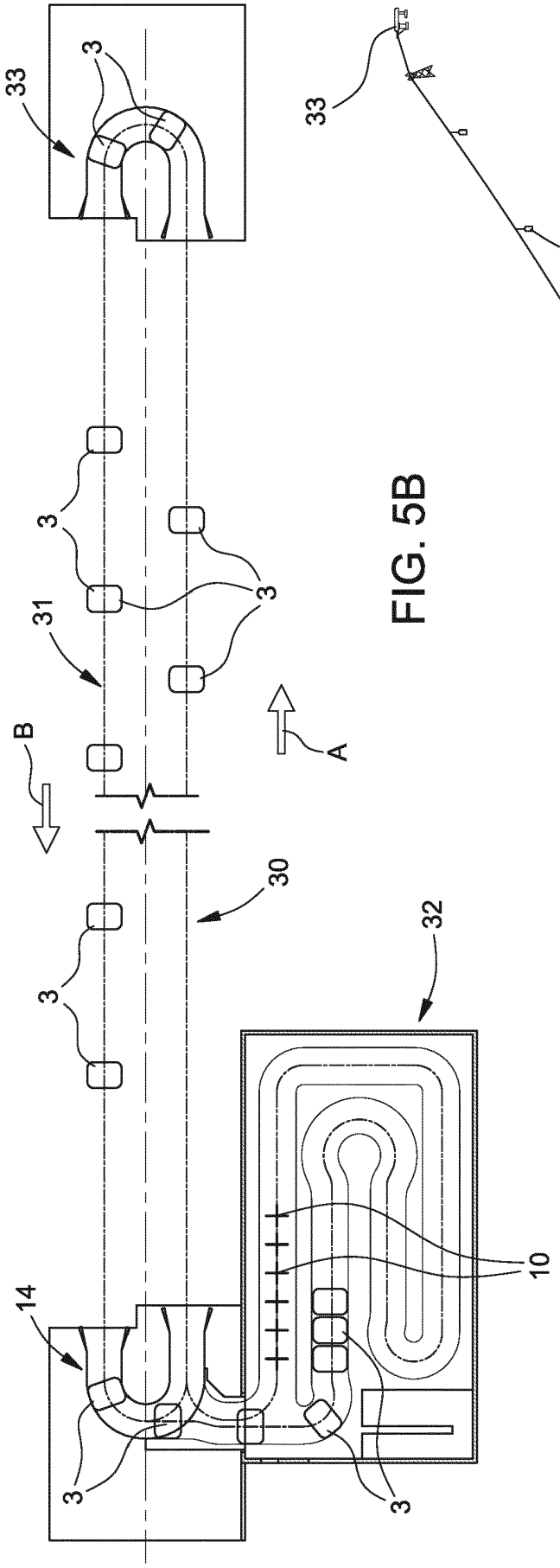

FIG. 5B

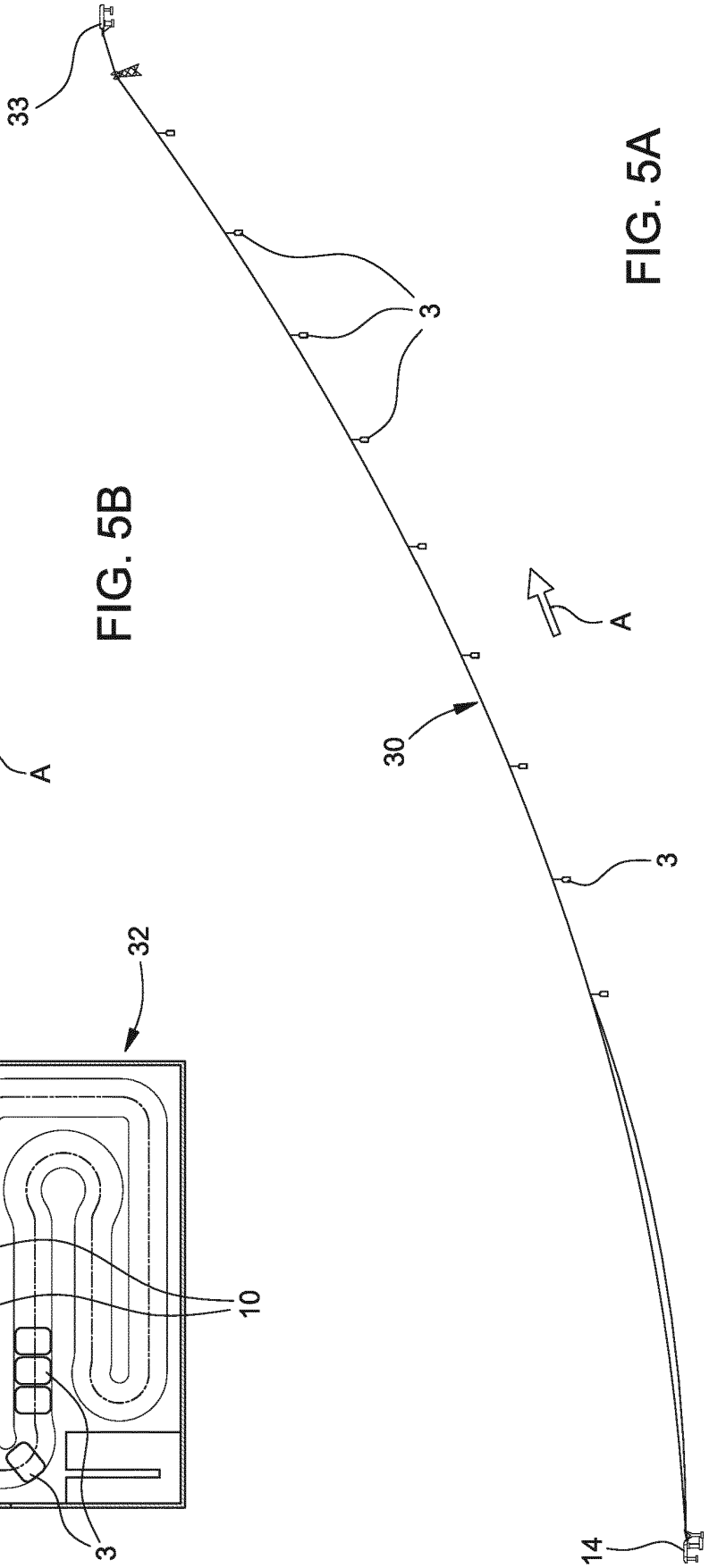

