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(71) Applicant: **ALSTOM Holdings**
93400 Saint-Ouen-sur-Seine (FR)

(72) Inventors:

- KRUEGER, Andreas**
38120 BRAUNSCHWEIG (DE)
- ROSENTHAL, Ilka**
38327 SEMMENSTEDT (DE)

(74) Representative: **Lavoix**
2, place d'Estienne d'Orves
75441 Paris Cedex 09 (FR)

(54) RAIL SWEEPER FOR A RAIL VEHICLE AND RAIL VEHICLE COMPRISING SAID RAIL SWEEPER

(57) The invention relates to a rail sweeper (20) for a rail vehicle, the rail sweeper comprising a shield structure (32) and a support structure (34), the shield structure being movable relative to the support structure, between an extended position and a retracted position.

The support structure comprises a first (40) and a second (42) beams, each beam extending between a proximal end (48) and a distal end (50), the proximal end

comprising a proximal coupling organ (52) for being fixed to the front end of a carbodyshell of the vehicle ; and the shield structure is slidably assembled with the first and second beams so that, in the extended position, the shield structure is disposed at the distal ends and, in the retracted position, the shield structure is closer to the proximal ends.

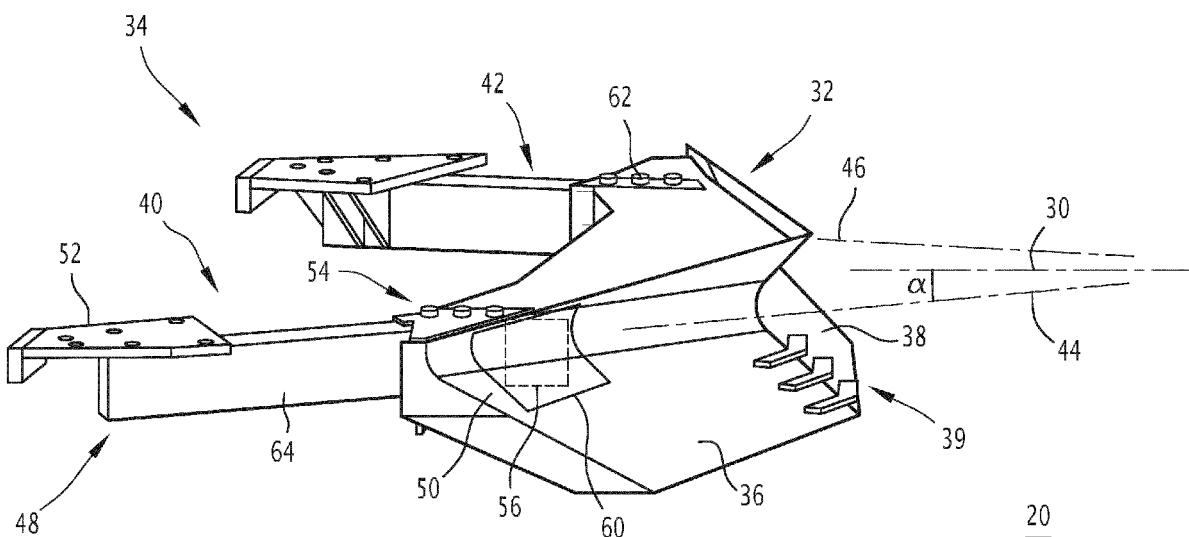


FIG.2

Description

[0001] The present invention relates to a rail sweeper for a rail vehicle having a carbodyshell, the carbodyshell having a front end, the rail sweeper comprising: a shield structure, arranged to push away a light obstacle placed under the front end of the carbodyshell ; and a support structure, designed for being fixed to said front end ; the shield structure being movable along a main axis relative to the support structure, between an extended position and a retracted position.

[0002] A rail sweeper, also known as snowplow or pilot, is a device which is usually placed at the front end of a rail vehicle, such as a train, to deflect possible obstacles present on the railway track. Such obstacles of low weight, such as snow, might otherwise derail the moving train.

