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(54) **MOUNTING DEVICE FOR MOUNTING A PAIR OF BALISES TO A RAILWAY TRACK AND SYSTEM COMPRISING SAID DEVICE**

VORRICHTUNG ZUR MONTAGE EINES BALISENPAARES AM GLEIS UND SYSTEM MIT EINER SOLCHEN VORRICHTUNG

DISPOSITIF DE MONTAGE POUR MONTER UNE PAIRE DE BALISES SUR UNE LIGNE DE CHEMIN DE FER ET SYSTÈME COMPRENANT LEDIT DISPOSITIF

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Description

[0001] The present description concerns the technical field of automatic protection systems of train travel and more specifically it concerns a mounting device for mounting a pair of balises to the sleepers of a track of a railway line or similar, as defined in the preamble of claim 1.

[0002] Automatic protection systems of a train (ATP - "Automatic Train Protection") are systems that have been recently devised in the railway sector that protect train travel moment by moment and that are the culmination of an attempt to harmonise the various European railways. In particular, the SCMT system (*"Sistema di Controllo della Marcia del Treno*") is an Italian design using innovative technology harmonised with the new European Rail Traffic Management System (ERTMS) and transparently supervises the work of the driving crew of the train.

[0003] The aforementioned SCMT system (the same goes for the analogous ERTMS) comprises a Ground Sub-System (SST) that transmits the information and an Onboard Sub-System (SSB) located onboard a train set that receives and processes such information, applying the appropriate protection.

[0004] The Ground Sub-System comprises so-called "balises" or "transponders" that are arranged between the two rails of a railway track. The balises are in practice electronic devices, essentially transponders, that are adapted to transmit the data relative for example to the appearance of the light signals, to the physical characteristics of the railway line or to the slow-down provisions. Typically, balises are divided into two main categories, in other words "programmable balises" and "fixed information content balises".

[0005] Programmable balises are typically connected to a control device comprising an electronic control device called "encoder". The encoder programmes the balises so that at a given moment they can transmit information or a "telegram" that is intended to be received by the Onboard Sub-System.

[0006] Unlike programmable balises, fixed information content balises are not connected to an encoder and typically always transmit the same information or "telegram".

[0007] The balises of the prior art are passive devices that do not require a power source. Indeed, such balises are energised through an electromagnetic field generated by a suitable apparatus installed on the locomotive at the moment when the train set transits in the section of the line at which the balises are installed.

[0008] The information transmitted by the aforementioned Ground Sub-System is processed by the computer of the Onboard Sub-System that controls the automatic intervention of the emergency brakes when the Driving crew does not respect the foreseen travel condition.

[0009] The SCMT automatically intervenes in the case in which the set control limits are not respected, which can for example relate to:

- conditions determined by the light signals,
- maximum speed allowed by the line,
- maximum speed in slowing down state,
- maximum speed allowed by rolling stock.

Further protective measures are carried out by other functionalities implemented in the system.

[0010] The SCMT Design meets the strategic objectives of increasing rail safety and for this reason the steps of development and homogenisation have followed rigorous testing and validation rules established at the European level by CENELEC (European Committee for Electrotechnical Standardization) in particular with regard to systems in which operating safety is an essential objective.

[0011] Precisely for this reason, the CENELEC standards have established methods that make it possible to attribute, according to probability-based parameters, the safety level associated with a system/application, highlighting its associated so-called "SIL" (Safety Integrity Level), on a scale that currently sees level 4 as the one adopted in the strictest applications.

[0012] Concerning in particular the installation of Ground Sub-Systems, it is known to install such systems at predetermined areas along a railway line. For safety reasons the balises are installed in pairs and in a predetermined arrangement in a central part of the track between the two rails. Specifically, it is known to install the balises of the pair independently, normally a distance of about 3m apart, each on a respective support base that is fixed to a sleeper of the track. Concerning this, it is known for example to fix the support bases for the balises by making holes in the sleepers and bolting the support bases to the sleepers themselves. Alternatively, it is known to fix the support bases for the balises through binding strips, like for example so-called "band it" tapes that are wound around the sleeper and suitable fastening elements foreseen on each support base. It should be observed that the installation of the balises must be extremely accurate since it affects the overall efficiency of the automatic protection system. In practice, in order to avoid interruptions in service or in the worst case risks to the means and/or to people, the installation of the balises must be such as to ensure both a particularly strong fastening of the balises and a correct transmission of information between the balises and the other elements of the automatic protection system.

[0013] Concerning in particular "programmable balises", once installed they are connected through electric cables, which pass normally beneath the rails to an encoder that is fixed to a fixed part of the railway infrastructure, like for example a pole or a fixed signalling device situated along the railway line.

[0014] The Ground Sub-Systems discussed above do, however, have some drawbacks. Indeed, such Sub-Systems have a relatively limited flexibility of use that does not make them particularly suitable, for example, for being used in the case of temporary railway worksites

and/or in the case of anomalous situations that require a first quick intervention of workers to ensure the safety of sections of track or areas that have undergone sudden damage.

[0015] A general purpose of the present description is to provide a mounting device for mounting a pair of balises to the sleepers of a track of a railway line that is able to overcome or at least partially reduce the drawbacks discussed above with reference to the prior art.

[0016] This and other purposes are achieved through a mounting device as defined in claim 1 in its most general form, and in the claims dependant on it in some particular embodiments.

[0017] Other objects of the present invention are a group of parts as defined in claim 11 and a system as defined respectively in claims 12 and 13.

[0018] The invention will become clearer from the following detailed description of embodiments thereof, made as an example and therefore in no way limiting in relation to the attached drawings, in which:

- figure 1 shows a partial perspective view of a section of a track of a railway line at which a system, in accordance with a first embodiment, is installed, comprising a mounting device for mounting a pair of balises to the sleepers of a track of a railway line;
- figure 2 shows a side plan view in which a group of parts of the system of figure 1 is shown including the aforementioned mounting device coupled with the sleepers of the track of figure 1, the sleepers being represented in section;
- figure 3 shows a side plan view of the group of parts of figure 2 shown in a first configuration;
- figure 4 shows a side plan view of the group of parts of figure 2 shown in a second configuration;
- figure 5 shows a plan view from above of the mounting device of figure 1;
- figure 6 shows a partial perspective section view of the group of parts of figure 4;
- figure 7 shows a partial perspective view of a section of a track of a railway line at which a system according to a second embodiment and represented in a first operative configuration is installed;
- figure 8 is a perspective view analogous to figure 7 in which the system of figure 7 is represented in a second operative configuration; and
- figure 9 shows a partial perspective section of a group of parts of the system of figures 7 and 8.

[0019] In the attached figures elements that are the same or similar will be indicated with the same reference numerals.

[0020] Initially with reference to figure 1, a system according to a currently preferred embodiment is shown that has been globally indicated with 1. As can be seen in figure 1, the system 1 is installed at a section of a track of a railway line or similar that has been generally indicated with T_R. The section of track T_R illustrated in figure 1 comprises two rails R1, R2 and a plurality of sleepers, in the example of figure 1 seven sleepers (some of which are partially represented in the figure), on which the rails R1, R2 are mounted. In accordance with an embodiment the system 1 is a ground system 1. More specifically, the system 1 is a ground sub-system of an automatic train protection system like for example an ATP ("Automatic Train Protection") system. More specifically, the system 1 is compatible, not for limiting purposes, with the SCMT system ("Sistema di Controllo della Marcia del Treno") and/or with the ERTMS ("European Rail Traffic Management System") system and/or with the SSC (Sistema di Supporto della Condotta, which is an ATP with on-board transmission of information by microwave devices).

[0021] The system 1 represents a mobile warning system for the train and for the driving crew. For this reason it can be defined as a mobile information point. It can be installed near to worksites situated along railway lines, to signal to the driving crew and/or to the train, or more generally to a railway vehicle, driving instructions like for example to slow down, stop, or to go ahead for railway lines equipped with so-called ATP (Automatic Train Protection) systems.

[0022] The system 1 is intended to protect the maintenance workers on the worksite, the means used to carry out the worksite activities and the means of transport even in unforeseen circumstances in order to minimise the consequences of possible human errors. For this reason, the system 1 represents a mobile information point that is particularly suitable for protecting worksites.

[0023] As can be seen in figure 1, the system 1 comprises a first group of parts 10, 11A, 11B and a second group of parts 5.

[0024] The first group of parts 10, 11A, 11B comprises a first and second balise 11A, 11B or transponders 11A, 11B, and a mounting device 10 according to a currently preferred embodiment. In accordance with a preferred embodiment the balises 11A, 11B are both "programmable balises" or variable information content balises. The mounting device 10 allows the balises 11A, 11B to be mounted to the sleepers of the track T_R.

[0025] In accordance with an embodiment, the second group of parts 5 comprises a control and processing unit 6 including an encoder or other electronic control device that is suitable for being operatively connected to the balises 11A, 11B to control/drive such balises 11A, 11B. In practice, the group of parts 5 is a control apparatus 5 of the balises 11A, 11B. According to a preferred embodiment, the second group of parts 5 comprises a mobile support structure 7 to which the unit 6 is fixed. The support structure 7 is preferably a collapsible structure and is able to be removably fixed to the rail R2 of the track T_R through anchoring elements 9.

[0026] Figures 3 and 4 show the aforementioned first group 10, 11A, 11B in two different configurations. More specifically, as can be seen in such figures, in accordance with an advantageous embodiment the mounting device

10 is suitable for taking up a first relatively unfolded configuration (figure 3) and a second relatively compact configuration (figure 4) with respect to the unfolded configuration. For example, the first unfolded configuration is a mounting configuration whereas the second compact configuration is a transportation configuration. In accordance with a preferred embodiment, in the mounting configuration the mounting device 10 has an overall length of about 3m whereas in the transportation configuration the transportation device has an overall length of about 1.5m. In this way, the mounting device 10 can be advantageously transported by a user, for example through a shoulder strap fixed to the mounting device 10.