FIG. 5A

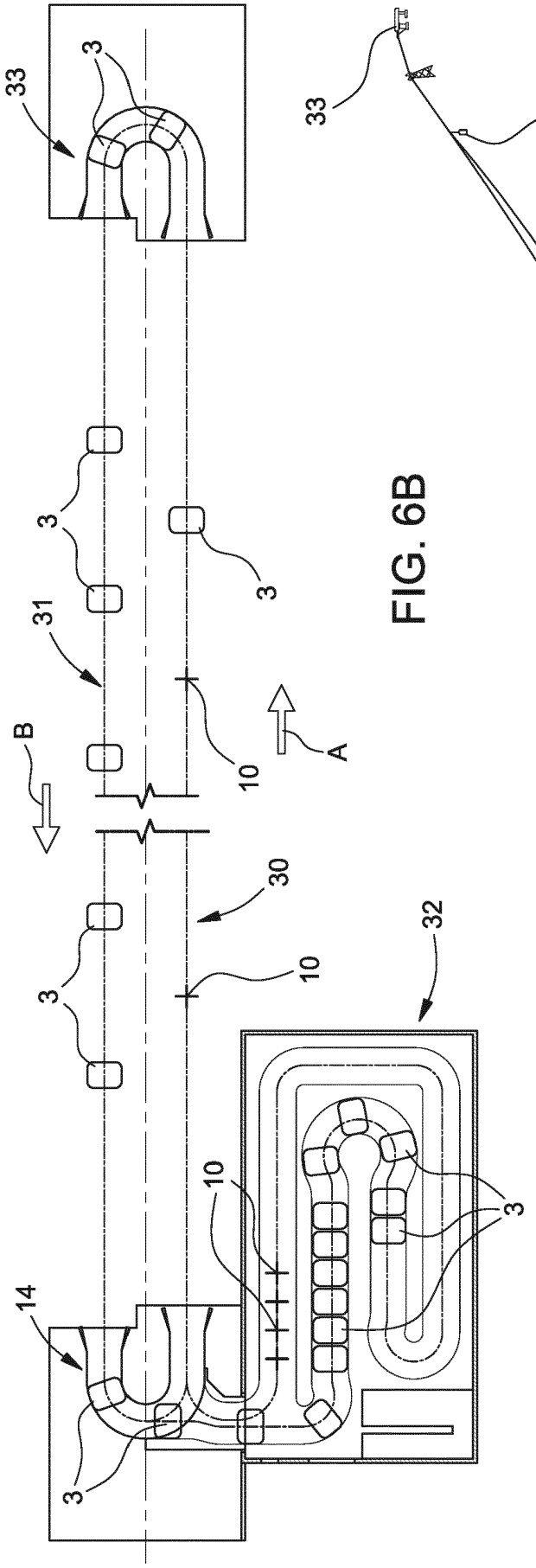

FIG. 6B

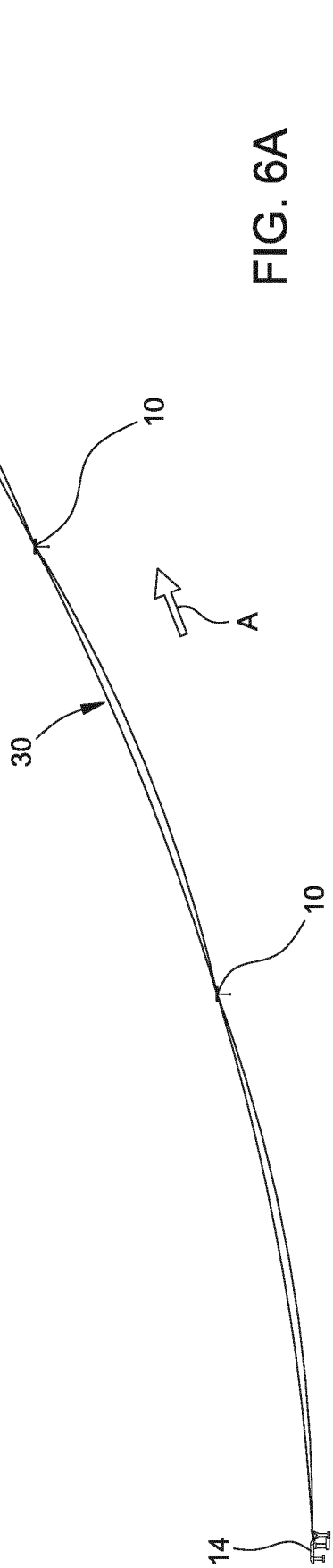

