Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2860268 A1 2013/05/30

(21) 2 860 268

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(86) **Date de dépôt PCT/PCT Filing Date:** 2012/11/21
(87) **Date publication PCT/PCT Publication Date:** 2013/05/30
(85) **Entrée phase nationale/National Entry:** 2014/06/23
(86) **N° demande PCT/PCT Application No.:** AT 2012/050183
(87) **N° publication PCT/PCT Publication No.:** 2013/075160
(30) **Priorités/Priorities:** 2011/11/22 (AT GM 634/2011); 2012/03/09 (AT A 293/2012)

(51) **Cl.Int./Int.Cl.** ***E01F 8/00*** (2006.01)

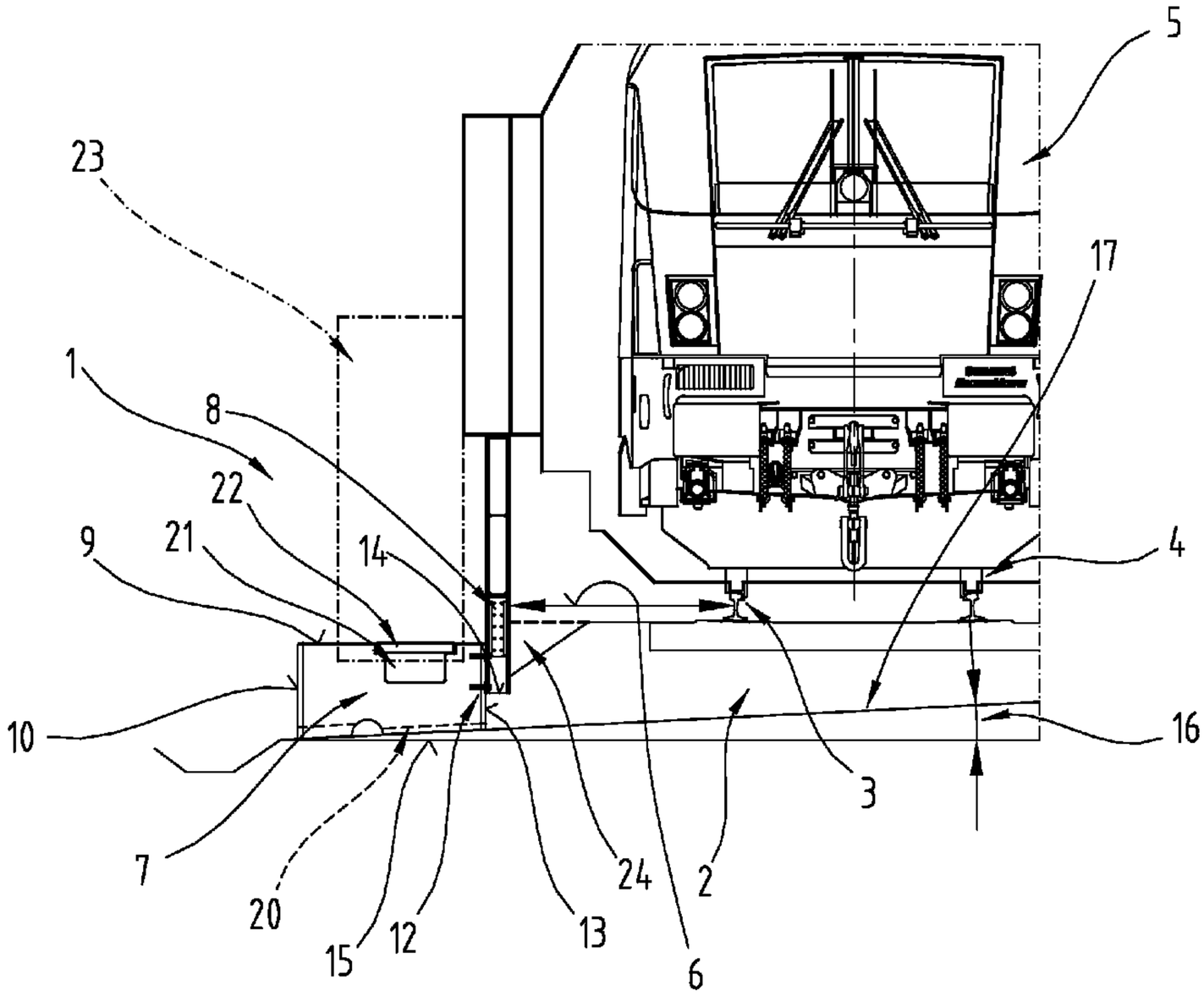
(71) **Demandeur/Applicant:**
ART ASAMER RUBBER TECHNOLOGY GMBH, AT

(72) **Inventeurs/Inventors:**
DANNER, THOMAS, AT;
LICHTBERGER, BERNHARD, AT;
MAYRHOFER, ERICH, AT

(74) **Agent:** RICHES, MCKENZIE & HERBERT LLP

(54) **Titre : DISPOSITIF ANTI-BRUIT**
(54) **Title: NOISE REDUCTION DEVICE**

Fig.1



(57) **Abrégé/Abstract:**
The invention relates to a noise reduction device (1) for arrangement on a traffic route, comprising at least one base element (7) and at least one wall element (8), the base element (7) having an upper side (9) and an underside (15) and the wall element (8) being arranged on the upper side (9) of the base element (7). The underside (15) of the base element (7) is directed at an angle (16) that is inclined relative to the horizontal line.

Abstract

The invention relates to a noise reduction device (1) for installation on a traffic route, comprising at least one base element (7) and at least one wall element (8), the base element (7) having a top face (9) and a bottom face (15), and the wall element (8) is disposed on the top face (9) of the base element (7). The bottom face (15) of the base element (7) is inclined at an angle (16) relative to the horizontal.

Fig. 1

Noise reduction device

The invention relates to a noise reduction device for installation on a traffic route, comprising at least one base element and at least one wall element, the base element having a top face and a bottom face, and the wall element is disposed on the top face of the base element, as well as a track system with rails and at least one noise reduction device disposed next to the rails, and the at least one base element has at least one wall element, and the rails are disposed on a ballast bed by means of crossties, and the ballast bed is disposed on a sub-structure.

Noise reduction devices in the form of wall elements are used along or on traffic routes to reduce noise. These noise reduction devices are usually erected in a fixed arrangement on or next to the traffic route and an appropriate foundation is built for this purpose, on which or in which stands for the noise reduction walls themselves are anchored, usually profiled I-sections or H-sections made from steel. However, other noise reduction devices are known which can be erected on the ballast bed of a track system without anchoring in the ground, in which case a connection is provided to the crossties of the track system.

AT 7 753 U1 describes a noise reduction element for use in railway construction. In order to reduce the noise which occurs when the wheels roll on the tracks, it is proposed that a sound reducing element be disposed on a base element constituting a stand surface which can be secured to the ground and which preferably extends vertically upwards, and which is able to move relative to the base element, preferably in a folding arrangement, and/or is mounted so as to be removable.

DE 298 05 730 U1 discloses a noise reducing wall for traffic routes having a support construction supported on the ground, on which prefabricated, sound-absorbing wall elements are secured, which support construction comprises several prefabricated, vertical frames in which the wall elements can be fitted, and the wall elements are at least partially made from recycled material and/or immobilized waste products.

WO 98/37276 A1 describes a sound reducing device for reducing the propagation of airborne sound, comprising a track system and an elastically deformable, low sound reducing wall

made from rubber or plastic extending in the track longitudinal direction, and the low sound reducing wall disposed at a distance from the track has profiling on its side facing the track (inner side), which extends essentially across the entire wall height, whereas its face remote from the track (outer side) is predominantly of a flat design. The inner side is inclined at an angle α and the outer side is inclined at an angle β, and is so respectively towards the track by reference to the track vertical, and the angle β is bigger than the angle α. The profiling of the inner side is a system of lips, and the lips are oriented at an angle γ, and are so towards the floor of the track relative to the track horizontal. The low sound reducing wall terminates at the top, where the inner side and outer side meet, by a lip inclined towards the track which is oriented at an angle δ, namely upwards relative to the track vertical. The low sound reducing wall also has at least one hollow chamber extending in the track longitudinal direction.