[0027] With reference to figures 3 and 4, it can be seen that the mounting device 10 comprises a first support base 12A to support the first balise 11A and a second support base 12B to support the second balise 11B. The balises 11A, 11B can be fixed to the support bases 12A, 12B through mounting elements 71A, 71B foreseen in the mounting device 10. In the example the balises 11A, 11B are screwed to the support bases 12A, 12B through mounting screws that pass through perforated spacers 71A, 71B and mounting holes (the mounting screws and the mounting holes are not represented in the figures) that are foreseen on the support bases 12A, 12B. In accordance with an embodiment, the support bases 12A, 12B are platelike support bases that preferably comprise two metallic support plates 12A, 12B. The support bases 12A, 12B are visible from a different angle in figure 5.

[0028] With reference to figures 1, 3 and 4, the mounting device 10 comprises first fastening elements 13A associated with the first support base 12A. The fastening elements 13A allow the mounting device 10, and in particular the support base 12A, to be fixed to a first sleeper T1 of the track T_R. Similarly, the mounting device 10 comprises second fastening elements 13B associated with the second support base 12B to fix the mounting device 10, and more specifically the support base 12B, to a second sleeper T2 of the track T_R. The sleeper T2 is situated a given distance from the first sleeper T1. Such a given distance between the sleepers T1 and T2 corresponds in the example to about 3m.

[0029] As can be seen in the figures, the mounting device 10 also comprises mechanical connection elements 15 arranged between the first and second support base 12A, 12B.

[0030] In accordance with a preferred embodiment the mechanical connection elements 15 comprise at least one hollow tubular member 15. More preferably, in accordance with an embodiment the tubular member 15 comprises a plurality of hollow tubular members 16, 22, 23 interconnected to one another. As can be seen in the figures, in the example the connection elements 15 comprise, not for limiting purposes, a central tubular member 16 and two pairs of side tubular members 22, 23 arranged on opposite sides with respect to the central tubular member 16. The tubular members 16, 22, 23 are interconnected to one another so as to form a telescopic tubular member 15 or telescopic tube 15. In accordance with a preferred embodiment, the two opposite end portions of the telescopic tube 15 are fixed to respective anchoring brackets 26A, 26B. Such brackets 26A, 26B are in turn fixed to the support bases 12A, 12B, preferably through anchoring bolts 81A, 81B (figure 5), in the example four bolts 81A, 81B for each bracket 26A, 26B, so as to be rigidly connected to the support bases 12A, 12B. With reference to figure 5, the bolts 81A, 81B are inserted through respective anchoring holes 82A, 82B, foreseen on the bases 12A, 12B. In accordance with an advantageous embodiment, the anchoring holes 82A, 82B are in a number such as to allow the brackets 26A, 26B to be fixed in a plurality of operative positioned with respect to the support bases 12A, 12B, for example three operative positions. This advantageously allows, if needed, a first rough adjustment of the distance between the support bases 12A, 12B when the mounting device 10 must be fixed to the sleepers T1, T2.

[0031] It should also be observed that, advantageously, in the case in which the mechanical connection elements 15 comprise a telescopic tube 15, the distance between the support bases 12A, 12B and/or the distance between the first and second fastening elements 13A, 13B can be selectively modified between a plurality of operative configurations of the device 10 that are comprised between the aforementioned compact (figure 4) and unfolded (figure 3) configurations by simply shortening or lengthening the telescopic tube 15 in the direction indicated by the double arrow X.

[0032] Going back to figures 3 and 4, in accordance with a preferred embodiment, the first fastening elements 13A comprise first coupling elements 17A to couple the mounting device 10 with the first sleeper T1. The first coupling elements 17A can be selectively moved with respect to the first support base 12A. In accordance with a preferred embodiment, the first coupling elements 17A are quick fastening elements. In accordance with a preferred embodiment, the coupling elements 17A have a generally L-shaped configuration.

[0033] In accordance with a preferred embodiment, the first fastening means 13A comprise first adjustment elements 18A suitable for adjusting the position of the first coupling elements 17A along a first adjustment direction, indicated by the double arrow A1, and second adjustment elements 19A to adjust the position of the first coupling elements 17A along a second adjustment direction, indicated by the double arrow A2. The second adjustment direction A2 is transversal to the first adjustment direction A1 and in the example coincides with the direction X.

[0034] In the example the first coupling elements 17A comprise in particular a clamp 17A whereas the first and second adjustment elements 18A, 19A respectively comprise a first adjustment screw 18A suitable for determining the sliding of the clamp 17A along the direction A1 and a second adjustment screw suitable for determining the sliding of the clamp 17A along the direction A2.

[0035] In accordance with a preferred embodiment, the

first fastening elements 13A comprise second coupling elements 21A to couple the mounting device 10 with the first sleeper T1. As can be seen from the figures, the second coupling elements 21A are coupling elements of a second type that is different with respect to that of the first coupling elements 17A. The second coupling elements 21A preferably comprise a pair of fastening lugs 21A or fastening throats 21A that are rigidly connected to the support base 12A. The fastening throats 21A are suitable for cooperating with binding strips (not represented in the figures), like for example so-called "band it" tapes of the known type, to fix the support base 12A to the sleeper T1. It should be observed that in the example the fastening throats 21A are foreseen in addition to the clamp 17A, and therefore act as auxiliary fastening elements. However, in accordance with an alternative embodiment that is less preferred since it reduces the versatility of use of the device 10, the clamp 17A could not be foreseen and just the fastening throats 21A could be foreseen. In this case, the fastening throats 21A would act as main fastening elements.

[0036] As can be seen for example in figures 3 and 4, in accordance with an embodiment the second fastening elements 13B comprise further first coupling elements 17B, further second coupling elements 21B and further first and second adjustment elements 18B, 19B that are structurally and functionally identical, respectively, to the first coupling elements 17A, to the second coupling elements 21A and to the first and second adjustment elements 18A, 19A and that for this reason will not be described any further here. It should be observed, in particular, that in general the same considerations discussed above with reference to the first fastening elements 13A apply to the second fastening elements 13B.

[0037] Now with reference to figure 6, it can be seen that in accordance with an advantageous embodiment, the mounting device 10 comprises electrical connection elements 36 housed in the telescopic tube 15. The electrical connection elements 36 can be operatively connected, respectively, to the first and second balises 11A, 11B and to the aforementioned encoder or other electronic control device suitable for controlling the first and second balises 11A, 11B. Preferably, the electrical connection elements 36 comprise a pair of electric cables 36 (partially represented in figure 6) that extend in the telescopic tube 15. Each of the electric cables 36 has a cable end portion 36A electrically connected or able to be electrically connected to a respective balise 11A, 11B, and an opposite cable end portion (not represented in the figures) that is connected to an electrical connection portion 15C of the telescopic tube 15. The electrical connection portion 15C is preferably located at a central part of the tube 15 and preferably comprises an electrical connector (not represented) that is suitable for cooperating with electrical connection elements outside the mounting device 10. In accordance with an advantageous embodiment, the electric cables 36 are elastically extensible electric cables.

[0038] We will now describe an example way of installing the mounting device 10 to the track T_R with reference to the embodiment illustrated in the figures. Considering the mounting device 10 initially in the transportation configuration (figure 4), the device 10 can be unfolded manually by a worker until it takes up, for example, the mounting configuration (figure 3). In particular, the support bases 12A, 12B of the mounting device 10 are rested on the respective sleepers T1, T2 with the clamps 17A, 17B a greater distance apart than that of the sleepers T1, T2 so that each of the clamps 17A, 17B is a certain distance from the respective sleeper. Once the support bases 12A, 12B have been positioned on the sleepers T1 and T2, through the adjustment screws 19A, 19B the clamps 17A, 17B are coupled with the sleepers T1, T2 so as to make the mounting device be pulled in the direction X (figure 2). Thereafter, through the adjustment screws 18A, 18B the clamps 17A, 17B are actuated so that each sleeper T1, T2 is clamped between the relative clamp 17A, 17B and the relative support base 12A, 12B. At this point the group 10, 11A, 11B is in the configuration illustrated in figure 2 in which it is firmly anchored to the sleepers T1, T2 and in which it is prevented from moving in the directions X and A1. It is clear that in the configuration of figure 2 movements of the group 10, 11A, 11B are also prevented also in the direction perpendicular to the directions X and A1, in other words movements in the direction Y of figure 5, considering the device represented in such a figure in the fastening condition to the sleepers T1,T2. Alternatively, if for example the sleepers T1, T2 are a different distance apart from that foreseen and such as not to allow the clamps 17A, 17B to be used effectively, the mounting device 10 can advantageously be fixed to the sleepers T1, T2 using the aforementioned binding strips and the fastening throats 21A, 21B.

[0039] With reference to figure 1, once the mounting device 10 has been fixed to the sleepers of the track T_R, the electrical connection between the encoder of the unit 6 and the balises 11A, 11B can be made through further electric cables 81 able to be removably connected to the electrical connection portion 15C of the telescopic tube 15.

[0040] Now with reference to figures 7 and 8, a system according to a further currently preferred embodiment is illustrated that has been globally indicated with 101. As can be seen in such figures, the system 101 is installed at a section of the track T_R. In accordance with an embodiment the system 101 is a ground system 101. More specifically, the system 101 is a ground sub-system of an automatic protection system of the train like for example an ATP ("Automatic Train Protection") system. More specifically, the system 101 is compatible, not for limiting purposes, with the SCMT (*"Sistema di Controllo della Marcia del Treno"*) system and/or with the ERTMS ("European Rail Traffic Management System") system and/or with the SSC (*Sistema di Supporto alla Condotta,* which is an ATP with on-board transmission of information by microwave devices). The system 101 represents a mo-

bile warning system for the train and the driving crew. For this reason it can be defined as a mobile information point. The system 101 is particularly effective in anomalous situations that require a first quick intervention of workers to ensure the safety of sections of track or areas that have undergone sudden damage and that will, thereafter, undergo appropriate extraordinary maintenance work.