FIG. 6A

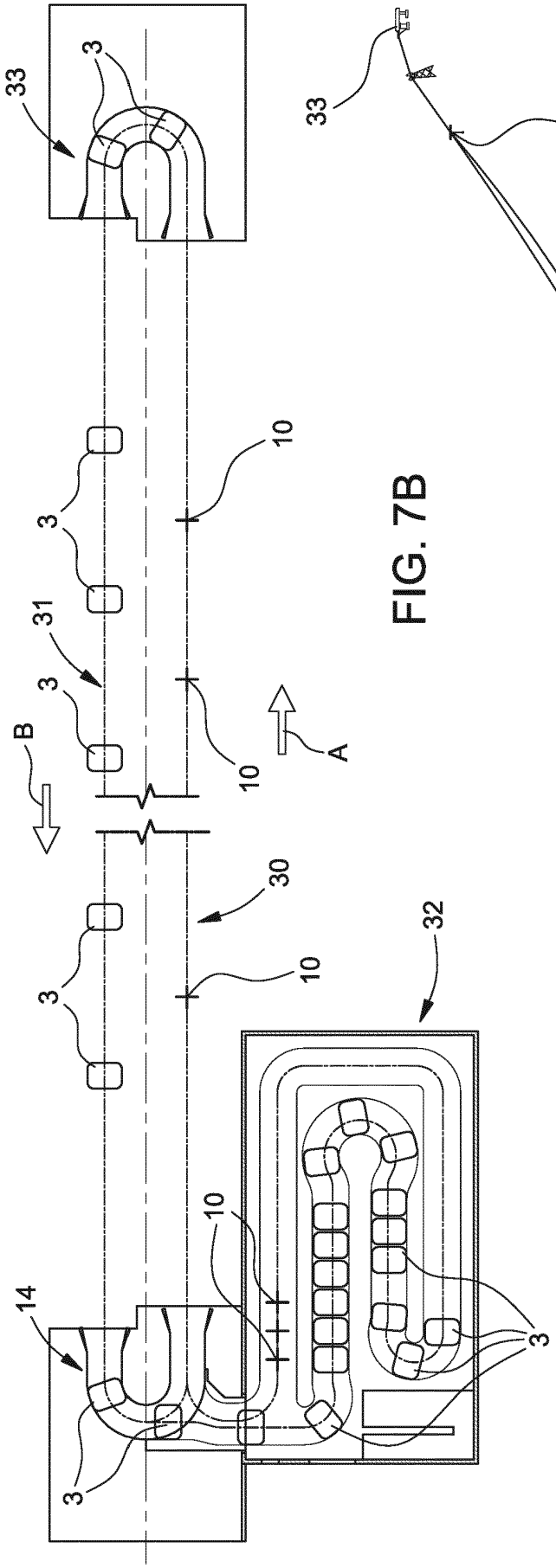

FIG. 7B