A fixing mechanism is known from AT 8 619 U1, which enables the use of a noise reducing wall without a foundation. The fixing mechanism consists of a simple profiled section which is easy to install and dismantle, which can be connected to a rail. Simple assembly and dismantling is achieved due to the effect of force acting on a mounting plate. An appropriately bent fitting support holds the noise reducing wall at an exact horizontal distance from the rail and at the same time stabilizes the right-angled position with respect to the track. A locking plate connects the noise reducing wall to the fixing mechanism by a latching action. The fitting support is encased in rubber or another elastic material to protect the track and crosstie and damp their vibrations. The offset of the fitting support at the transition from the crosstie to the ballast bed underneath is used to ensure that the latter is embedded in the ballast and the full weight of the noise reducing wall is borne by the ballast bed.

AT 9 954 U1 discloses a noise reduction wall for screening the noise which occurs due to travel on railway tracks, the height of the noise reduction wall disposed on either side of a track being approximately 0.5 m to 2 m. The distance between two noise reduction walls — lying opposite one another normally to a longitudinal direction of the track — is in a range of only approximately 3 to 5 % bigger than the width of a clearance outline of the track, and the angle of a side of the noise reduction wall facing the track is in a range of approximately -15 to +15 ° relative to the vertical and a flank nose is provided on a bottom end of the noise reduction wall lying on the ballast of the track on a side remote from the track with a nose end

spaced at a distance apart from said remote side, which subtends an angle of approximately 10° to approximately 40° with respect to the horizontal.

AT 508 575 B1 discloses a noise reducing device for installation on a traffic route comprising at least one wall element, and the wall element is disposed on at least one base element which can be installed on or adjacent to the traffic route without a foundation, and the base element can be installed on a ballast bed of a track and is not anchored in the ground, and the base element has at least one connecting element by means of which the base element can be connected to a crosstie and/or a rail of a track.

DE 20 2011 052 057 U1 describes a noise reduction device for installation on a ballast bed of a track system, comprising at least one wall element having a wall element longitudinal extension, and the wall element is disposed on at least one base element having a base element longitudinal extension in the direction of the wall element longitudinal extension, and the base element has a first front face and a second front face, and the two front faces lie opposite one another along the base element longitudinal extension, and the first front face of the base element is provided with a first curvature and the second front face of the base element is provided with a second curvature, and the two curvatures extend in the direction perpendicular to the base element longitudinal extension.

The objective of this invention is to propose an improved noise reduction device for railways. In particular, the objective of the invention is to propose an improved foundation-free noise reduction device for railways close to the clearance outline.

The expression “clearance” should be understood in the context of the technical terminology used in the field of railway construction (see e.g. DE 20 2011 052 057 U1).

The objective is achieved on the basis of the noise reduction device outlined above and the track system outlined above, and in the case of the noise reduction device, the bottom face of the base element is oriented at an angle relative to the horizontal, and the noise reduction device proposed by the invention is used for the track system and is disposed on the substructure.

The advantage of this is that because the bottom face of the base element is angled, the noise reduction device can be placed directly on the so-called sub-structure. Due to the base element, it is not necessary to provide any foundation for the wall elements, which means that they can be erected without foundations. Furthermore, by using the base element, it is possible to create a safe walkway next to the tracks which can also be separated from the tracks by the wall element, thereby further increasing the safety of the safety area, and in particular the suction effect of a passing train does not act on persons who happen to be in the safety area such as personnel maintaining the track or does so to only a reduced degree. The advantage of the base element is that these persons are safe and can even remain standing whilst a train passes by because there is no need for them to move onto the natural ground next to the run of track. This is of particular advantage in regions of the track run with a bank or slopes. This design of the noise reduction device has another advantage compared with the variants with a direct connection to the crossties or tracks because settlement of the ballast bed does not have any effect on the position of the noise reduction device.

Based on one embodiment of the noise reduction device, at least one recess is provided in the bottom face of the base element. This results in better stability in terms of the position of the noise reduction device on the sub-structure because the at least one recess is able to impart to the noise reduction device greater resistance to lateral shifting forces.

The at least one recess may extend from a first longitudinal side face to a second longitudinal side face of the base element. This directs surface water away more effectively, and this (drainage) recess optionally also helps to maintain a stable position, as explained above.

To improve drainage of the ballast bed still further, one of the two longitudinal side faces of the base element may extend obliquely with respect to the other longitudinal side face, at least in certain regions. This enables water to drain in the direction towards the above-mentioned recess extending transversely to the longitudinal direction of the base element.

To make electrical installation work easier, at least one duct – what is known as a cable trough – may be provided in the base element, which is accessible from the top face of the base element. Another advantage of this design of the base element is that this duct is not dis-

posed directly on or in the sub-structure as is usually the case in the prior art and therefore does not obstruct drainage of the ballast bed.

Furthermore, the wall element may be retained by at least one support element, and the support element is height-adjustable and/or can be pivoted towards the horizontal. Due to this additional feature, the noise reduction device can be more easily used on banked track routings in spite of them being disposed on the sub-structure so that no complex constructions are necessary in these regions of the track routing.

At least one base element projection may be provided on the rear longitudinal end face of the base element. This improves stabilization of the base element because this base element projection can be disposed underneath or in the ballast bed(s) so that the weight of the ballast on this base element projection holds down the noise reduction device in the fitted state.

Based on one embodiment of the track system, the ballast bed extends as far as the wall element of the noise reduction device. This enables an improved safety area to be obtained in the region of the noise reduction device because the region adjoining the noise reduction device is flat so that a surface can be made available which can be safely walked on. This is of advantage especially in situations where passengers have to be evacuated or for the purpose of inspections, for example by the locomotive driver, because it is not necessary to negotiate the sloping side edges of the ballast bed (ballast edge) as is usually the case in the prior art. Another advantage of this design is that the noise reduction device is not able to move inwards towards the track into the clearance outline due to wind or the suction effect caused by a passing train because it is prevented from doing so by the ballast disposed in between.

To provide a clearer understanding, the invention will be described in more detail below with reference to the appended drawings.

These are schematically simplified drawings illustrating the following:

Fig. 1 a detail from a track system in cross-section;

Fig. 2 a front view illustrating an embodiment of the base element of the noise reduction device;

Fig. 3 a plan view of another embodiment of the base element of the noise reduction device;

Fig. 4 a plan view of another embodiment of the base element of the noise reduction device;

Fig. 5 a detail from a track system in cross-section with one embodiment of the noise reduction device;

Fig. 6 a view at an angle from underneath illustrating an embodiment of the noise reduction device;

Fig. 7 a view at an angle from behind illustrating another embodiment of the noise reduction device.

Firstly, it should be pointed out that the same parts described in the different embodiments are denoted by the same reference numbers and the same component names and the disclosures made throughout the description can be transposed in terms of meaning to same parts bearing the same reference numbers or same component names. Furthermore, the positions chosen for the purposes of the description, such as top, bottom, side, etc., relate to the drawing specifically being described and can be transposed in terms of meaning to a new position when another position is being described.

Fig. 1 illustrates a first embodiment of a noise reduction device 1. In particular, this noise reduction device 1 is erected as a noise reducing wall in the region of a track system 2 and, as illustrated in Fig. 1, the advantage of the noise reduction device 1 is that it can be positioned very close to track runs 3 so that the noise generated in the region of wheels 4 of railway vehicles 5 and the track runs 3 can be effectively damped or directed to an area where it no longer constitutes a nuisance, even if the structural height of the noise reduction device 1 is low.

The noise reduction device 1 illustrated in Fig. 1 is naturally positioned to allow unhindered operation of railway vehicles 5, i.e. it is disposed at a sufficient distance 6 from the travelling railway vehicles 5. Due to the construction of the noise reduction device 1, this distance 6 may be between 0.5 m and 1.2 m, in particular between 0.7 m and 1 m, so that the noise reduction device 1 can be erected very close to the source of the noise. In this respect, the distance 6 is measured between the edge of the outer edge of the noise reduction device 1 facing the rails and the middle of the neighboring rail.

The noise reduction device 1 comprises or consists of a base element 7 and at least one wall element 8, and several wall elements 8 may also be used, for example two placed one above the other. It would naturally also be possible to use a different number of wall elements 8 disposed one above the other in the noise reduction device 1.

Such a wall element 4 may have a length of for example ca. 3 m, a width of ca. 12 cm to ca. 20 cm and a height of ca. 80 cm to ca. 100 cm, although these figures should not be construed as restrictive.