[0041] This can occur for example following landslides, rockfalls, floods, losses of the transported load etc.. In such situations, it is typically necessary for the system 101 to transmit information on the state of the line to the computer of the onboard sub-system foreseen onboard a train set only until the performance of the section of the railway line involved have been appropriately restored.

[0042] Again with reference to figures 7 and 8, the system 101 comprises a group of parts 110, 11C, 11D, 127C, 127D and a manoeuvring apparatus 105. The group of parts 110, 11C, 11D, 127C, 127D corresponds to a further embodiment of the group of parts 10, 11A, 11B discussed above.

[0043] The group of parts 110, 11C, 11D, 127C, 127D comprises a third and a fourth balise 11C, 11D, and a mounting device 110 according to a further advantageous embodiment. In accordance with a preferred embodiment, the balises 11C, 11D are both "fixed information content balises". The mounting device 110 allows the balises 11C, 11D to be mounted to the sleepers of the track T_R.

[0044] In accordance with a preferred embodiment, the mounting device 110 has a general structure almost identical to that described above in relation to the mounting device 10. In other words, in the example described here the mounting device 110 comprises a first and a second support base identical to the bases 12A, 12B, first and second fastening elements identical to the fastening elements 13A, 13B, and a telescopic tube 115 substantially identical to the telescopic tube 15. For this reason such elements will not be described in greater detail here.

[0045] The installation of the mounting device 110 is also analogous to that of the device 10 and it will not be repeated here.

[0046] With reference to figure 9, it can be seen that the mounting device 110 differs from the mounting device 10 mainly in that the telescopic tube 115 houses mechanical transmission elements 136 inside it instead of the electric cables 36.

[0047] In accordance with a preferred embodiment, the mechanical transmission elements 136 comprise a first transmission shaft 136A housed in the central tubular member 16, a second transmission shaft 136B housed in the tubular member 22 and a transmission screw 136C, or nut screw 136C, housed in the tubular member 23. The shafts 136A, 136B and the screw 136C are arranged coaxial to each other and are rotatably mounted in the telescopic tube 115 so as to be able to rotate about a rotation axis

[0048] ZZ.

[0049] Advantageously, the shaft 136A has a polygonal outer profile. In the example, the shaft 136A in particular has a hexagonal outer shape.

[0050] The shaft 136B also has a polygonal outer profile, in the example hexagonal. As can be seen in figure 9, the polygonal outer profile of the shaft 136B has larger dimensions with respect to the polygonal outer profile of the shaft 136A. Moreover, the shaft 136B is a hollow shaft having a cavity (not represented in the figures) defined by a portion of the shaft 136B that is counter-shaped with respect to the polygonal outer profile of the shaft 136A. In particular, the shaft 136A and the shaft 136B are coupled together so as to allow the sliding of the shaft 136A in the cavity of the shaft 136B, and so as to create a mechanical coupling between them to allow the transmission of motion between the shafts 136A and 136B following the rotation of the shaft 136A about the axis ZZ.

[0051] The transmission screw 136C is also hollow and has a screw cavity (not represented in the figures) defined by a polygonal screw portion that is counter-shaped with respect to the polygonal outer profile of the shaft 136B. The shaft 136B and the screw 136C are coupled together in an analogous way to that discussed above with reference to the shafts 136A, 136B. In other words, the transmission screw 136C and the shaft 136B are coupled together so as to allow the sliding of the shaft 136B in the screw cavity and so as to create a mechanical coupling with each other to allow the transmission of motion between the shaft 136B and the transmission screw 136C following the rotation of the shaft 136B about the axis ZZ.

[0052] Thanks to the aforementioned way of coupling between the shafts 136A, 136B and the transmission screw 136C it is advantageously possible both to carry out the transmission of motion between such elements and to make the mounting device 110 take up, respectively, an unfolded configuration and a compact configuration analogous to those described above with reference to the mounting device 10 (figures 3 and 4).

[0053] In accordance with an embodiment, in order to drive the rotation of the shafts 136A, 136B and of the transmission screw 136C the mounting device 110 comprises transmission gears 141, 142, that are arranged at a mechanical connection portion 115D provided on the telescopic tube 115. In accordance with an embodiment the transmission gears 141, 142 comprise a pair of conical gear wheels 141, 142 coupled together. The wheel 141 is suitable for being actuated from the outside of the telescopic tube 115 through a transmission portion 143 fixedly connected to the wheel 141. The wheel 142 rotates as a unit with the shaft 136A so as to set the shaft 136A in rotation about the axis ZZ.

[0054] With reference to figures 7 and 8, it can be seen that in accordance with an embodiment the mounting device 110 comprises a first and second shielding member 127C, 127D or shields 127C, 127D preferably shaped like a box. The shields 127C, 127D are used to shield the balises 11C, 11D so as to prevent, when desired, the transmission of information between the balises 11C,

11D and an onboard system present on a train set and suitable for cooperating with the balises 11C, 11D.

[0055] In accordance with an embodiment, the mechanical transmission elements 136 are connected or can be connected to the shields 127C, 127D to move such shields 127C, 127D between a first shielding configuration (figure 7), in which the shields 127C, 127D are suitable for shielding the balises 11C, 11D so as to prevent the transmission of information between the balises 11C, 11D and an onboard system of a train set suitable for cooperating with such balises, and a non-shielding configuration (figure 8), in which the shields 127C, 127D allow the transmission of information between the balises 11C, 11D and an onboard system of a train set suitable for cooperating with the balises 11C, 11D.

[0056] Going back to figure 9, the mounting device 110 comprises two connection plates 151 (just one of such plates is visible in figure 9) that are coupled with the transmission screw 136C through a threaded connection 152. The connection plates 151 are arranged symmetrically with respect to the threaded connection 152. The plates 151 are in turn rigidly connected to the shield 127D through suitable connection elements or thicknesses (not illustrated in the figures) that are suitable for keeping the shield 127D a given distance from the telescopic tube 115 in order to avoid mechanical interference with the latter. Specifically, the shield 127D comprises an upper wall 128 and a parallel lower wall (not represented) that are joined together through a side wall 129. The aforementioned connection elements are respectively fixed to the plates 151 and to the lower wall of the shield 127D. Such a lower wall (not represented) in particular has a shaped edge so as to avoid mechanically interfering with parts of the mounting device 110 when the shield 127D takes up the aforementioned shielding configuration (figures 7 and 9). By rotating the transmission screw 136C it is thus possible to determine the translation of the shield 127D in the direction of the axis ZZ. Preferably, in order to allow the translation of the plates 151 some sliding grooves (not represented) are foreseen laterally on the tubular member 23.

[0057] In order to allow the movement of the shield 127C, the transmission elements 136 comprise a further conical gear wheel (not represented) coupled with the wheel 141 and analogous to the wheel 142. Moreover, the transmission elements 136 comprise further transmission elements (not represented in the figures) that are structurally and operatively identical to the transmission shafts 136A, 136B and to the transmission screw 136C. Such further transmission elements are connected to the shield 127C through further connection elements that are structurally and operatively identical to those described above with reference to the shield 127D. Such further transmission elements and further connection elements, which are housed in the part of the telescopic tube 115 that is not shown in figure 9, are not therefore described any further here.

[0058] With reference to figures 7 and 8, the manoeuvring apparatus 105 or control apparatus 105 is operatively connected to the shields 127C, 127D through the aforementioned mechanical transmission elements 136. According to an embodiment, the manoeuvring apparatus 105 comprises a mobile support structure 70. The support structure 70, which is preferably a collapsible structure, in figures 7 and 8 is removably fixed to the rail R2 through anchoring elements 90 that in the example are identical to the aforementioned anchoring elements 9. As can be seen in figures 7 and 8, in the operative conditions the manoeuvring apparatus 105 is arranged on the ballast laterally with respect to the track T_R.

[0059] In accordance with a preferred embodiment, the apparatus 105 comprises a manoeuvring element 106, or manoeuvring lever 106, which in the operative condition of the system 101 is operatively connected to the mechanical transmission elements 136 housed in the mounting device 110. Preferably, the lever 106 can be connected to the transmission elements 136 through a transmission group 107 and suitable intermediate control elements 108, 109. Preferably, the transmission group 107 comprises a gearbox 107 whereas the intermediate control elements 108, 109 comprise articulated arms 108, 109 removably connected through a mechanical joint to the transmission portion 143 (figure 9) associated with the gear wheel 143.

[0060] From what has been outlined above it can thus be understood that by actuating the manoeuvring lever 106, it is possible to move the shields 127C, 127D. In practice, the lever 106 can be moved between a first operative position (figure 7) and a second operative position (figure 8) that are preferably angularly spaced apart by about 90°. In particular, the first and second operative position of the lever 106 respectively correspond to the aforementioned shielding configuration (figure 7) and non-shielding configuration (figure 8) of the shields 127C, 127D. In accordance with a preferred embodiment, for safety reasons the lever 106 can be selectively locked at least in one of the aforementioned first and second operative positions. This can be carried out for example through a suitable locking pin (not represented) that can be removably coupled with the transmission group 107 so as to mechanically interfere with the latter.

[0061] It should be observed that numerous modifications and/or variants can be brought to a mounting device and/or to systems according to the present description.