[0003] Obstacles should be deflected as early as possible because otherwise they might damage the train, thus resulting in unnecessary maintenance costs. For this reason, the rail sweeper is placed as far ahead as possible on the front end of the carbodyshell.

[0004] It is known to provide the rail vehicle with shock absorbers, able to absorb the impact energy in case of impacts with high-weight obstacles disposed on the path.

[0005] In order to guarantee the proper functioning of the shock absorbers, document EP3575178, in the name of the Applicant, discloses a rail sweeper of the aforementioned type, able to retract in case of a high-energy impact.

[0006] However, the design of such a rail sweeper limits the course of the shield structure along the main axis, due to its bulk. Such a design also implies a low positioning of the shield structure. The protection against snow is therefore insufficient for the snowy areas, where the snow layers on the ground may be very thick.

[0007] The present invention aims to solve the above-mentioned problems. For this purpose, the invention relates to a rail sweeper of the aforementioned type, wherein : the support structure comprises a first and a second beams, extending respectively along a first beam axis and along a second beam axis ; each of the first and second beams has a proximal end and a distal end, the proximal end comprising a proximal coupling organ for being fixed to the front end of the carbodyshell ; and the shield structure is slidably assembled with the first and second beams so that, in the extended position, the shield structure is disposed at the distal ends of the first and second beams and, in the retracted position, the shield structure is closer to the proximal ends of the first and second beams than in the extended position.

[0008] According to preferred embodiments, the rail sweeper for a rail vehicle may include one or more of the following features, considered alone or in any technically possible combination:

- the shield structure comprises a first and a second openings, each of the first and second beams being

able to slide, along the main axis, in said first opening and said second opening respectively ;

- the shield structure comprises a first and a second concave deflecting surfaces, each of said deflecting surfaces forming a groove extending horizontally from the main axis and inclined relative to said main axis ;
- the distal end of each of the first and second beams comprises a coupling panel, so that, in the extended position of the shield structure, each coupling panel closes the corresponding first or second opening and forms a continuous surface with the corresponding first or second deflecting surface ;
- the distal end of each of the first and second beams comprises a distal coupling organ assembled to the shield structure in the extended position; and wherein the distal coupling organ comprises a tearing element, able to break under an impact between the shield structure and a heavy obstacle disposed along the main axis ;
- each of the first and second beam axes is inclined relative to the main axis, of an angle comprised between 0° and 30°, preferably comprised between 20° and 25° ;
- at least one of the first and second beams comprises a bending area disposed between the proximal end and the distal end ;

[0009] The invention also relates to a rail vehicle having a carbodyshell extending along a horizontal moving axis, the carbodyshell having a front end the rail vehicle comprising a rail sweeper as described above, the support structure of said rail sweeper being fixed to the front end, the main axis of the rail sweeper being parallel to the horizontal moving axis.

[0010] According to preferred embodiments, the rail vehicle may include one or more of the following features, considered alone or in any technically possible combination:

- each of the first and second beam axes is disposed substantially horizontally ;
- the rail vehicle also comprises at least one shock absorber extending along the moving axis, ahead of the front end, and the retracted position of the shield structure of the rail sweeper allowing said at least one shock absorber to absorb an impact energy of an impact of the rail vehicle along the horizontal moving axis.

[0011] The invention will be easier to understand in view of the following description, provided solely as an example, and with reference to the appended drawings, wherein :

- Figure 1 is a schematic side view of a rail vehicle according to an embodiment of the invention, comprising a rail sweeper ; and

- Figure 2 is a perspective view of the rail sweeper of Figure 1.

[0012] Figure 1 shows a rail vehicle 10, such as a train, according to an embodiment of the invention.

[0013] The rail vehicle 10 is designed for running along a moving direction, substantially horizontal. In the following description, an orthonormal basis (X, Y, Z), associated with the rail vehicle 10, is considered. X represents the moving direction, considered horizontal, and Z represents the vertical direction.