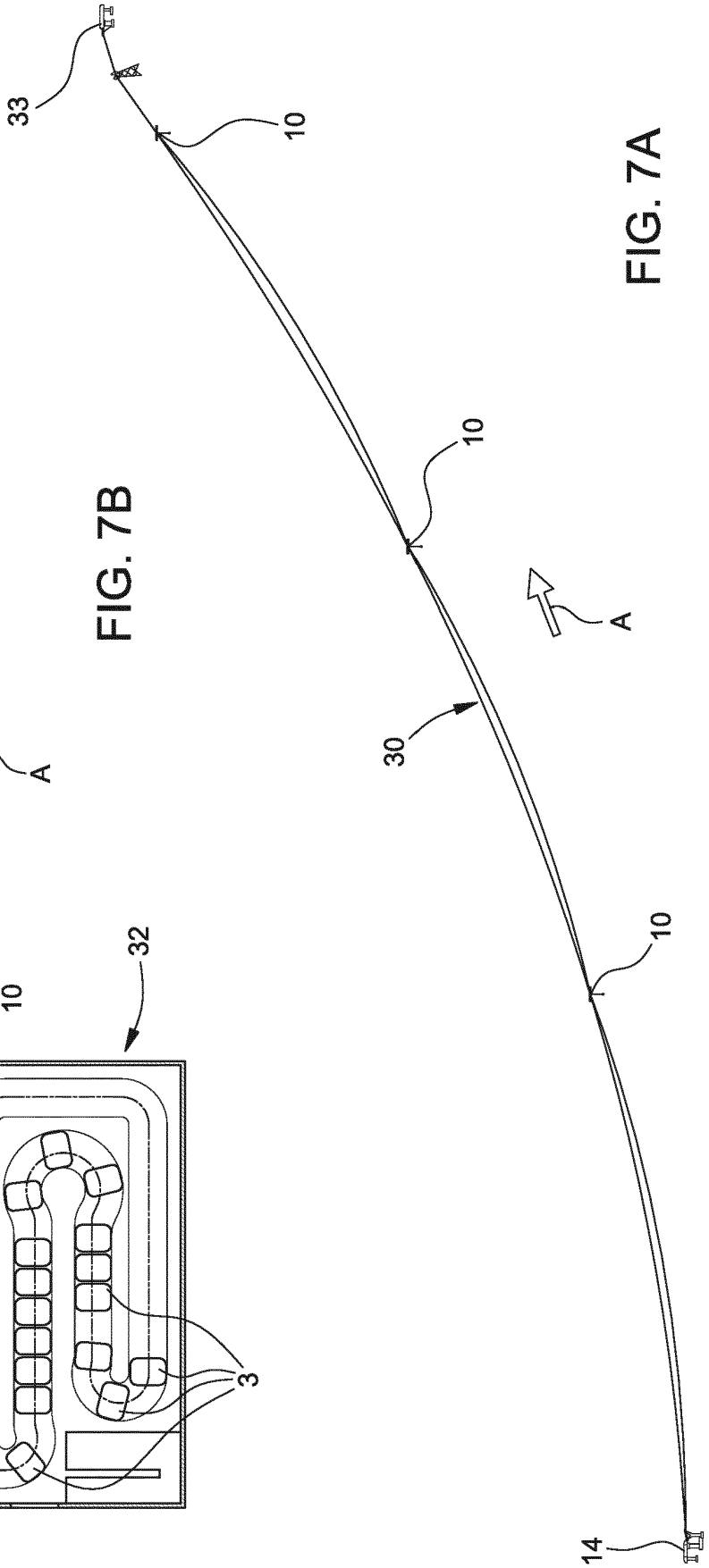

FIG. 7A

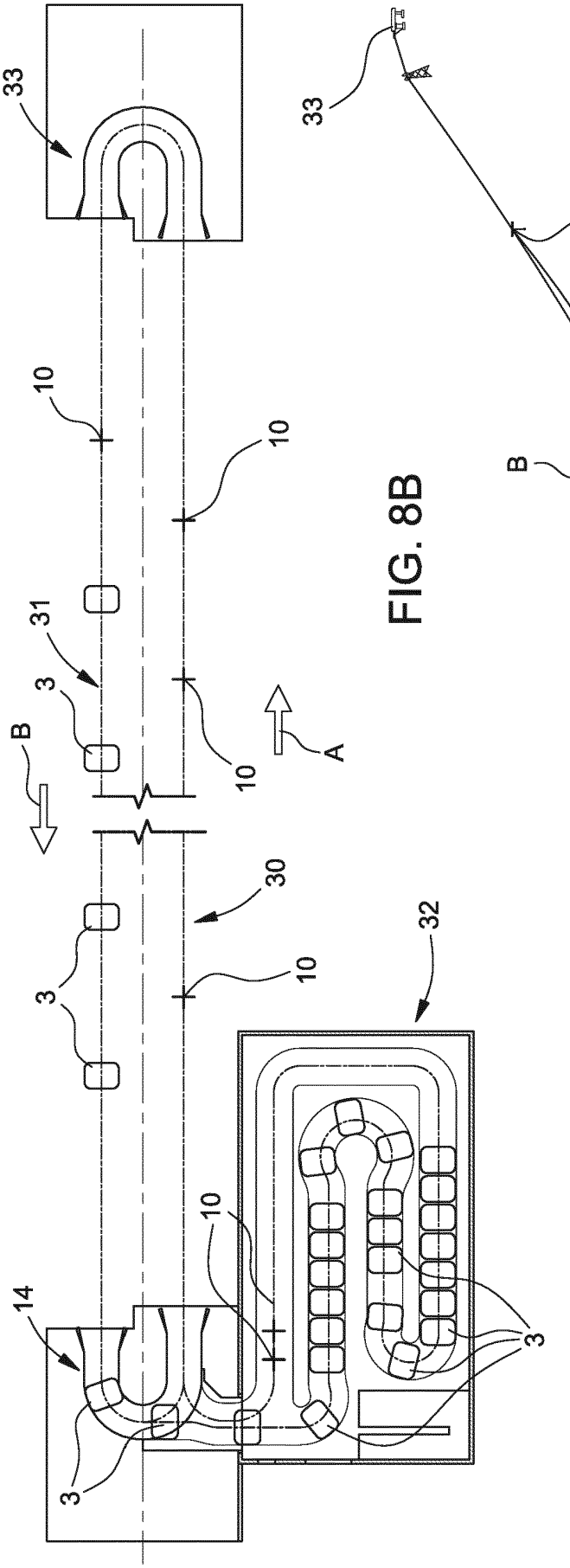

FIG. 8B