[0062] In accordance with an embodiment, the telescopic tubes 15, 115 can be replaced by non-telescopic tubes. For example, in accordance with an embodiment the telescopic tubes 15, 115 can be replaced by a plurality of tubular members connected together in an articulated manner. Such tubular members can for example be connected through articulated mechanical joints so that the mounting devices 10, 110 are suitable for taking up a compact configuration and an unfolded configuration. In this case both the electrical connection elements 36 and the mechanical transmission elements 136 can in any case be housed in the tubular members.

[0063] In accordance with a less preferred embodiment, since it makes the transportation of the mounting devices 10, 110 less easy, each of the telescopic tubes 15, 115 can be replaced for example by a rigid tubular member having a predetermined and non-adjustable fixed length. In this case just the distance between the first and second fastening elements 13A, 13B can be varied.

[0064] In accordance with a less preferred embodiment, each of the telescopic tubes 15, 115 can be replaced for example by a non-hollow connection element, for example a full shaft. In this case just the distance between the first and second fastening elements 13A, 13B can be varied. Moreover, in this case the electrical connection elements 36 or the transmission elements 136 must be arranged on the track without being protected inside a tubular structure.

[0065] In other words, in general it is sufficient for the distance between the first and the second fastening elements 13A, 13B of the mounting devices 10, 110 to be able to be selectively modified. This can be carried out by providing mobile fastening elements 13A, 13B and/or by providing mechanical connection elements 15, 115 suitable for respectively taking up a compact configuration and an unfolded configuration.

[0066] It should also be observed that in accordance with an advantageous embodiment, the mounting devices 10, 110 and/or the systems 1, 101 described above can be made at least in part using composite materials and/or light alloys.

[0067] Based on what has been described above, it is therefore possible to understand how a mounting device for mounting a pair of balises to the sleepers of a track according to the present description allows the aforementioned purposes to be accomplished.

[0068] Thanks to the possibility of selectively varying the distance between the first and second fastening elements of a mounting device according to the present description, it is possible to fix the balises to the sleepers in a particularly practical and effective manner virtually irrespective of the type of sleepers that may be present on the section of track considered and of the distances at which the sleepers themselves are arranged. Moreover, a mounting device according to the present description is a device having particularly versatile use and it is very practical to transport, which makes it a device that is particularly suitable in the case of temporary railway worksites.

[0069] Without affecting the principle of the invention, the embodiments and the details can be widely varied with respect to what has been described and illustrated purely as a non-limiting example, without for this reason departing from the scope of the invention as defined in the attached claims.

Claims

1. Mounting device (10; 110) for mounting a pair of balise (11A, 11B; 11C, 11D) to the sleepers (T1, T2) of a track (T_R) of a railway line or similar, comprising:

   - a first support base (12A) to support a first balise (11A) of said pair;
   - first fastening elements (13A) associated with the first support base (12A) to fix the mounting device (10; 110) to a first sleeper (T1) of said track (T_R); **characterised in that** it comprises:
   - a second support base (12B) to support a second balise (11B) of said pair;
   - second fastening elements (13B) associated with the second support base (12B) to fix the mounting device (10; 110) to a second sleeper (T2) of said track (T_R) that is located a given distance from the first sleeper (T1); and
   - mechanical connection elements (15, 115) interposed between said first and second support base (12A, 12B); the distance between the first and the second fastening elements (13A, 13B) being selectively modifiable.

2. Mounting device (10; 110) according to claim 1, suitable for taking up a first relatively unfolded configuration and a second relatively compact configuration with respect to said unfolded configuration.

3. Mounting device (10; 110) according to claim 2, wherein the compact configuration is a transportation configuration and wherein the unfolded configuration is a mounting configuration.

4. Mounting device (10; 110) according to any one of the previous claims, wherein said mechanical connection elements (15, 115) comprise at least one hollow tubular member.

5. Mounting device (10; 110) according to any one of the previous claims, wherein the first fastening elements (13A) comprise first coupling elements (17A) to couple the mounting device (10; 110) with the first sleeper (T1), the first coupling elements (17a) being able to be selectively moved with respect to the first support base (12A).

6. Mounting device (10; 110) according to claim 5, wherein the first fastening elements (13A) comprise first adjustment elements (18A) suitable for adjusting the position of the first coupling elements (17A) along a first adjustment direction (A1) and second adjustment elements (19A) to adjust the position of the first coupling elements (17A) along a second adjustment direction (A2) transversal to the first adjustment direction (A1).

7. Mounting device (10; 110) according to any one of the previous claims, wherein the first fastening elements (13A) comprise second coupling elements (21A) for coupling the mounting device (10; 110) with the first sleeper (T1), the second coupling elements (21A) being rigidly connected to the first support base (12A).

8. Mounting device (10; 110) according to claim 4, wherein said at least one hollow tubular member (15; 115) comprises a plurality of hollow tubular members (16, 22, 23) interconnected with one another.

9. Mounting device (10) according to claim 4 or 8, comprising electrical connection elements (36) housed in the hollow tubular member (15), the electrical connection elements (36) being able to be operatively connected, respectively, to the first and second balise (11A, 11B) and to an encoder or to another electronic control device suitable for controlling the first and second balise (11A, 11B).

10. Mounting device (10; 110) according to claim 4 or 8, comprising mechanical transmission elements (136) housed in the hollow tubular member (115), the mechanical transmission elements (136) being able to be operatively connected, respectively, with a first and second shield member (127C, 127D) and to a manoeuvring apparatus (105) suitable for moving said shield members (127C, 127D), the shield members (127C, 127D) being suitable for shielding said balise (11C, 11D) so as to prevent the transmission of information between the first and second balise (11C, 11D) and an on-board system provided aboard a train and suitable for cooperating with the first and second balise (11C, 11D).

11. Group of parts (10, 11A, 11B; 110, 11C, 11D) comprising a mounting device (10; 110) according to any one of the previous claims and said first and second balise (11A, 11B; 11C, 11D).

12. System (1), comprising a group of parts (10, 11A, 11B) according to claim 11 and an encoder or another electronic control device adapted to be operatively connected to the first and second balise (11A, 11B) to control the first and second balise (11A, 11B).

13. System (101), comprising a group of parts (110, 11C, 11D, 127C, 127D) according to claim 11, dependent on claim 10, and comprising said manoeuvring apparatus (105) and said first and second shield member (127C, 127D).

14. System (101) according to claim 13, wherein said manoeuvring apparatus (105) comprises a manoeuvring lever (106) able to be moved between a first and a second operative position corresponding, respectively, to a shielding configuration and a non-shielding configuration of said shield members (127C, 127D).

Patentansprüche

1. Anbringvorrichtung (10; 110) zum Anbringen eines Paares von Balisen (11A, 11 B; 11C, 11D) an den Schwellen (T1, T2) eines Gleises (T_R) einer Eisenbahnlinie oder dergleichen, die folgende Merkmale aufweist:

   - eine erste Trägerbasis (12A) zum Tragen einer ersten Balise (11A) des Paares;
   - erste Befestigungselemente (13A), die der ersten Trägerbasis (12A) zugeordnet sind, um die Anbringvorrichtung (10; 110) an einer ersten Schwelle (T1) des Gleises (T_R) zu fixieren;

   dadurch gekennzeichnet, dass sie folgende Merkmale aufweist:

   - eine zweite Trägerbasis (12B) zum Tragen einer zweiten Balise (11 B) des Paares;
   - zweite Befestigungselemente (13B), die der zweiten Trägerbasis (12B) zugeordnet sind, um die Anbringvorrichtung (10; 110) an einer zweiten Schwelle (T2) des Gleises (T_R) zu fixieren, die sich in einem gegebenen Abstand von der ersten Schwelle (T1) befindet; und
   - mechanische Verbindungselemente (15, 115), die zwischen der ersten und der zweiten Trägerbasis (12A, 12B) angeordnet sind;

   wobei der Abstand zwischen den ersten und den zweiten Befestigungselementen (13A, 13B) selektiv modifizierbar ist.

2. Anbringvorrichtung (10; 110) gemäß Anspruch 1, die dazu geeignet ist, eine erste relativ ausgefaltete Konfiguration und eine zweite relativ kompakte Konfiguration bezüglich der ausgefalteten Konfiguration einzunehmen.

3. Anbringvorrichtung (10; 110) gemäß Anspruch 2, bei der die kompakte Konfiguration eine Transportkonfiguration ist und bei der die ausgefaltete Konfiguration eine Anbringkonfiguration ist.

4. Anbringvorrichtung (10; 110) gemäß einem der vorhergehenden Ansprüche, bei der die mechanischen Verbindungselemente (15, 115) zumindest ein hohles röhrenförmiges Bauglied aufweisen.

5. Anbringvorrichtung (10; 110) gemäß einem der vorhergehenden Ansprüche, bei der die ersten Befestigungselemente (13A) erste Kopplungselemente

(17A) zum Koppeln der Anbringvorrichtung (10; 110) mit der ersten Schwelle (T1) aufweisen, wobei die ersten Kopplungselemente (17a) in der Lage sind, bezüglich der ersten Trägerbasis (12A) selektiv bewegt zu werden.

6. Anbringvorrichtung (10; 110) gemäß Anspruch 5, bei der die ersten Befestigungselemente (13A) erste Einstellelemente (18A), die zum Einstellen der Position der ersten Kopplungselemente (17A) entlang einer ersten Einstellrichtung (A1) geeignet sind, und zweite Einstellelemente (19A) zum Einstellen der Position der ersten Kopplungselemente (17A) entlang einer zweiten Einstellrichtung (A2), die zu der ersten Einstellrichtung (A1) quer verläuft, aufweisen.

7. Anbringvorrichtung (10; 110) gemäß einem der vorhergehenden Ansprüche, bei der die ersten Befestigungselemente (13A) zweite Kopplungselemente (21 A) zum Koppeln der Anbringvorrichtung (10; 110) mit der ersten Schwelle (T1) aufweisen, wobei die zweiten Kopplungselemente (21 A) starr mit der ersten Trägerbasis (12A) verbunden sind.