[0014] The rail vehicle 10 comprises a carbodyshell 12, at least a bogie 14, and at least one shock absorber 16. In the embodiment of Figure 1, the rail vehicle 10 also comprises a front coupler 18.

[0015] The rail vehicle 10 also comprises a rail sweeper 20 according to an embodiment of the invention.

[0016] The carbodyshell 12 extends along a moving axis 22, parallel to X, of the rail vehicle 10. The bogie 14, shown on Figure 1, is fixed to a lower part of the carbodyshell 12. The bogie 14 allows the rail vehicle 10 to circulate on rails 21 which form a path for the rail vehicle 10.

[0017] The carbodyshell 12 comprises a front end 24, disposed ahead of the bogie 14 relative to the moving axis 22. A bottom space 26 is vertically comprised between a lower surface 28 of said front end 24 and a bottom end of the bogie 14.

[0018] In the embodiment of Figure 1, the front coupler 18 extends along the moving axis 22, ahead of the front end 24.

[0019] The at least one shock absorber 16 is designed for absorbing an impact energy in case of an impact with an obstacle disposed in the path of the rail vehicle 10, on or between the rails 21.

[0020] The at least one shock absorber 16 extends along the moving axis 22, ahead of the front end 24. Preferably, the rail vehicle 10 comprises two shock absorbers 16, disposed on either side of the front coupler 18. More preferably, the two shock absorbers 16 are disposed symmetrically relative to a vertical median plane of the front end 24, said vertical median plane including the moving axis 22.

[0021] The rail sweeper 20 is fixed to the lower surface 28 of the front end 24 and disposed in the bottom space 26.

[0022] The rail sweeper 20 alone is shown on Figure 2. The rail sweeper 20 extends along a main axis 30 and comprises a shield structure 32 and a support structure 34. Preferably, the main axis 30 of the rail sweeper 20 is parallel to the moving axis 22, when the rail sweeper 20 is fixed to the front end 24 of the carbodyshell 12. In other terms, the main axis 30 of the rail sweeper 20 extends along X.

[0023] In the embodiment of Figure 1 and in the following description, the main axis 30 is merged with the moving axis 22 of the rail vehicle 10.

[0024] The shield structure 32 is designed for pushing away light obstacles, such as snow, placed on the path

of the rail vehicle 10.

[0025] Preferably, a projection of the shield structure 32 on a horizontal plane is substantially V-shaped. More precisely, the shield structure 32 comprises a first 36 and a second 38 deflecting surfaces, symmetrical relative to the vertical median plane of the front end 24. In the embodiment of Figures 1 and 2, each deflecting surface 36, 38 is curved, with a concavity substantially oriented forward. In other terms, each deflecting surface 36, 38 forms a substantially rectilinear groove, extending horizontally from the main axis 30 and inclined relative to said main axis.

[0026] Preferably, the shield structure 32 also comprises an antyclimber 39, disposed at a junction of the first 36 and second 38 deflecting surfaces.

[0027] The support structure 34 comprises a first 40 and a second 42 beams, extending respectively along a first beam axis 44 and along a second beam axis 46. Preferably, the first 40 and second 42 beams are disposed on either side of the vertical median plane of the front end 24. More preferably, the first 40 and second 42 beams are symmetrical relative to said vertical median plane.

[0028] Preferably, each of the first 44 and second 46 beam axes is inclined relative to the main axis 30 of an angle α comprised between 0° and 30° . More preferably, the angle α is comprised between 20° and 25° .

[0029] Each of the first 40 and second 42 beams has a proximal end 48 and a distal end 50. The proximal end 48 comprises a proximal coupling organ 52 for being fixed to the lower surface 28 of the front end 24. Preferably, the proximal coupling organ 52 comprises a plate able to be screwed to the lower surface 28.