This noise reduction device 1 may consist of several parts, and in particular the base element 7 and wall element 8 may be separate components of the noise reduction device 1.

The base element 7 is preferably a concrete base in the form of a flat element. For example, such a base element 3 may have a width of ca. 1.1 m, a length of ca. 3 m and a maximum height (in the region of the wall element 8) of up to ca. 0.53 m, these figures also being given purely by way of example.

A top face 9 is preferably flat and optionally has a gradient in the direction towards longitudinal end faces 10 extending in the direction of a base element longitudinal extension 11. The gradient may be only a few degrees, for example between 0.5 ° and 3 °, to allow water to drain off (Fig. 3).

However, it would also be possible for this base element 3 to be designed so that an at least approximately flat surface 14 is formed in a side region 12 adjoining a second longitudinal

end face 13 on which the wall element or elements 8 is or are disposed, and the width of this surface 14 in the direction towards the tracks may at least approximately correspond to or be greater than the width of the wall elements 8.

It is also possible for the base element 7 to be made integrally with the wall element 8.

A bottom face 15 of the base element 7 constituting its standing surface is inclined at an angle 16 relative to the horizontal.

The term "horizontal" in this context should be construed as meaning the plane with respect to which the wall element is orthogonally oriented when positioned perpendicularly, as illustrated in Fig. 1. Slight variances (in particular up to a maximum 1 °) are permissible in the context of manufacturing tolerances.

The angle 16 may be selected from a range with a lower limit of 2 ° and an upper limit of 10°. For example, the angle is 5 ° because this angle 16 essentially approximates the angle of inclination of a so-called sub-structure 17 on which the base element 7 stands.

Track systems 2 with ballast beds are usually designed so that there is a sub-structure 17 (for example a compacted sand-gravel mixture or a layer of asphalt) with a 5° inclination underneath the ballast of the track. Amongst other things, the purpose of this sub-structure 17 is to increase the load-bearing capacity of the track structure, increase resistance to frost and above all direct precipitation water sideways into the drainage.

Based on the preferred embodiment of the noise reduction device 1 illustrated in Fig. 1, the wall elements 8 are disposed in the immediate vicinity of the rails. In particular, they are disposed on the base element 7 at least approximately flush with the inwardly lying, i.e. pointing towards the track run 3, longitudinal end face 13, and they may also be disposed at a slight distance apart from this longitudinal end face but in any event in the part-region 12. In other words, the wall elements 8 separate the rail region from the outer region of the base element 7, which is free at the top. However, the converse arrangement of the wall element 8 is also possible, i.e. positioned in an arrangement which is flush in particular with the outer longitudinal end face 10 of the base element 7. In principle, a centered arrangement on the base ele-

ment 7 is also possible, although in this case, the base element 7 would have to be made wider because the region of the base element 7 which must be free to walk on, i.e. the safety area of the track system 2, must be at least 50 cm wide.

The advantage of the preferred inwardly lying arrangement of the wall elements is that the ballast can be cleaned using the machines that are standard these days without any problems.

The base element 7 may have an elastomer element, for example a rubber mat or a non-woven material, on the bottom face 15 in order to increase its coefficient of friction on the one hand and to improve the ability to distribute the weight of the noise reduction device 1 through the sub-structure 17 on the other hand. This elastomer element or non-woven material may be adhered to the bottom face of the base element 7 and another option is to lay it in the formwork when producing the base element 7 so that it is already joined to the concrete base during production.

The two widthways end faces 18, 19 may be of a straight design as illustrated in Fig. 3 or may be provided with a curvature, as illustrated in Fig. 6 and as described in DE 20 2011 052 057 U1, to which reference may be made.

In order to fit the wall element 8 on the base element 7, at least two anchoring plates may be provided, which are disposed at a distance apart from the two widthways end faces 18,19, as known from AT 508 575 B1, to which reference may be made. These anchoring plates enable support elements for the wall elements to be screwed on. In principle, however, it is also possible for the support elements to be screwed to the base element 7 or affixed thereon directly without anchoring plates.

The support element is provided in the form of a profiled H-section in particular so that the wall elements 8 can be slotted into it without additional connecting elements. Naturally, the wall elements 30 could also be connected to the support element by mechanical means and/or by a positively fitting connection if necessary. Likewise, it is also possible to use other support elements, for example support elements to provide a lateral connection and mounting for the wall elements 8 as described in DE 20 2011 052 057 U1, to which reference may be made in this connection. The wall elements 8 may therefore be disposed in a standing arrangement

on the top face 9 of the base element 7 or secured to the longitudinal end face 13 and not disposed standing on the base element 7.

The wall elements 8 and optionally the base element 7 are made from concrete, preferably a lightweight concrete incorporating pores, preferably open pores. However, it would also be possible for the base element 7 to be produced from a non-porous concrete.

It should be pointed out that by lightweight concrete is meant a concrete with a maximum weight by volume of 2000 kg/m³.

The lightweight concrete may have pores with a size selected from a range of 2 mm to 12 mm, in particular from a range of 4 mm to 8 mm. It is also of advantage to provide pores of differing sizes because this enables a broader spectrum of sound frequencies to be covered.

However, it is also possible for the wall element 8 to be made from a different material, as described in more detail below, for example from a rubber granulate/concrete mixture or a composite element comprising two lateral facing walls with rubber granulate disposed in between or rubber granulate bonded with a binding agent. Another possible way of improving the acoustic effect is to provide the side faces, in particular those faces directed towards the traffic route, with commercially available acoustic non-woven material.

Another option is for the wall element 8 as a whole to be made from a plastic or a hard elastomer or similar.

In addition, it is also possible for the wall element 8 to be constructed in a different way, for example from woodwork materials, in which case these woodwork materials may also be used in the form of composite materials, for example with wooden lathwork on the two side walls, i.e. the walls directed towards and away from the traffic route, and an acoustic filling or noise-reducing filling made from insulating material or similar in between.

In the case of wall elements 8 filled with rubber granulate, it is also possible for them to be cast, for example from an elastomer, in particular a hard elastomer, or from concrete, in which

case an appropriate recess is provided between the two side walls which is then filled with rubber granulate.

In one embodiment of the wall element 8, rock wool is used as a filling for the carcasses.

It is also possible for the wall element 8 to be at least partially or entirely made from a lightweight metal or a lightweight metal alloy, for example from aluminum or an aluminum alloy.

A wall element 8 is preferably designed so that it can be lifted by a single person. This means that – if the noise reduction device is not going to be provided with flush-mounted doors, although this is an option – the wall elements 8 can be moved if necessary, thereby providing access to the safety area without difficulty.

Another option is to provide a barrier element on or in the wall element 8 to counter sound waves, for example made from metal, plastic or concrete.

The wall elements 8 are preferably disposed on the base elements 7 in such a way that they span two mutually adjacent base elements 7, thereby enabling cohesiveness within the noise reduction wall system 20 to be improved. Another option is for the base element 7 to be of a length in the direction of the track extension which at least approximately corresponds to the length of the wall elements 8 in the same direction.

If necessary, it is also possible to connect the wall element 8 to the base element 7 by mechanical means.

Based on one embodiment of the noise reduction device 1, at least one recess 20 is provided in the bottom face 15 of the base element 7, as indicated by broken lines in Fig. 1. This is a channel-type or groove-shaped recess 20 in particular, which may extend from the first longitudinal end face 10 to the second longitudinal end face 13 of the base element 7. As a result of this recess 20 extending transversely to the track, surface water flowing into the ballast bed is able to drain away unimpeded. Naturally, it would also be possible to provide more than one such recess 20 on the bottom face 15 of the base element 7. Similarly, another option is to

provide this/these recess(es) 20 for drainage in the form of continuous bores in the base element 7.

However, the at least one recess 20 may also be provided in the form of a fluted arrangement, as illustrated in Fig. 2. In this case, it is preferable to provide several recesses 20 on the bottom face 15 because with such recesses 20, which may be provided in addition to the recess 20 for drainage or as an alternative to it, the resistance of the base element 7 to lateral shifting forces on the sub-structure 17 can be improved. These recesses 20 may have a triangular cross-section, as illustrated in Fig. 2. However, other cross-sectional shapes would also be possible, for example rectangular or square, etc..