8. Anbringvorrichtung (10; 110) gemäß Anspruch 4, bei der das zumindest eine hohle röhrenförmige Bauglied (15; 115) eine Mehrzahl hohler röhrenförmiger Bauglieder (16, 22, 23) aufweist, die miteinander verbunden sind.

9. Anbringvorrichtung (10) gemäß Anspruch 4 oder 8, die elektrische Anschlusselemente (36) aufweist, die in dem hohlen röhrenförmigen Bauglied (15) untergebracht sind, wobei die elektrischen Anschlusselemente (36) in der Lage sind, mit der ersten beziehungsweise der zweiten Balise (11A, 11 B) und mit einem Codierer oder einer anderen elektronischen Steuervorrichtung, die zum Steuern der ersten und der zweiten Balise (11A, 11 B) geeignet ist, wirksam verbunden zu werden.

10. Anbringvorrichtung (10; 110) gemäß Anspruch 4 oder 8, die mechanische Kraftübertragungselemente (136) aufweist, die in dem hohlen röhrenförmigen Bauglied (115) untergebracht sind, wobei die mechanischen Kraftübertragungselemente (136) in der Lage sind, mit einem ersten beziehungsweise einem zweiten Abschirmbauglied (127C, 127D) und mit einer Manövriervorrichtung (105), die zum Bewegen der Abschirmbauglieder (127C, 127D) geeignet ist, wirksam verbunden zu werden, wobei die Abschirmbauglieder (127C, 127D) zum Abschirmen der Balisen (11C, 11D) geeignet sind, um die Übertragung von Informationen zwischen der ersten und der zweiten Balise (11C, 11 D) und einem an Bord eines Zuges vorgesehenen eingebauten System, das dazu geeignet ist, mit der ersten und der zweiten Balise (11C, 11D) zusammenzuwirken, zu verhindern.

11. Gruppe von Teilen 10, 11A, 11 B; 110, 11C, 11D), die eine Anbringvorrichtung (10; 110) gemäß der vorhergehenden Ansprüche und die erste und die zweite Balise (11A, 11 B; 11C, 11 D) aufweist.

12. System (1), das eine Gruppe von Teilen (10, 11A, 11B) gemäß Anspruch 11 und einen Codierer oder eine andere elektronische Steuervorrichtung aufweist, die dazu angepasst ist, mit der ersten und der zweiten Balise (11A, 11 B) wirksam verbunden zu werden, um die erste und die zweite Balise (11A, 11 B) zu steuern.

13. System (101), das eine Gruppe von Teilen (110, 11C, 11D, 127C, 127D) gemäß Anspruch 11, der auf Anspruch 10 rückbezogen ist, aufweist und die Manövriervorrichtung (105) und das erste und das zweite Abschirmbauglied (127C, 127D) aufweist.

14. System (101) gemäß Anspruch 13, bei dem die Manövriervorrichtung (105) einen Manövrierhebel (106) aufweist, der in der Lage ist, zwischen einer ersten und einer zweiten Betriebsposition, die einer Abschirmkonfiguration beziehungsweise einer Nicht-Abschirmkonfiguration der Abschirmbauglieder (127C, 127D) entsprechen, bewegt zu werden.

Revendications

1. Dispositif de montage (10; 110) pour monter une paire de balises (11A, 11B ; 11C, 11D) sur les traverses (T1, T2) d'une voie (T_R) d'une ligne de chemin de fer ou similaire, comprenant :

- une première base de support (12A) pour supporter une première balise (11A) de ladite paire ;
- des premiers éléments de fixation (13A) associés à la première base de support (12A) pour fixer le dispositif de montage (10 ; 110) sur une première traverse (T1) de ladite voie (T_R) ;

caractérisé en ce qu'il comprend :

- une seconde base de support (12B) pour supporter une seconde balise (11B) de ladite paire ;
- des seconds éléments de fixation (13B) associés à la seconde base de support (12B) pour fixer le dispositif de montage (10 ; 110) à une seconde traverse (T2) de ladite voie (T_R) qui est située à une distance donnée de la première traverse (T1) ; et
- des éléments de raccordement mécaniques (15, 115) interposés entre lesdites première et seconde bases de support (12A, 12B) ;

la distance entre les premiers et les seconds éléments de fixation (13A, 13B) étant sélectivement mo-

difiable.

2. Dispositif de montage (10 ; 110) selon la revendication 1, approprié pour adopter une première configuration relativement dépliée et une seconde configuration relativement compacte par rapport à ladite configuration dépliée.

3. Dispositif de montage (10 ; 110) selon la revendication 2, dans lequel la configuration compacte est une configuration de transport et dans lequel la configuration dépliée est une configuration de montage.

4. Dispositif de montage (10 ; 110) selon l'une quelconque des revendications précédentes, dans lequel lesdits éléments de raccordement mécaniques (15, 115) comprennent au moins un organe tubulaire creux.

5. Dispositif de montage (10 ; 110) selon l'une quelconque des revendications précédentes, dans lequel les premiers éléments de fixation (13A) comprennent des premiers éléments d'accouplement (17A) pour accoupler le dispositif de montage (10 ; 110) à la première traverse (T1), les premiers éléments d'accouplement (17a) étant capables d'être sélectivement déplacés par rapport à la première base de support (12A).

6. Dispositif de montage (10 ; 110) selon la revendication 5, dans lequel les premiers éléments de fixation (13A) comprennent des premiers éléments d'ajustement (18A) appropriés pour ajuster la position des premiers éléments d'accouplement (17A) le long d'une première direction d'ajustement (A1) et des seconds éléments d'ajustement (19A) pour ajuster la position des premiers éléments d'accouplement (17A) le long d'une seconde direction d'ajustement (A2) transversale à la première direction d'ajustement (A1).

7. Dispositif de montage (10 ; 110) selon l'une quelconque des revendications précédentes, dans lequel les premiers éléments de fixation (13A) comprennent des seconds éléments d'accouplement (21A) pour accoupler le dispositif de montage (10 ; 110) à la première traverse (T1), les seconds éléments d'accouplement (21A) étant rigidement raccordés à la première base de support (12A).

8. Dispositif de montage (10 ; 110) selon la revendication 4, dans lequel ledit au moins un organe tubulaire creux (15 ; 115) comprend une pluralité d'organes tubulaires creux (16, 22, 23) mutuellement raccordés les uns aux autres.

9. Dispositif de montage (10) selon la revendication 4 ou 8, comprenant des éléments de connexion électriques (36) logés dans l'organe tubulaire creux (15), les éléments de connexion électriques (36) étant capables d'être fonctionnellement connectés, respectivement, aux première et seconde balises (11A, 11B) et à un encodeur ou à un autre dispositif de commande électronique approprié pour commander les première et seconde balises (11A, 11B).

10. Dispositif de montage (10 ; 110) selon la revendication 4 ou 8, comprenant des éléments de transmission mécaniques (136) logés dans l'organe tubulaire creux (115), les éléments de transmission mécaniques (136) étant capables d'être fonctionnement raccordés, respectivement, à des premier et second organes de protection (127C, 127D) et à un appareil de manoeuvre (105) approprié pour déplacer lesdits organes de protection (127C, 127D), les organes de protection (127C, 127D) étant appropriés pour protéger les balises (11C, 11D) afin d'empêcher la transmission d'informations entre les première et seconde balises (11C, 11D) et un système embarqué prévu à bord d'un train et approprié pour coopérer avec les première et seconde balises (11C, 11D).

11. Groupe de pièces (10, 11A, 11B ; 110, 11C, 11D) comprenant un dispositif de montage (10 ; 110) selon l'une quelconque des revendications précédentes et lesdites première et seconde balises (11A, 11B ; 11C, 11D).

12. Système (1), comprenant un groupe de pièces (10, 11A, 11B) selon la revendication 11 et un encodeur ou un autre dispositif de commande électronique adapté pour être fonctionnellement connecté aux première et seconde balises (11A, 11B) pour commander les première et seconde balises (11A, 11B).

13. Système (101), comprenant un groupe de pièces (110, 11C, 11D, 127C, 127D) selon la revendication 11, dépendant de la revendication 10, et comprenant ledit appareil de manoeuvre (105) et lesdits premier et second organes de protection (127C, 127D).

14. Système (101) selon la revendication 13, dans lequel ledit appareil de manoeuvre (105) comprend un levier de manoeuvre (106) capable d'être déplacé entre des première et seconde positions fonctionnelles correspondant, respectivement, à une configuration de protection et une configuration de non-protection desdits organes de protection (127C, 127D).