[0030] The distal end 50 of each of the first 40 and second 42 beams comprises a distal coupling organ 54, described below.

[0031] The shield structure 32 is movable along the main axis 30 relative to the support structure 34, between an extended position and a retracted position. The extended position is shown on Figures 1 and 2.

[0032] More precisely, the shield structure 32 is slidably assembled with the first 40 and second 42 beams so that, in the extended position, the shield structure 32 is disposed at the distal ends 50 and, in the retracted position, the shield structure is closer to the proximal ends 48 than in the extended position.

[0033] In the embodiment of Figures 1 and 2, each of the first 36 and second 38 deflecting surfaces comprises a traversing opening 56 in which the first 40 or second 42 beam, respectively, is able to slide along the main axis 30.

[0034] The distal coupling organ 54 of the distal end 50 of each beam 40, 42 comprises a coupling panel 60, so that, in the extended position of the shield structure 32, each coupling panel 60 closes the corresponding opening 56 and forms a continuous surface with the corresponding deflecting surface 36, 38.

[0035] The distal coupling organ 54 of the distal end

50 of each beam 40, 42 also comprises at least one tearing element 62, assembling said distal end 50 with the shield structure 32 in the extended position. The tearing element 62 is able to break under an impact, along the main axis 30, between the shield structure 32 and a heavy obstacle disposed on the path of the rail vehicle 10.

[0036] As shown on Figure 2, the distal coupling organ 54 of each distal end 50 comprises a plurality of tearing elements 62, such as breakable screws.

[0037] The tearing elements 62 are designed for breaking under an impact of a force level along X superior or equal to a predetermined threshold. For example, the predetermined threshold is higher than 300kN, so the obstacle deflector does not shear off during the clearing of the track from smaller obstacles. More preferably, the predetermined threshold is around 600kN.

[0038] In a preferred embodiment, at least one of the first 40 and second 42 beams comprises a bending area 64 disposed between the proximal end 48 and the distal end 50. The bending area 64 has a lower resistance than other areas of the beams 40, 42, so that said bending area 64 is able to bend under an impact on the corresponding beam 40, 42.

[0039] More preferably, each of the first 40 and second 42 beams comprises a bending area 64.

[0040] An implementation of the rail vehicle 10 and of the rail sweeper 20 will now be described.

[0041] The rail sweeper 20 is considered in an initial state, wherein the tearing elements 62 are intact and the shield structure 32 is in the extended position relative to the support structure 34. As the rail vehicle 10 circulates on rails 21 along the moving axis 22, the shield structure 32 removes lights obstacles disposed on or between the rails. For example, if the rails 21 are covered with snow, each of the groove-shaped first 36 and second 38 deflecting surfaces evacuates the snow on a side of the rail vehicle 10.

[0042] Due to the design of the invention, it is possible to place the shield structure 32 at an upper end of the bottom space 26, close to the lower surface 28 of the front end of the carbodyshell 12. Therefore, the rail sweeper 20 is adapted for evacuating thick layers of snow before a passage of the rail vehicle 10 on the rails 21.

[0043] In case of a heavy obstacle on the rails 21, such as another vehicle, an impact of a force level along X superior or equal to the predetermined threshold causes the tearing elements 62 to break and the shield structure 32 to slide along the first 40 and second 42 beams from the extended position to the retracted position.

[0044] Thus, the shield structure 32 moves back relative to the front end 24 of the carbodyshell, allowing a proper functioning of the shock absorbers 16. The low bulk of the shield structure 32 along X allows it to be disposed very close to the bogie 14 in the retracted position. The amplitude along X between the extended and the retracted positions is thus improved compared with the prior art.

[0045] In an embodiment, the impact also causes the

bending areas 64 of the beams 40, 42 to deform, allowing the distal end 50 of each beam to move back relative to the front end 24. Such a deformation of the beams 40, 42 is also useful in a non-symmetrical impact, so as to move back the shield structure 32.