These recesses 20 may extend in the direction of the base element longitudinal extension 11 (Fig. 3) and/or orthogonally thereto and/or transversely to these directions.

The above-mentioned recesses 20 preferably extend across the entire length of the base element 7 in the direction of the base element longitudinal extension 11 and/or across the entire width of the base element 7 or from the first longitudinal end face 10 to the second longitudinal end face 13 and/or from the first widthways end face 18 to the second widthways end face 19. However, it would also be possible for these recesses not to be of a continuous design. Another option is to provide discrete recesses 20 so that the bottom face 175 has micro- or macro-structuring, for example.

Based on another embodiment of the base element, the longitudinal end face 13 of the base element 7 may extend obliquely with respect to the other longitudinal end face 10, at least in certain regions, as illustrated in Fig. 3. This improves the drainage of the recess or recesses 20 on the bottom face 15 (Fig. 1) of the base element 7. Although two such recesses 20 are illustrated in Fig. 3, each with two regions of the longitudinal end face 13 with opposing inclinations, it is also possible to provide only one or several such recess(es) 20, in which case a correspondingly tapering region of the base element 7 is provided for every recess 20. Several recesses 20 could also be provided for every such region. The recesses 20 are preferably disposed in the region of the respective point with the smallest width of the base element 7, as illustrated in Fig. 3.

These inclined regions of the longitudinal end face 13 of the base element need not necessarily be of a straight design. It would also be possible for this region or these regions of the longitudinal end face 13 to be based on a curved design, thereby forming a "drainage pan".

Furthermore, this drainage pan or the inclined region need not be provided across the entire height of the base element 7, although this is possible. This region or these regions preferably extend starting from the bottom face 15 across only a part-region of the height of the base element 7. As a result, the surface 14 for supporting the wall element 8 has a constant cross-section across the entire length of the base element 7 (as viewed from above).

Furthermore, the inwardly lying longitudinal end face 13 (relative to the installed position of the noise reduction device 1) is designed so that it is inclined entirely towards the outwardly lying longitudinal end face 10, in other words the base element 7 has a tapering design in the region of the bottom face 15, as illustrated in Fig. 4. In this case, the recess 20 for drainage is disposed in the region of the widthways end face 18 or 19 of the base element 7, depending on the direction of inclination of the longitudinal end face 13. The recess 20 in this case may be a chamfer in the bottom edge of the widthways end face 18 or 19, and another option is for the recess 20 to be provided in the form of the chamfers of two adjoining base elements 7.

Returning to the diagram in Fig. 1, in the context of another embodiment of the noise reduction device 1, at least one duct 21 is provided in the base element, which is accessible from the top face 9 of the base element 7. In particular, it is a cable trough integrated in the surface of the base element 7 that can be walked on. Such cable troughs are used for signal cables, cables for railway equipment, optical cables, signal amplifiers, etc., for example.

In the prior art, such cable troughs are laid in the drainage region of the ballast bed, which means that they prevent water from draining away, thereby having an adverse effect on the ability to maintain the track system. This is likewise a disadvantage as regards the cables and other electronic devices which are often accommodated in the cable troughs. By providing cable troughs in the base element 7, the disadvantages known from the prior art can be avoided. For the sake of completeness, it should be pointed out that the duct 21, in other words the cable trough, extends across the entire length of the base element 7 in the direction of the base element longitudinal extension 11 (Fig. 3).

The duct 21 is preferably provided with cover plates 22 which can be walked on so as to avoid interference with the walk-on surface of a safety area 23, indicated by broken lines in Fig. 1.

The duct 21 may also be used for other purposes if necessary.

As already explained above, the wall element 8 is retained by at least one support element, for example a profiled H-section, into which the wall elements 8 can simply be slotted. Based on another embodiment of the noise reduction device 1, the support element may be height-adjustable (e.g. by means of several mounting bores in the support element or by means of telescopically extractable support elements) and/or may be pivotable towards the horizontal (for example within a range of between 0 ° and 5 ° or 0° and 3 °), in which case, appropriate joints may be provided. This enables the noise reduction device 1 to be mounted even on banked runs, in particular on bends, in which the ballast height of the ballast bed is of differing heights (as viewed in cross-section), and the overall height of the wall elements 8 can be levelled relative to one another so that the wall elements 8 to the right and left of the track system 2 terminate at least approximately at the same height and can also be vertically oriented in bend regions.

In order to obtain a fine adjustment of the height levelling between the base element 7 and the wall element 8 and/or between the wall elements 8, it is also possible to insert spacer strips, for example made from rubber. Such spacer pieces can also be provided between the support element and the base element 7 for the same reason.

In order to level the height, wall elements 8, in particular those made from open-pored concrete, may be made to different heights and combined with other wall elements 8 based on a standard module height depending on the desired height.

In the preferred embodiment, at least the top two rows of wall elements 8 (or more than two) are made as highly absorbing wall elements of a standard height (e.g. 500mm).

In the context of the invention, a ballast bed 24 may extend as far as the wall element 8 of the noise reduction device 1, as indicated by broken lines in Fig. 1, in other words ballast at the top is placed flat alongside the track span, thereby providing a surface that can be walked on in a situation where passengers have to be evacuated or for the locomotive driver during an inspection within the noise reducing wall when a train is standing on the track span.

On the inner side facing the track span, the base element 7 may be configured so that a region of a pre-definable height, e.g. at least 600 mm, is left free from the ballast top edge down to the sub-structure 17 between the outer flush crosstie edge and base element 7 so that ballast cleaning work can also be undertaken unhindered using maintenance equipment.

The embodiments of the noise reduction device offer the advantage that practically all types of work can be carried out on the track unhindered (tamping, ballast cleaning, track rebuilding, planing, work on overhead cables, rail machining, etc.). When working on the track without a derailer, workers in the working area remove the wall elements 8 and can therefore make their way unhindered to the safety area in the event of a train warning. The same procedure can be used in principle in the event of evacuation. However, another option is to provide sound-insulated doors at regular intervals (e.g. at a distance of 150 m) for the purpose of evacuation. Another advantage of this design is that the noise reduction device 1 is not able to move inwards towards the track and into the clearance outline as a result of wind and the suction effect of a passing train because it is prevented from doing so by the ballast in between. A safety area 23 can also be made available in which persons can stand safe and on the flat.

The top face 9 may have the same angle of inclination as the bottom face 15. However, it is also possible for the top face 9 of the base element 7 to be designed so that it extends parallel with the horizontal, in which case the bottom face 15 is inclined relative to the top face 9, in particular the top face 9 and bottom face 15 subtend an angle 16 as described above. It is also possible for the lengthways and widthways end faces 10, 13, 18 and 19 to be at least approximately vertically oriented. Reference may be made to Fig. 5. Based on this embodiment, it is not necessary for the support element to be pivotable towards the horizontal.

Fig. 6 illustrates an embodiment of the noise reduction device 1 viewed at an angle from underneath. The base element 7 is illustrated with the wall element 8 mounted on it. The base

element 7 has several recesses 20 in the bottom face 15 which are used to drain water from the traffic route, in particular the railroad, and which are preferably open at the bottom, as illustrated in Fig. 6. The recesses 20 comprise at least one longitudinal recess 25 and at least one, preferably several, transverse recess(es) 26.

The longitudinal recess 25 extends from the widthways end face 18 to the widthways end face 19 in the direction of the base element longitudinal extension 11 of the base element 7. Since the longitudinal recess 25 is preferably designed so that it is open in the widthways end faces 18, 19, a power connection can be established between the base elements 7 through this longitudinal recess 25 by fitting several base elements 7 together. However, it is also possible for the longitudinal recess 25 to be closed at the widthways end faces 18, 19.

The transverse recesses 26 extend transversely, in particular orthogonally, to the at least one longitudinal recess 25 and open into the longitudinal recess 25. The latter may therefore serve as a collection passage. It is preferable to provide several transverse recesses 26 with different cross-sectional surfaces in the base element 7. In order to provide more reliable drainage even if the longitudinal end face 13 directed towards the ballast bed 24 is straight (Fig. 1), several inwardly disposed transverse recesses 26 are provided, starting from the longitudinal end face 13 and opening into the longitudinal recess 25, which have a smaller cross-sectional surface than transverse recesses 26 extending from the longitudinal recess 25 into the second, outer longitudinal end face 10. These inwardly lying transverse recesses 26 may also have a smaller cross-sectional surface than the longitudinal recess 25. In this respect, it may be of advantage if these inwardly lying transverse recesses 26 are disposed at a shorter distance from one another than the outwardly lying transverse recesses 26. The outer transverse recesses 26 are preferably disposed in the region of the widthways end face 18, 19, as may be seen from Fig. 6.