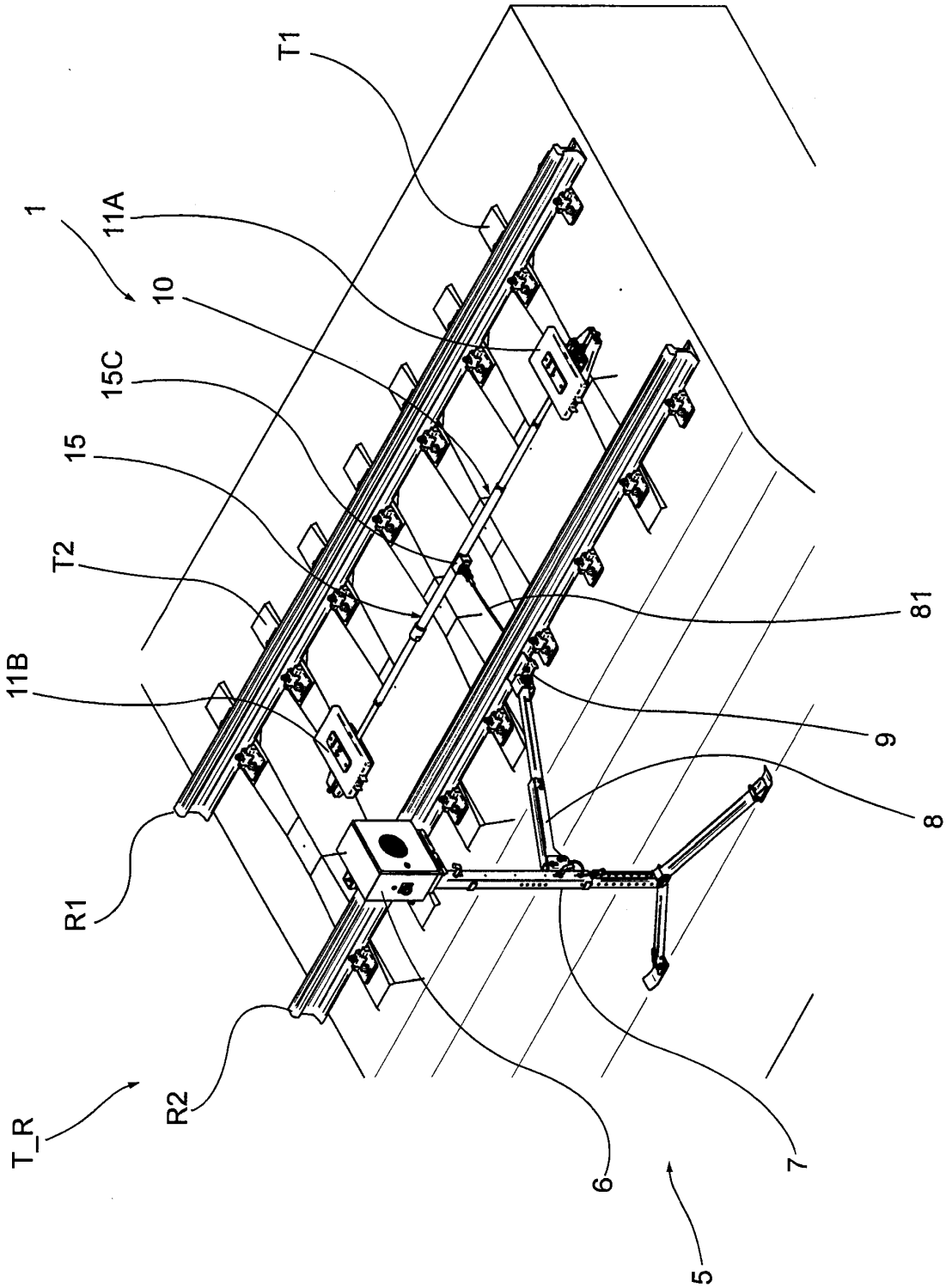

FIG. 1

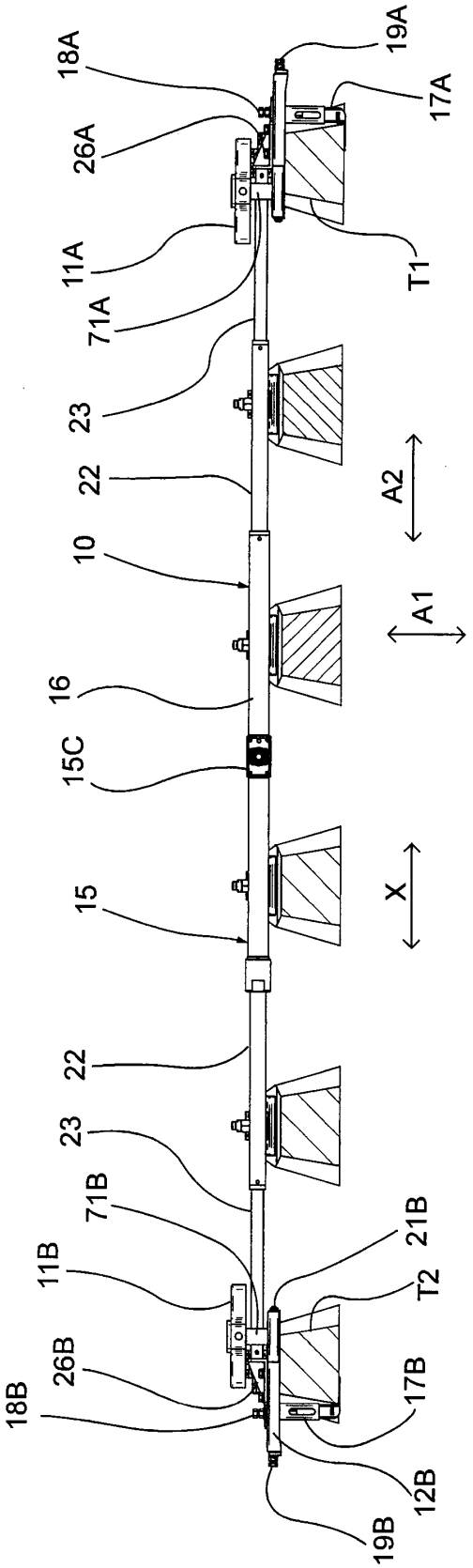
18A
19A
26A
17A
11A
T1
71A
23
22
A2
10
A1
16
15C
X
15
22
23
71B
21B
11B
T2
26B
17B
18B
12B
19B

FIG. 2

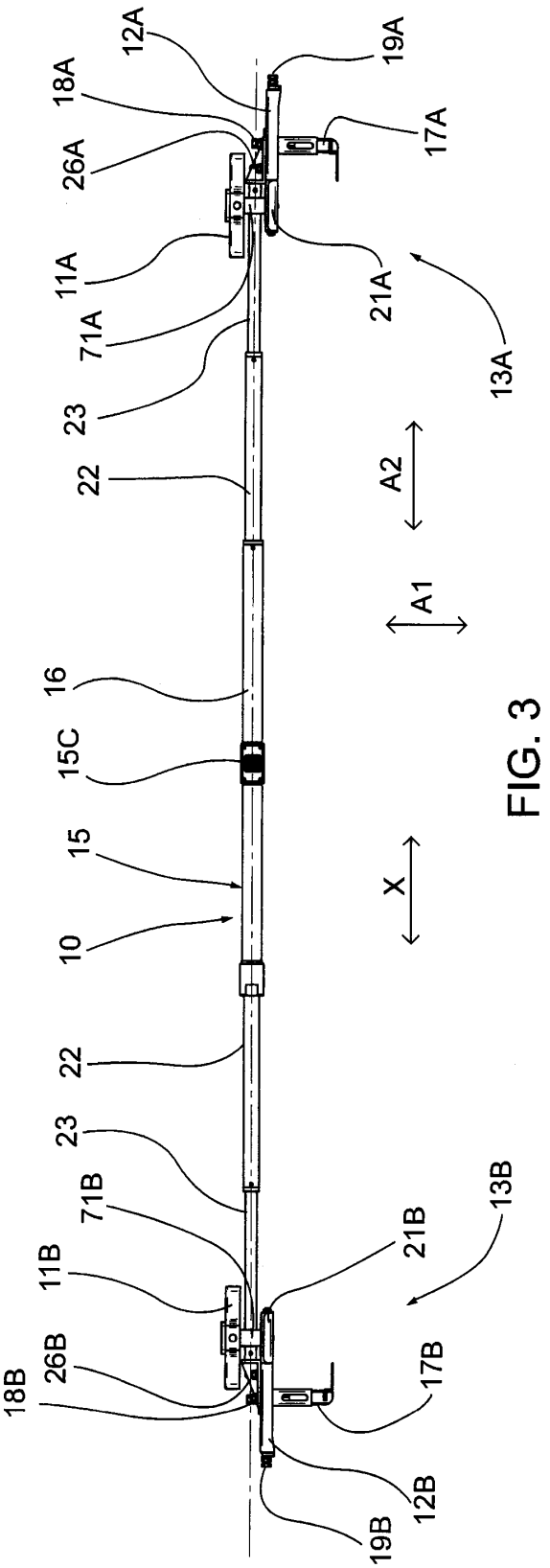
12A
18A
19A
26A
17A
11A
21A
71A
13A
23
22
A2
A1
16
15C
X
15
10
22
23
71B
13B
21B
11B
26B
17B
18B
12B
19B

FIG. 3

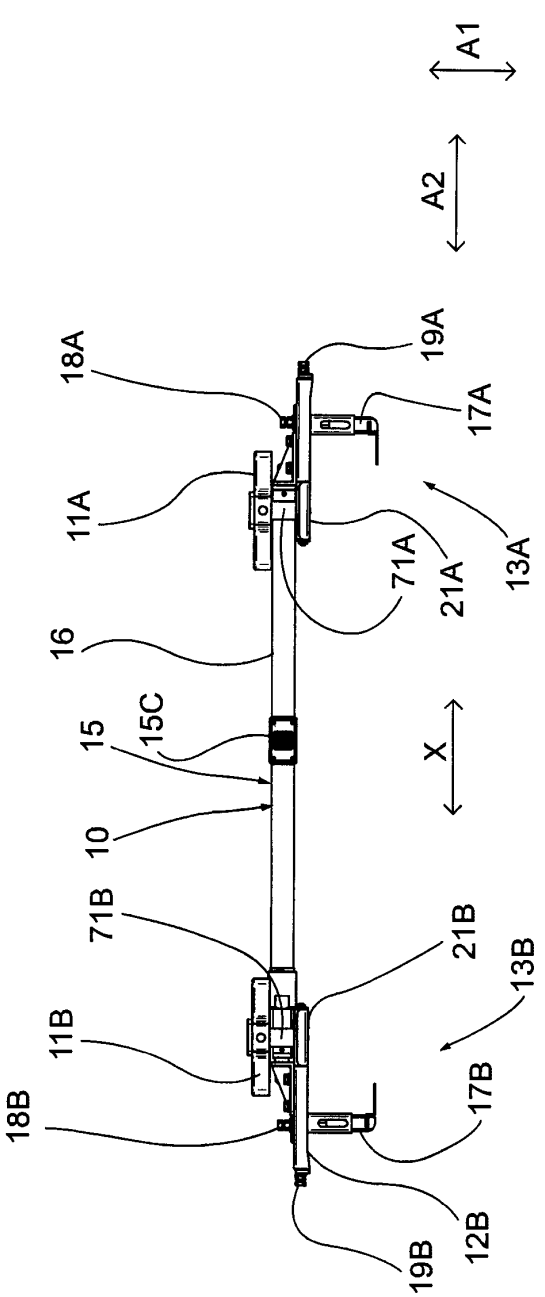
A1
A2
X
18A
19A
17A
11A
71A
21A
13A
16
15
15C
10
71B
21B
13B
11B
17B
18B
12B
19B