[0046] The anticlimber 39 prevents that the other vehicle forming an obstacle climbs up on to the vehicle 10 during a crash and it also prevents the shield structure 32 from sliding vertically when moved to the retracted position. The shield structure 32 is allowed to remain in a horizontal position.

Claims

1. A rail sweeper (20) for a rail vehicle (10) having a carbodyshell (12), the carbodyshell (12) having a front end (24),

the rail sweeper (20) comprising a shield structure (32), arranged to push away a light obstacle placed under the front end (24) of the carbodyshell (12); and a support structure (34), designed for being fixed to said front end (24);
the shield structure (32) being movable along a main axis (30) relative to the support structure (34), between an extended position and a retracted position,
the rail sweeper (20) being characterized in that:

- the support structure (34) comprises a first (40) and a second (42) beams, extending respectively along a first beam axis (44) and along a second beam axis (46);

- each of the first (40) and second (42) beams has a proximal end (48) and a distal end (50), the proximal end (48) comprising a proximal coupling organ (52) for being fixed to the front end (24) of the carbodyshell (12); and

- the shield structure (32) is slidably assembled with the first (40) and second (42) beams so that, in the extended position, the shield structure (32) is disposed at the distal ends (50) of the first (40) and second (42) beams and, in the retracted position, the shield structure (32) is closer to the proximal ends (48) of the first (40) and second (42) beams than in the extended position.

2. The rail sweeper (20) according to claim 1, wherein the shield structure (32) comprises a first and a second openings (56), each of the first (40) and second (42) beams being able to slide, along the main axis (30), in said first opening and said second opening (56) respectively.

3. The rail sweeper (20) according to claim 1 or claim 2, wherein the shield structure (32) comprises a first (36) and a second (38) concave deflecting surfaces, each of said deflecting surfaces (36, 38) forming a groove extending horizontally from the main axis (30) and inclined relative to said main axis (30). 5

4. The rail sweeper (20) according to claim 3 combined with claim 2, wherein the distal end (50) of each of the first (40) and second (42) beams comprises a coupling panel (60), so that, in the extended position of the shield structure (32), each coupling panel (60) closes the corresponding opening (56) and forms a continuous surface with the corresponding deflecting surface (36, 38). 10

5. The rail sweeper (20) according to any one of the previous claims, wherein the distal end (50) of each of the first (40) and second (42) beams comprises a distal coupling organ (54) assembled to the shield structure (32) in the extended position; and wherein the distal coupling organ (54) comprises a tearing element (62), able to break under an impact between the shield structure (32) and a heavy obstacle disposed along the main axis (30). 15 20 25

6. The rail sweeper (20) according to any one of the previous claims, wherein each of the first (44) and second (46) beam axes is inclined relative to the main axis (30), of an angle (α) comprised between 0° and 30°, preferably comprised between 20° and 25°. 30