It should be pointed out that the terms “inwardly” and “outwardly” refer to the installed position of the noise reduction device 1 and denote the region of the noise reduction device 1 facing the ballast bed 24 (Fig.1) and rails. Accordingly, the terms “outer” and “outwardly lying” refer to the oppositely lying side of the noise reduction device 1.

Although the longitudinal recess 25 and the transverse recesses 26 in Fig. 1 are illustrated with a semi-circular cross-section, it would also be possible for them to have other cross-sectional shapes.

In the context of the invention, a longitudinal groove may also be provided in the top face 9 of the base element 7, which extends across the entire length of the base element 7 and which serves as the mount for the wall element 8, as illustrated in Fig. 6. This longitudinal groove 27 has a width which is only slightly greater than the width of the wall element 8 in the same direction, preferably is at most 20 %, in particular at most 10 %, wider than the wall element 8. This enables the stability of the fit of the wall element 8 in the base element 7 to be improved.

For drainage purposes, instead of or in addition to the recesses 20 in the bottom face 15 of the base element 7, the latter could also be provided with at least one drainage duct (drainage pipe) with a closed cross-section. For details of the orientation of this at least one drainage duct, reference may be made to the explanation given in connection with the recesses 20 used for drainage.

Fig. 7 illustrates another embodiment of the noise reduction device 1 viewed at an angle from behind. In this embodiment, the base element 7 has a widened base because at least one base element projection 28 is provided on the longitudinal end face 13, i.e. the rear face, of the base element 7 facing the ballast bed 24 (Fig. 1), which in particular is of an integral design with the base element 7. This base element projection 28 extends in the direction away from the longitudinal end face 13 of the base element 7. Consequently, the base element projection 28 extends beyond the wall element 8 in the direction towards the ballast bed 24. As a result, the base element 7 extends down underneath the ballast bed 24 (Fig. 1) due to this at least one base element projection 28, thereby additionally securing the base element 7 due to the natural weight of the ballast bed 24 disposed on this base element projection 28.

The base element projection 28 may extend across only a part-region or across the entire base element longitudinal extension 11 (Fig. 3). Another option is to provide several, for example two or three, base element projections 28 in the direction of the base element longitudinal extension 11 disposed one after the other.

Furthermore, a top face 29 of the base element projection 28 is of a downwardly inclined design, as may be seen from Fig. 7.

The base element projection 28 preferably adjoins the bottom face 15 of the base element 7 in a flush arrangement and is a constituent part of this bottom face 15. However, it would also be possible for the base element projection 28 to be offset from this bottom face 15 in the direction of the height of the base element 7.

For the preferred situation in which the bottom face of the base element projection 28 is disposed in the plane of the bottom face 15 of the base element 7, the bottom face is preferably inclined at the same inclination relative to the horizontal as the bottom face 15. In this case, it is also preferred if the at least one recess 20, in particular for draining the sub-structure, is provided on or in the bottom face of the base element projection 28.

It is also possible for the base element projection 28 to taper away forwards in the direction of the longitudinal end face 13 of the base element 7.

For the sake of completeness, it should be pointed out that the so-called center element of the sound reducing wall, as illustrated in Fig. 5 between the two track runs, may be based on the embodiments described in AT 508 575 B1 or DE 20 2011 052 057 U1. For more details, reference may be made to AT 508 575 B1 and DE 20 2011 052 057 U1.

The embodiments of the noise reducing device 1 described above are used as so-called field elements in particular.

The embodiments illustrated as examples represent possible variants of the noise reduction device 1, and it should be pointed out at this stage that the invention is not specifically limited to the variants specifically illustrated, and instead the individual variants may be used in different combinations with one another and these possible variations lie within the reach of the person skilled in this technical field given the disclosed technical teaching.

For the sake of good order, finally, it should be pointed out that, in order to provide a clearer understanding of the structure of the noise reduction device, it and its constituent parts are illustrated to a certain extent out of scale and/or on an enlarged scale and/or on a reduced scale.

It should also be pointed out that parts of the noise reduction device 1 and track system 2 may be construed as independent inventions in their own right. The provision of the duct 21, i.e. cable trough, in the base element 7, in particular in the safety area 23, for example, may be construed as an independent invention. Another independent invention is the provision of the noise reduction device 1 in the track system 2, as illustrated in Fig. 1. The height compensating system described above may also be construed as an independent invention. In respect of these independent inventions, the bottom face 15 of the base element 7 need not necessarily be based on an inclined design, in which case it is also possible for the bottom face to extend at least approximately parallel with the horizontal. In the context of these other independent inventions, it is also possible for the noise reduction device to be disposed on a solid road. Another independent invention may be the provision of the base element projection 28.

List of reference numbers

1	Noise reduction device	21	Duct
2	Track system	22	Cover plate
3	Track run	23	Safety area
4	Wheel	24	Ballast bed
5	Railway vehicle	25	Longitudinal recess
6	Distance	26	Transverse recess
7	Base element	27	Longitudinal groove
8	Wall element	28	Base element projection
9	Top face	29	Top face
10	Longitudinal end face		
11	Base element longitudinal extension		
12	Side region		
13	Longitudinal end face		
14	Surface		
15	Bottom face		
16	Angle		
17	Sub-structure		
18	Widthways end face		
19	Widthways end face		
20	Recess		

Claims

1. Noise reduction device (1) for installation on a traffic route, comprising at least one base element (7) and at least one wall element (8), the base element (7) having a top face (9) and a bottom face (15), and the wall element (8) is disposed on the top face (9) of the base element (7), wherein the bottom face (15) of the base element (7) is inclined at an angle (16) relative to the horizontal.

2. Noise reduction device (1) according to claim 1, wherein at least one recess (20) is provided in the bottom face (15) of the base element (7).

3. Noise reduction device (1) according to claim 2, wherein the at least one recess (20) extends from a first longitudinal end face (10) to a second longitudinal end face (13) of the base element (7).

4. Noise reduction device (1) according to claim 3, wherein the second longitudinal end face (13) of the base element (7) extends obliquely with respect to the first longitudinal end face (10) in at least certain regions.

5. Noise reduction device (1) according to one of claims 1 to 4, wherein at least one duct (21) is provided in the base element (7) which is accessible from the top face (9) of the base element (7).

6. Noise reduction device (1) according to one of claims 1 to 5, wherein the wall element (8) is retained by at least one support element, and the support element is height-adjustable and/or can be pivoted towards the horizontal.

7. Noise reduction device (1) according to one of claims 1 to 6, wherein at least one base element projection 28 is disposed on the rear longitudinal end face 13 of the base element 7.

8. Track system (2) with rails and at least one noise reduction device (1) disposed next to the rails and comprising at least one base element (7) and at least one wall element (8),

and the rails are disposed on a ballast bed (24) by means of crossties, and the ballast bed is disposed on a sub-structure (17), wherein the noise reduction device (1) is as defined in one of the preceding claims and is disposed on the sub-structure (17).

9. Track system (2) according to claim 8, wherein the ballast bed (24) extends as far as the wall element (8) of the noise reduction device (1), in particular extends at least approximately horizontally with respect to the wall element (8).