FIG. 4

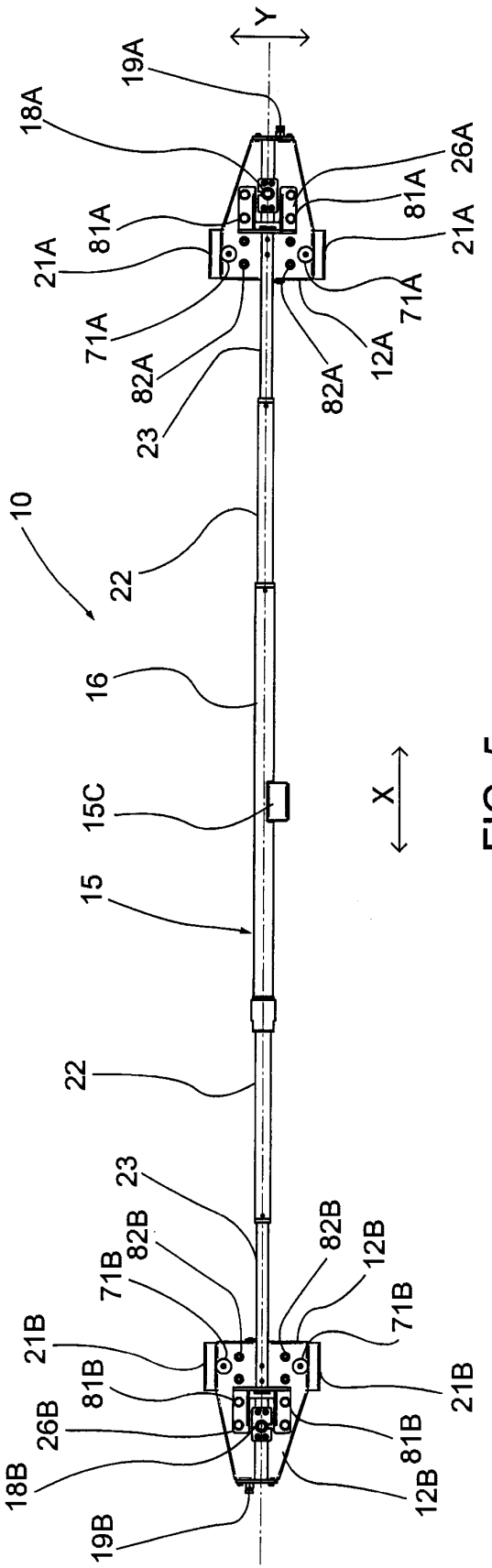
Y
X
19A
18A
26A
81A
21A
71A
82A
12A
23
10
22
16
15C
15
82B
12B
71B
21B
81B
26B
18B
19B

FIG. 5

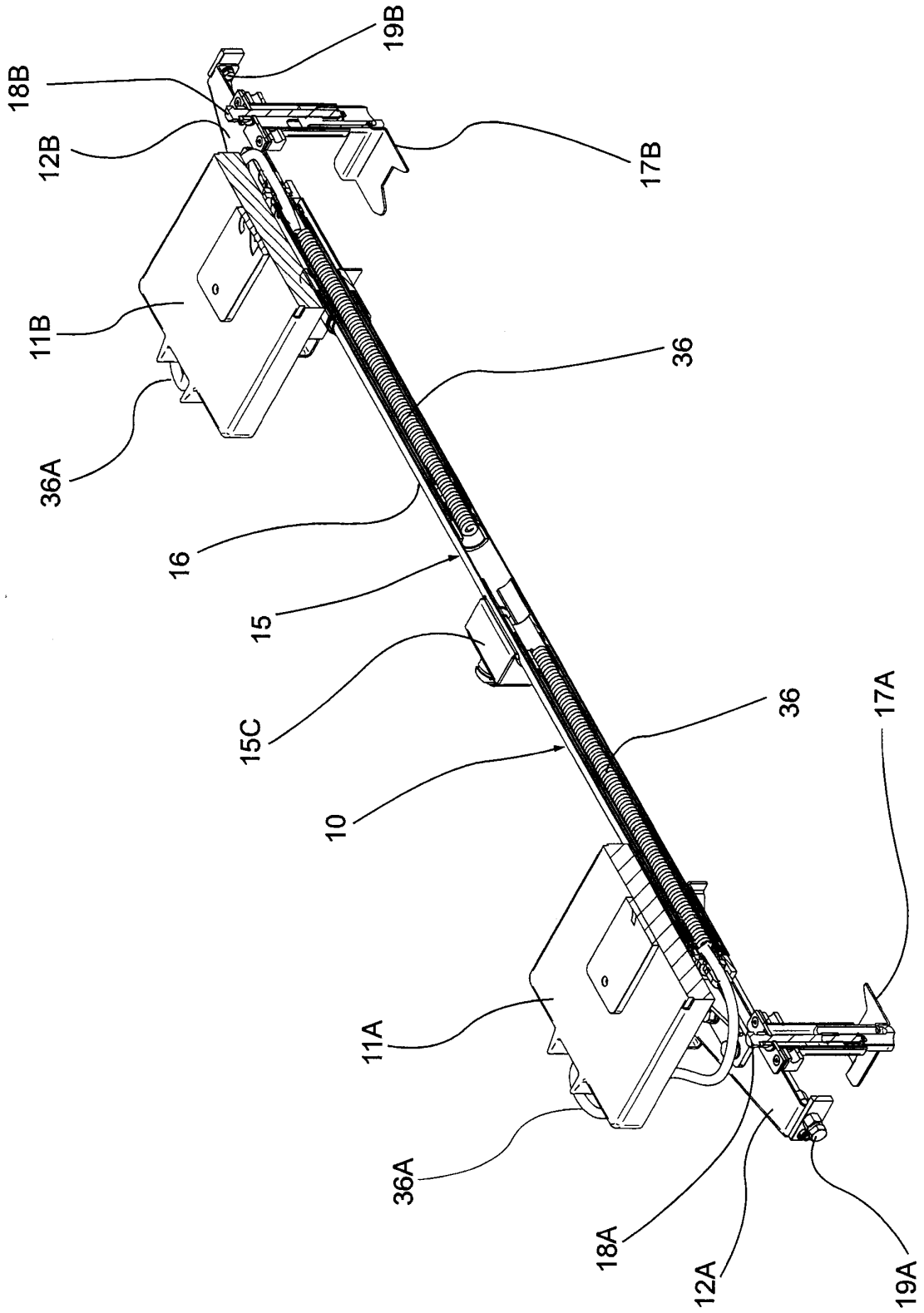

FIG. 6

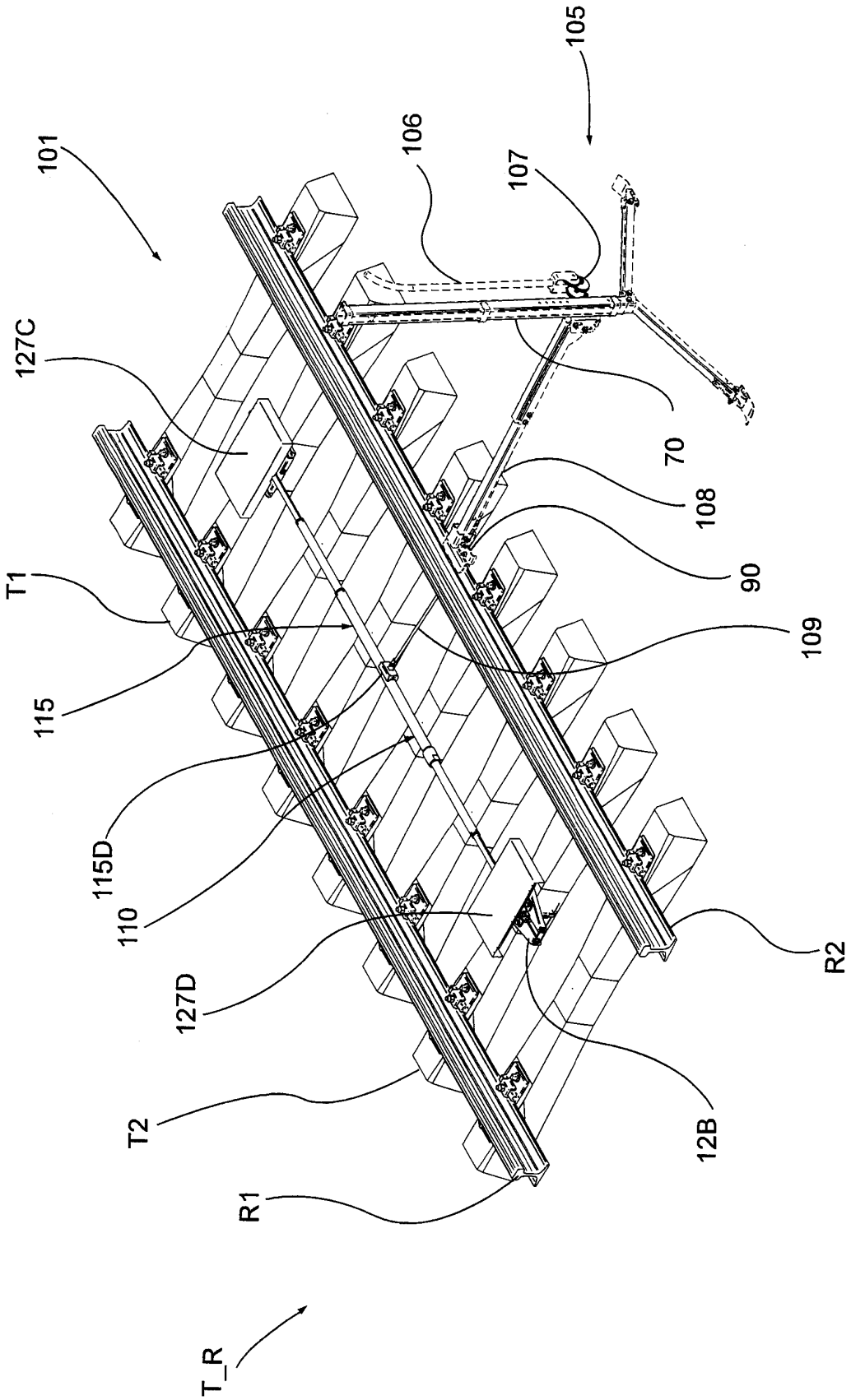
101
105
106
107
127C
70
108
90
T1
109
115
115D
110
127D
R2
T2
12B
R1
T_R