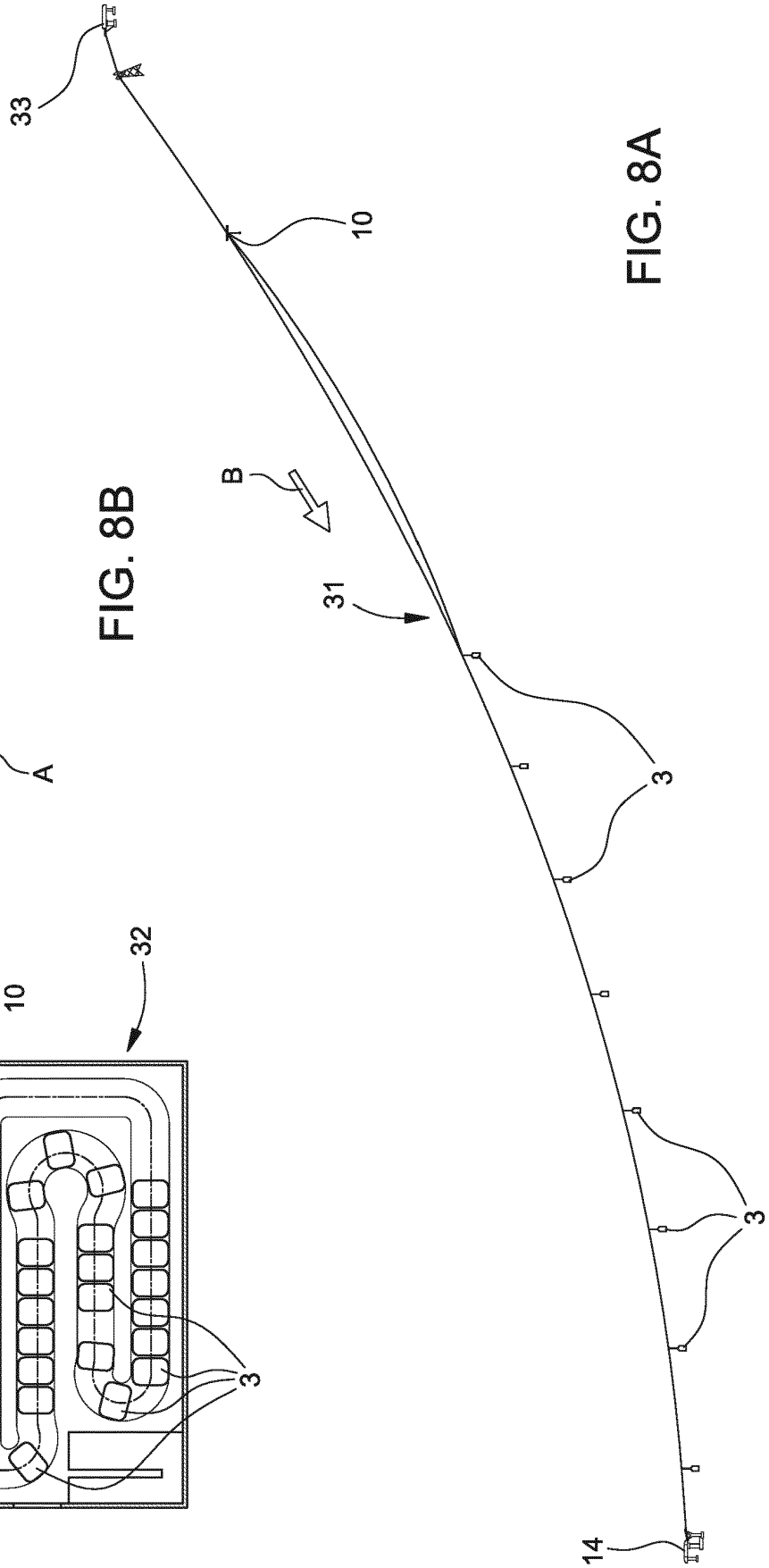

FIG. 8A

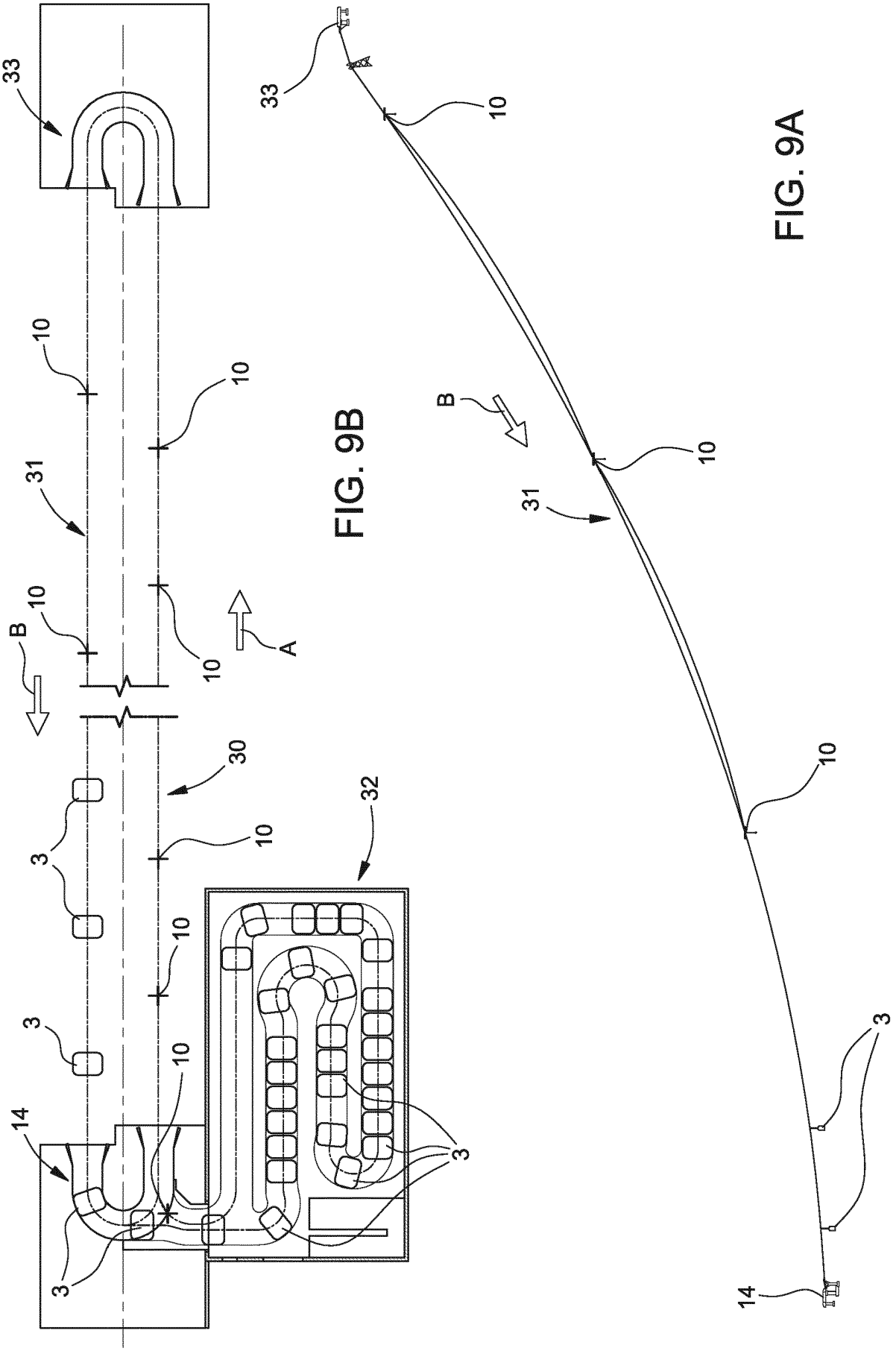

FIG. 9A