Fig.1

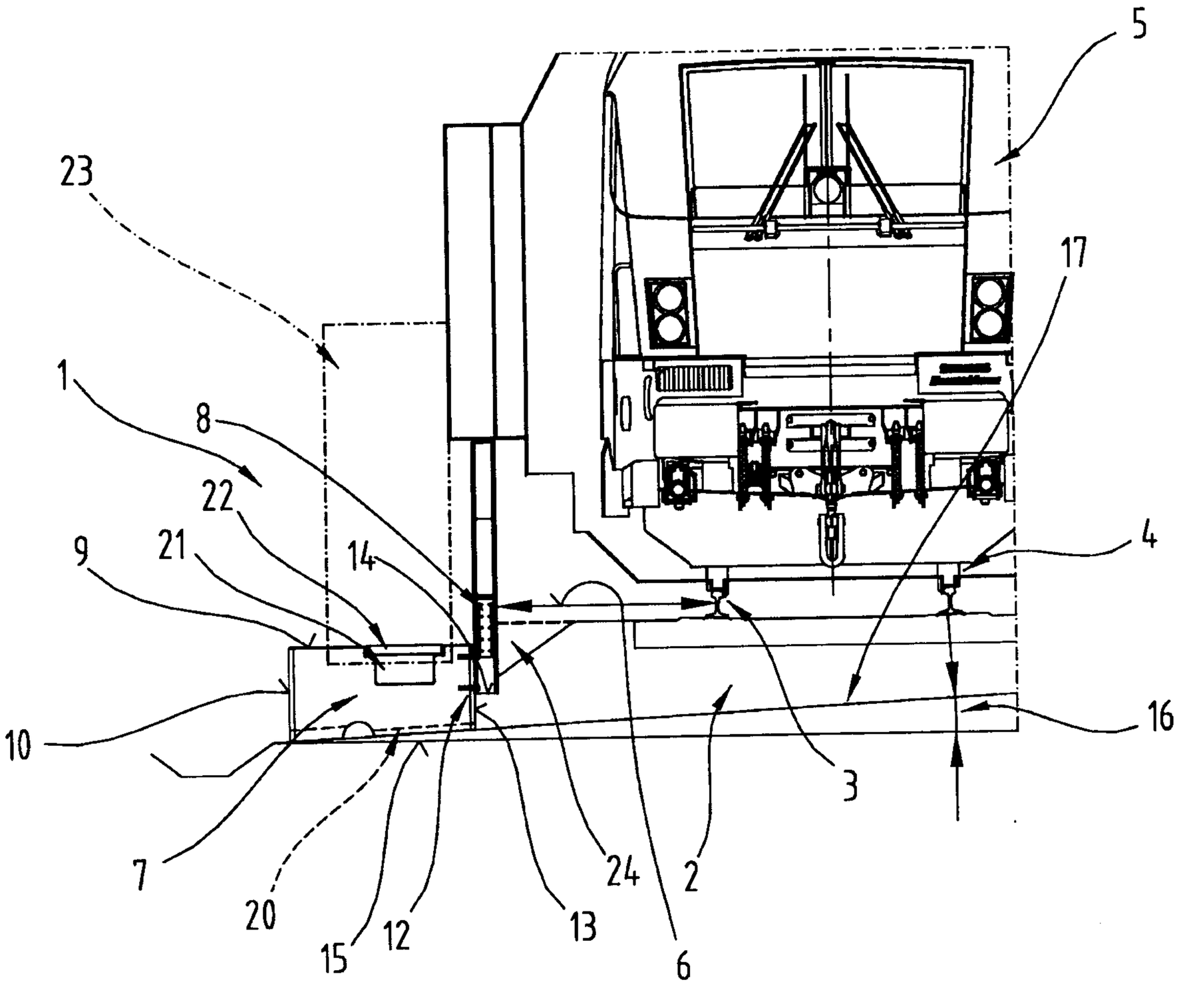


Fig.2

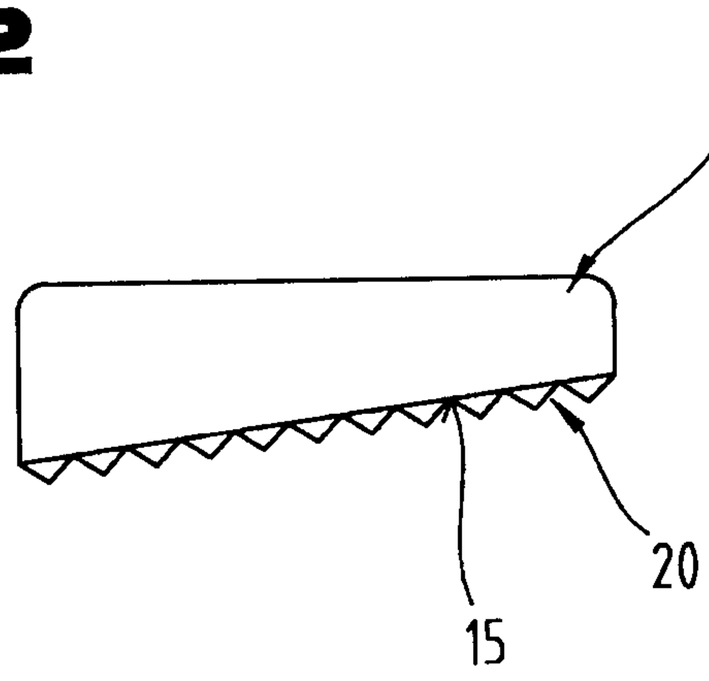


Fig.4

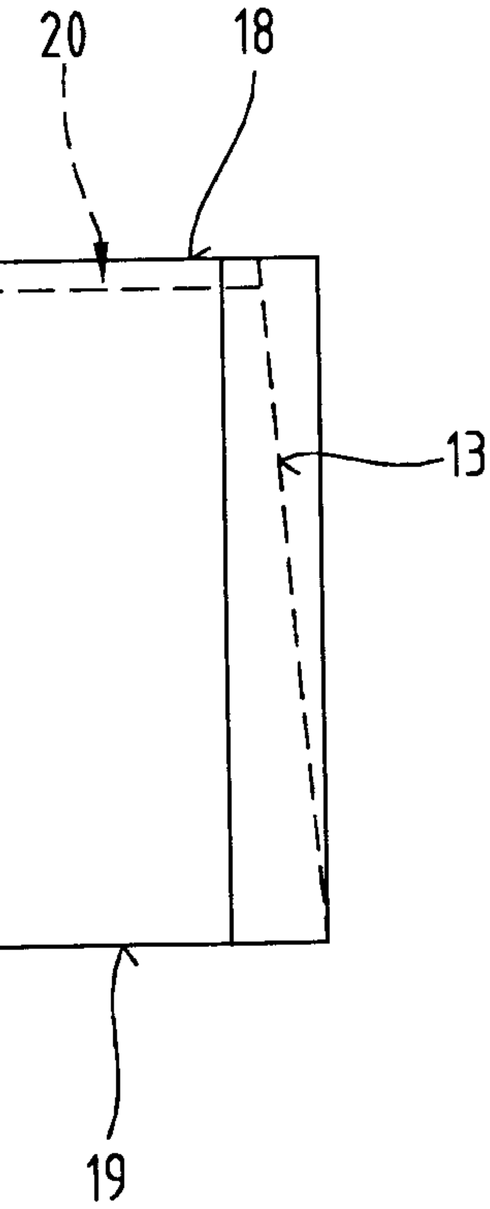
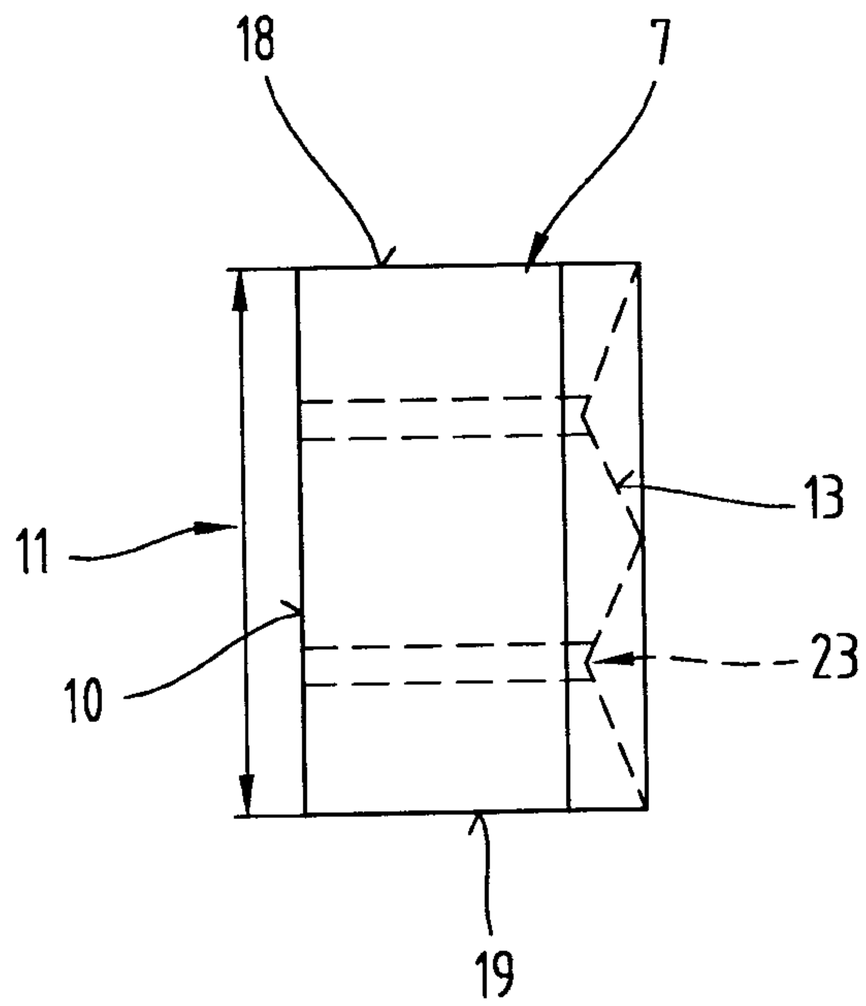