FIG. 7

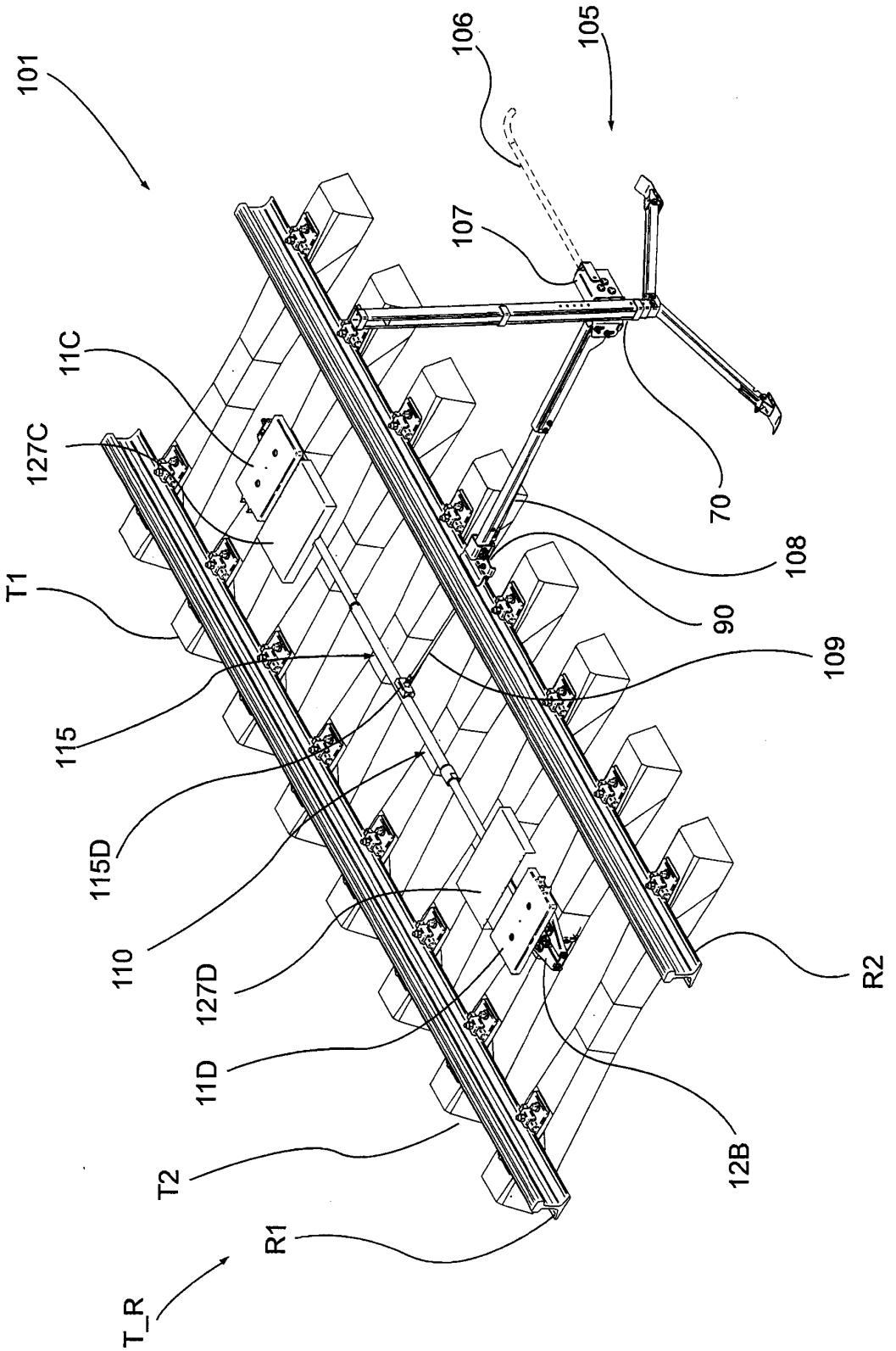
101
106
105
107
11C
127C
70
T1
108
90
109
115
115D
110
127D
11D
T2
R1
T_R
12B
R2

FIG. 8

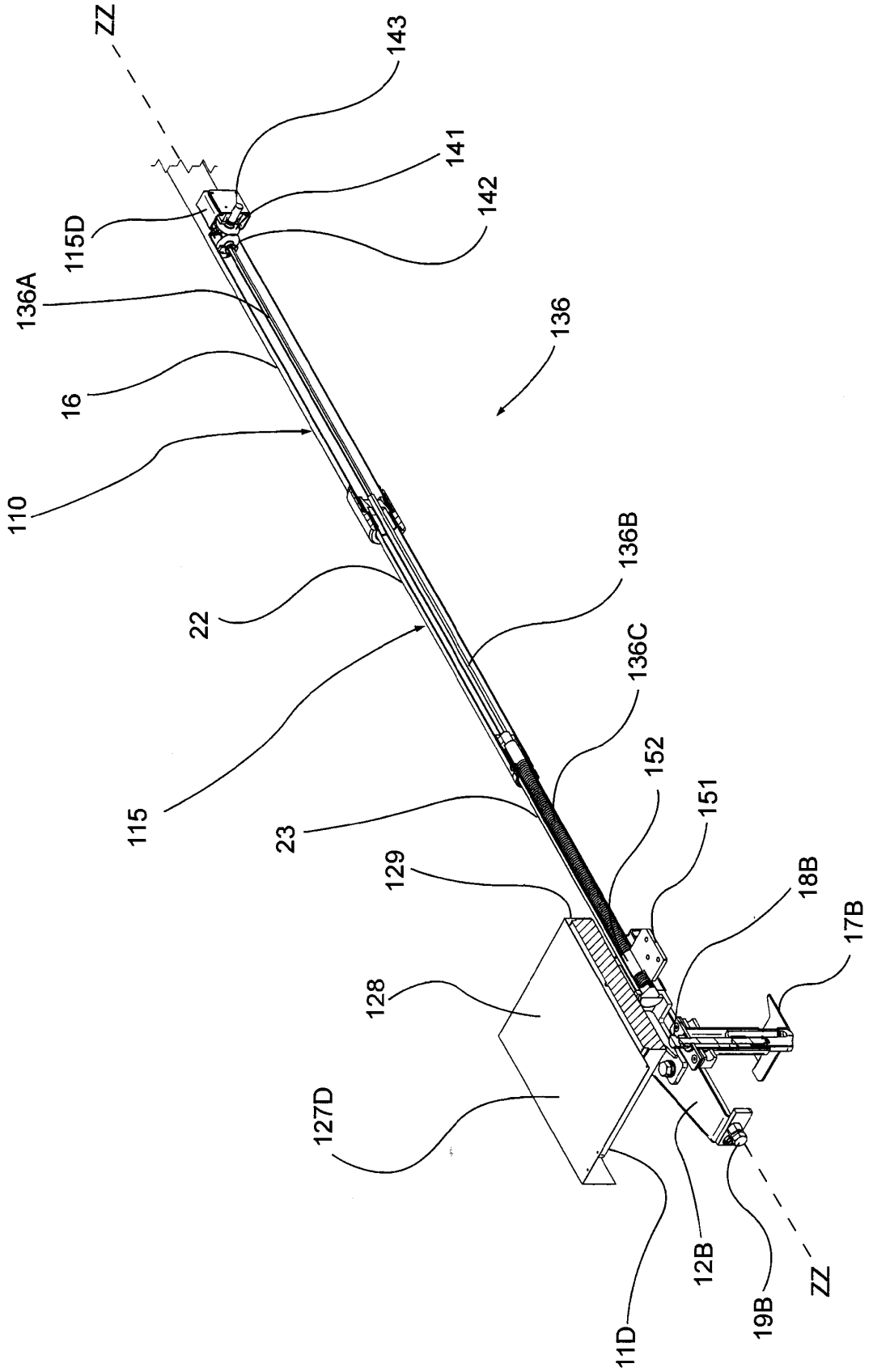
ZZ
143
141
142
115D
136A
16
110
136
22
136B
136C
115
23
152
151
129
18B
17B
128
127D
12B
19B
11D
ZZ

FIG. 9