FIG. 9B

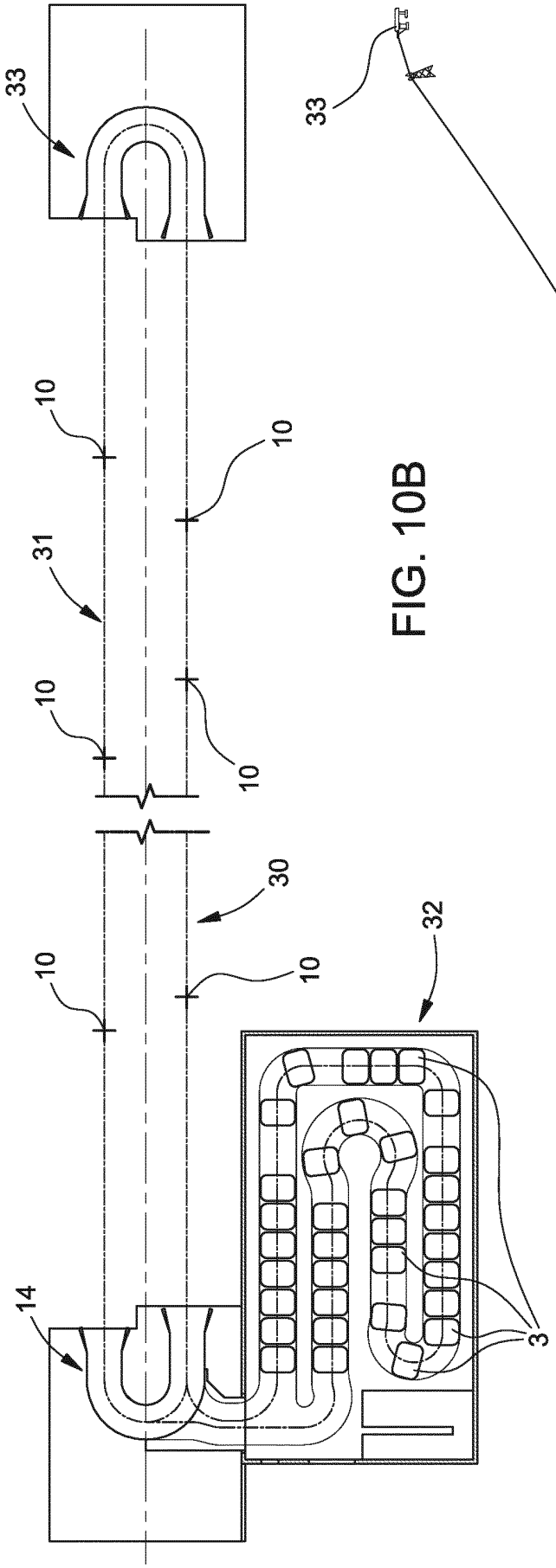

FIG. 10B

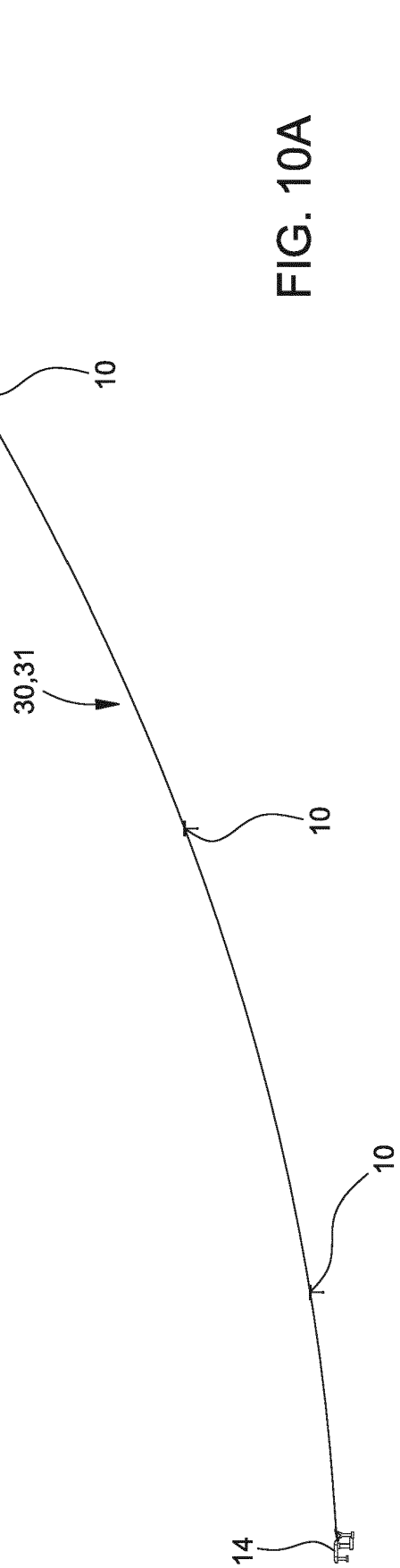