Fig.3



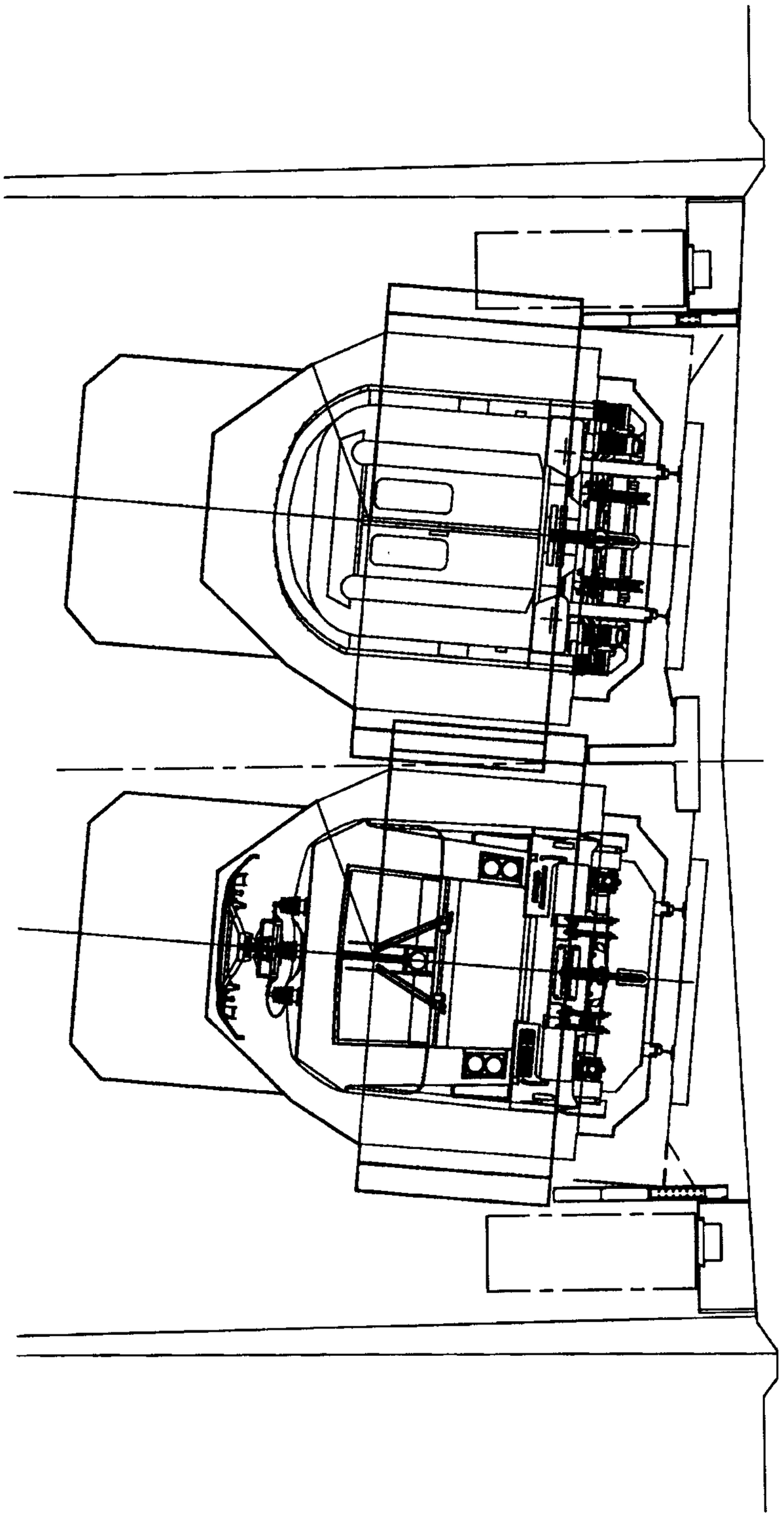


Fig. 3-5

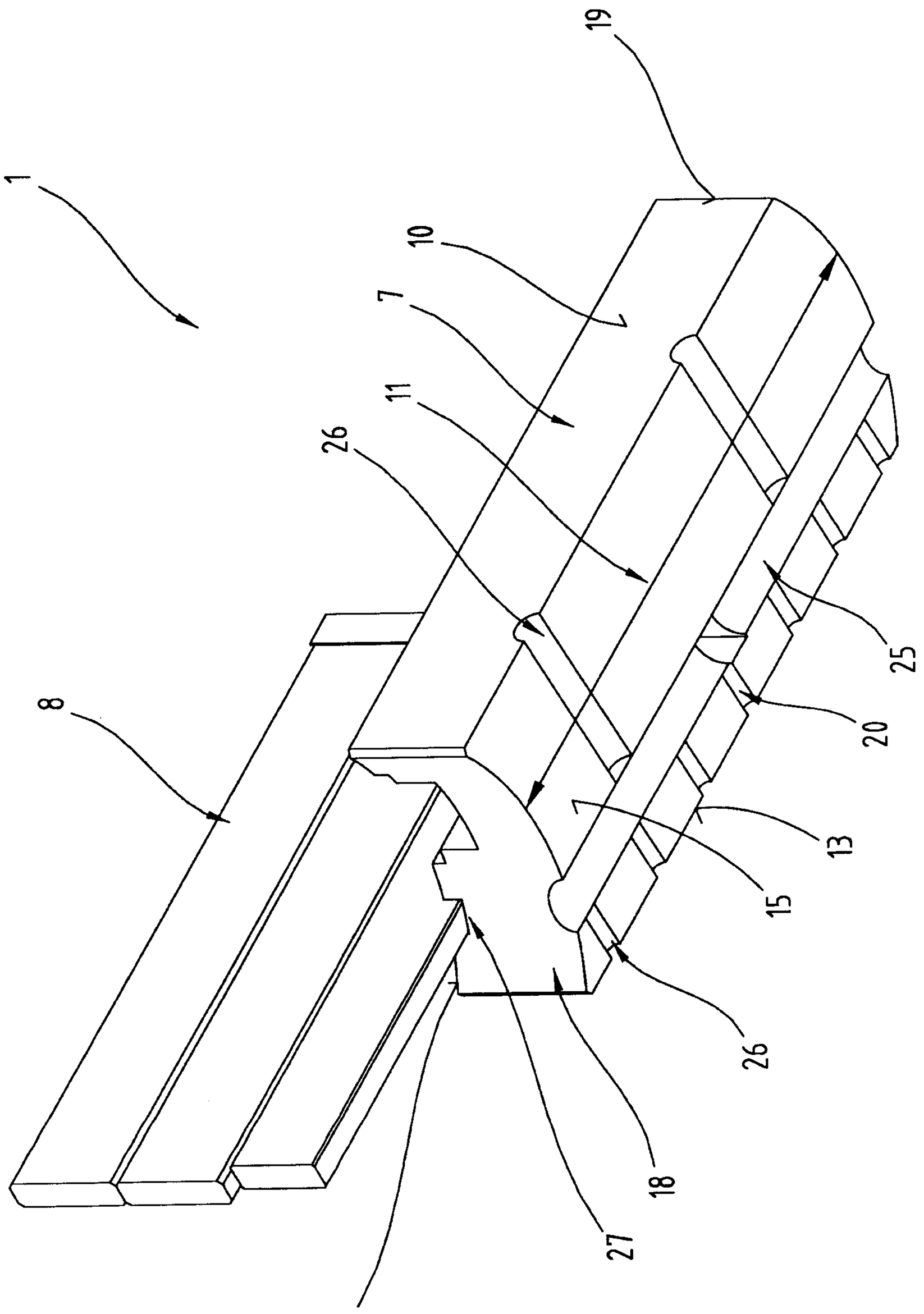


Fig.6

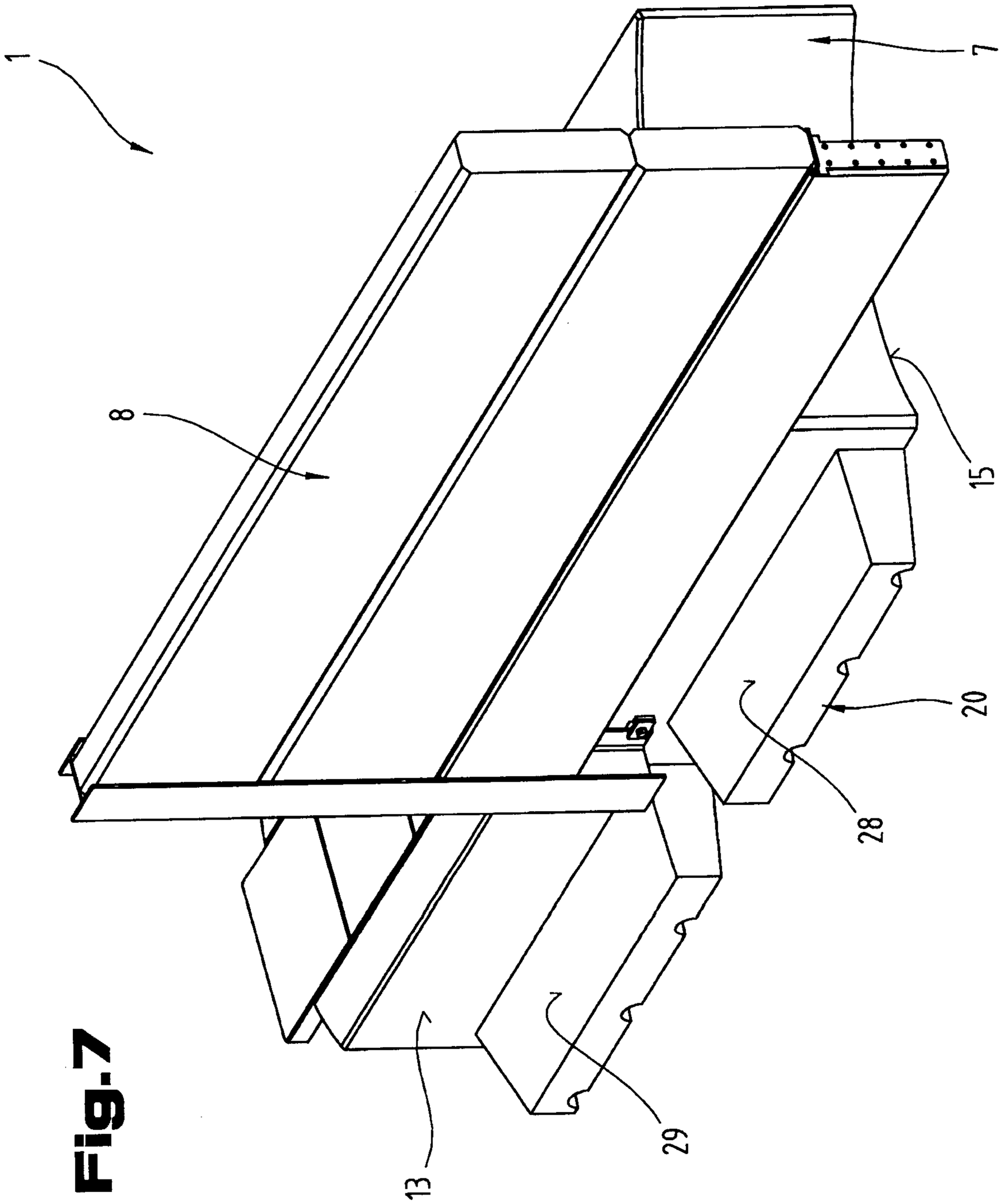


Fig.7

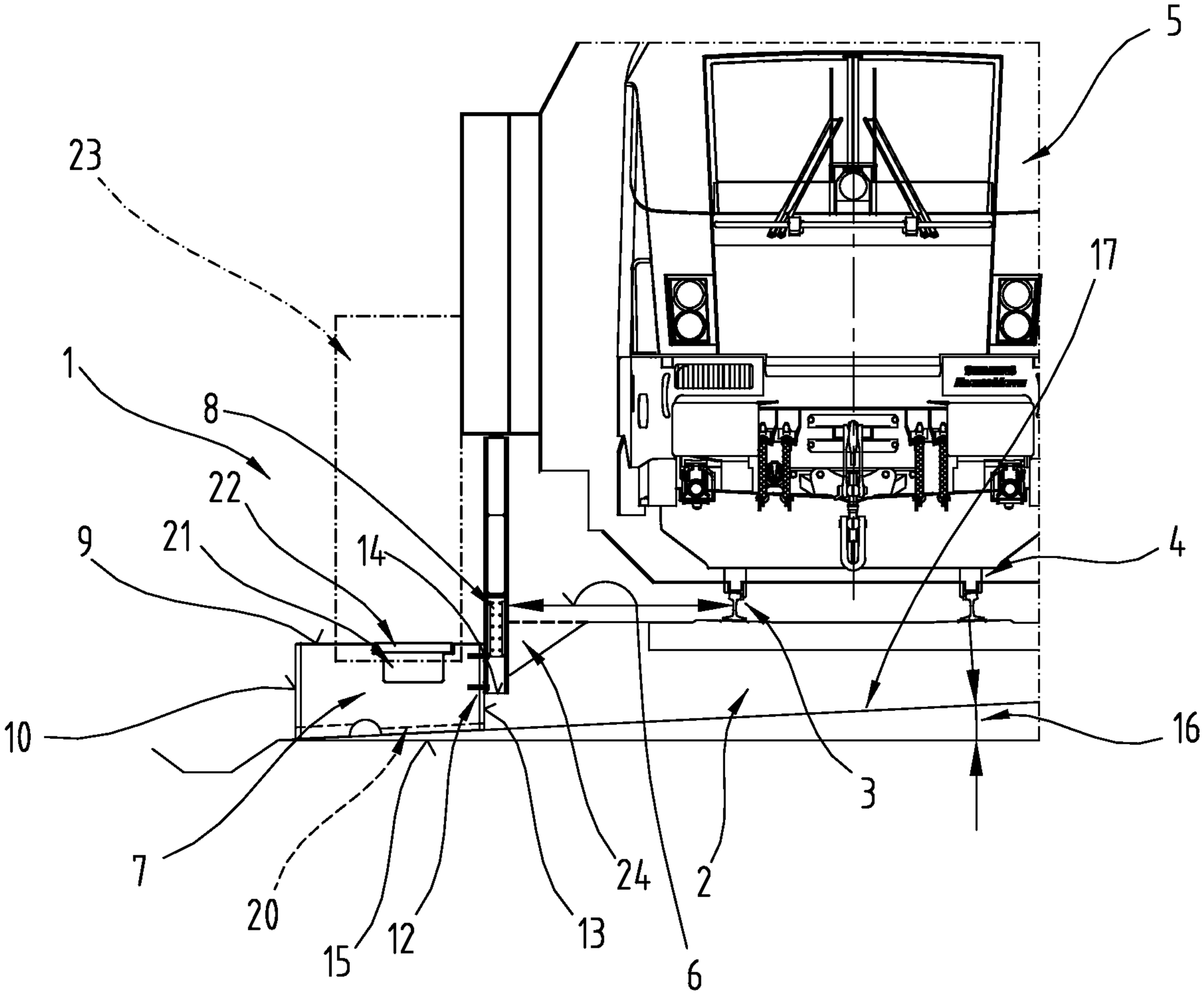



Fig.1