FIG. 10A

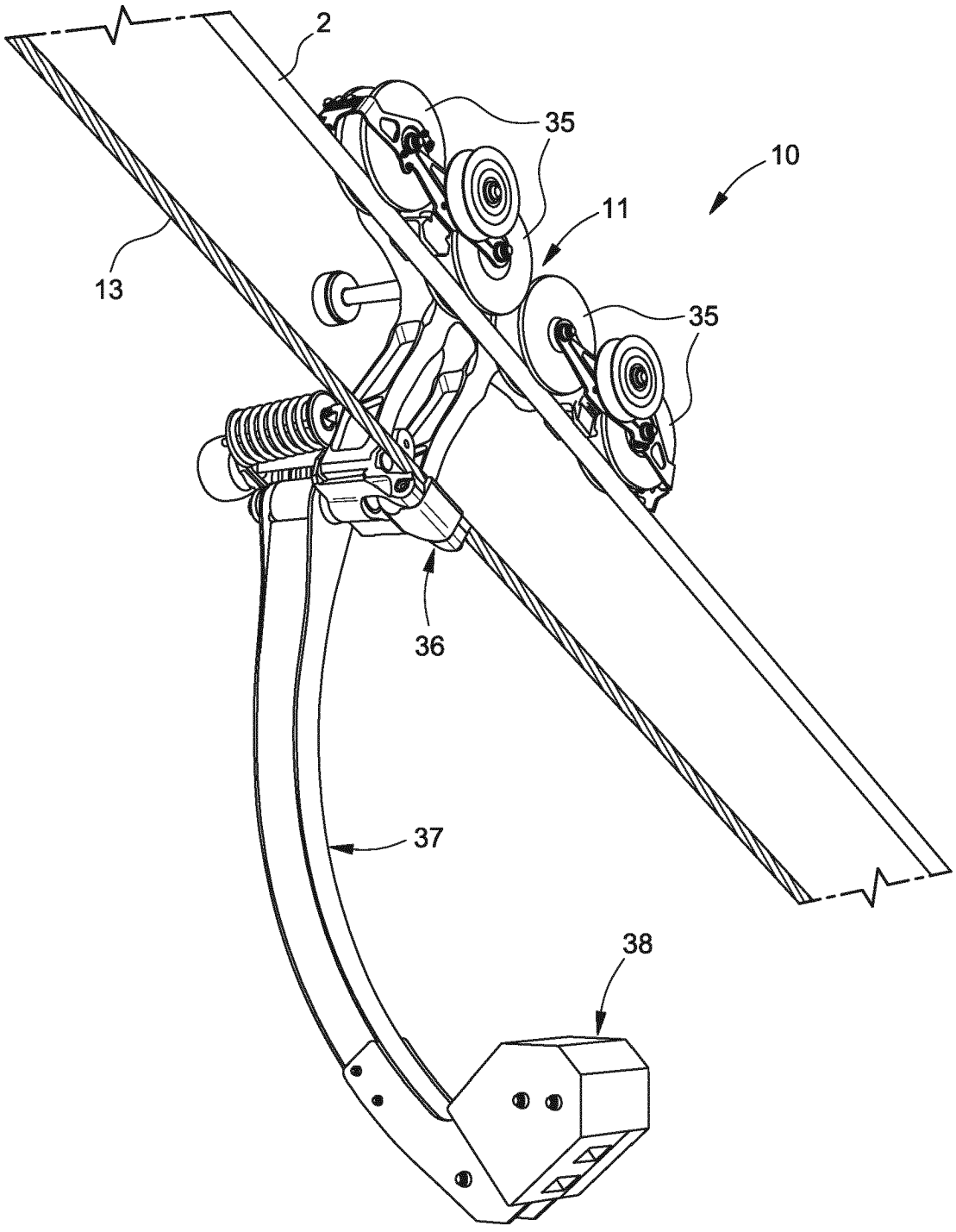

FIG. 11

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- IT 102022000026529 **[0001]**
- US 6363859 B1 **[0010]**