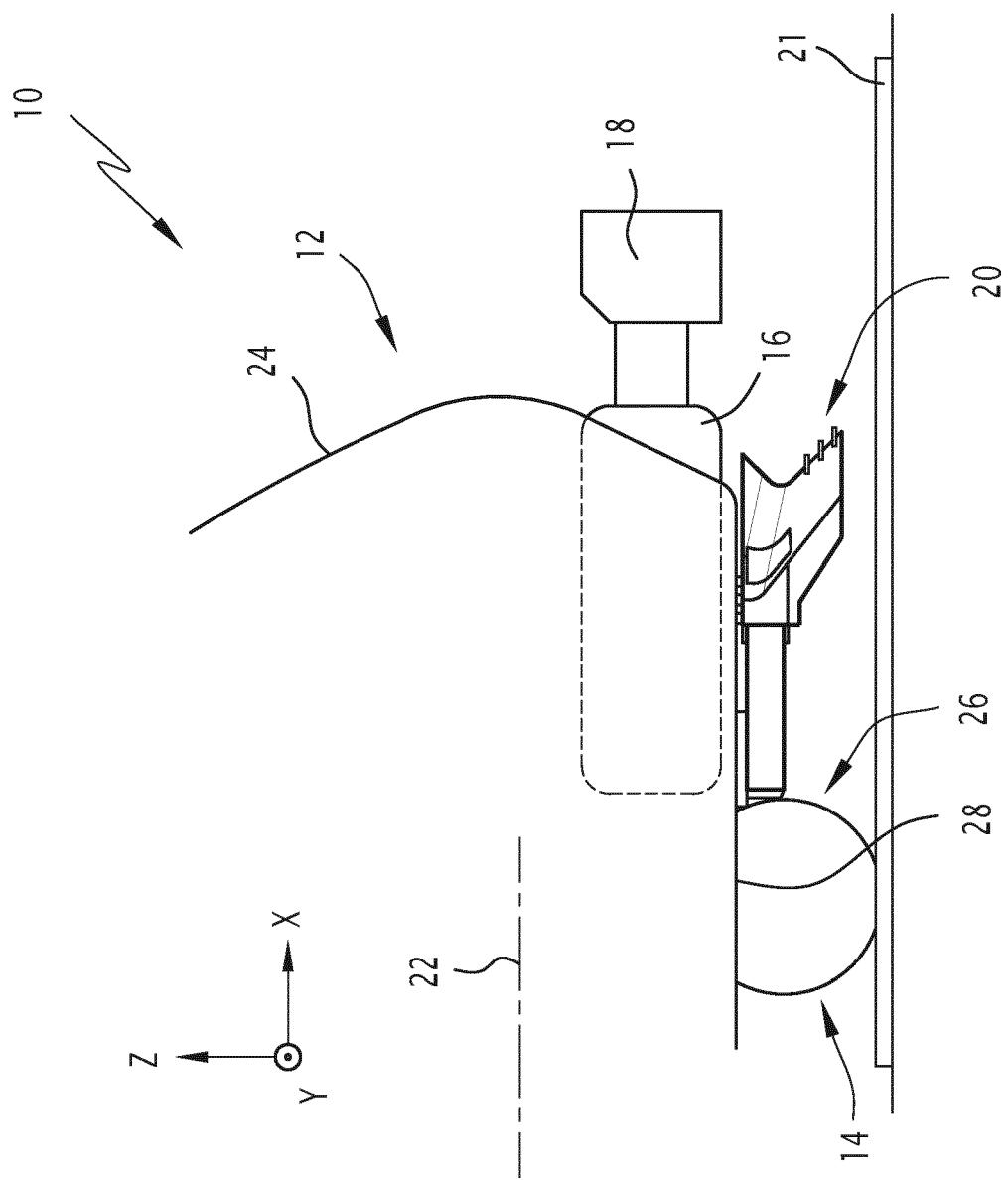
7. The rail sweeper (20) according to any one of the previous claims, wherein at least one of the first (40) and second (42) beams comprises a bending area (64) disposed between the proximal end (48) and the distal end (50). 35

8. A rail vehicle (10) having a carbodyshell (12) extending along a horizontal moving axis (22), the carbodyshell (12) having a front end (24), the rail vehicle (10) comprising a rail sweeper (20) according to any one of the previous claims, the support structure (34) of said rail sweeper (20) being fixed to the front end (24), the main axis (30) of the rail sweeper (20) being parallel to the horizontal moving axis (22). 40 45

9. The rail vehicle (10) according to claim 8, wherein each of the first (44) and second (46) beam axes is disposed substantially horizontally. 50

10. The rail vehicle (10) according to claim 8 or 9, also comprising at least one shock absorber (16) extending along the moving axis (22), ahead of the front end (24), the retracted position of the shield structure (32) of the rail sweeper (20) allowing said at least one shock absorber (16) to absorb an impact energy of an impact of the rail vehicle (10) along the horizontal moving axis (22). 55

FIG.1



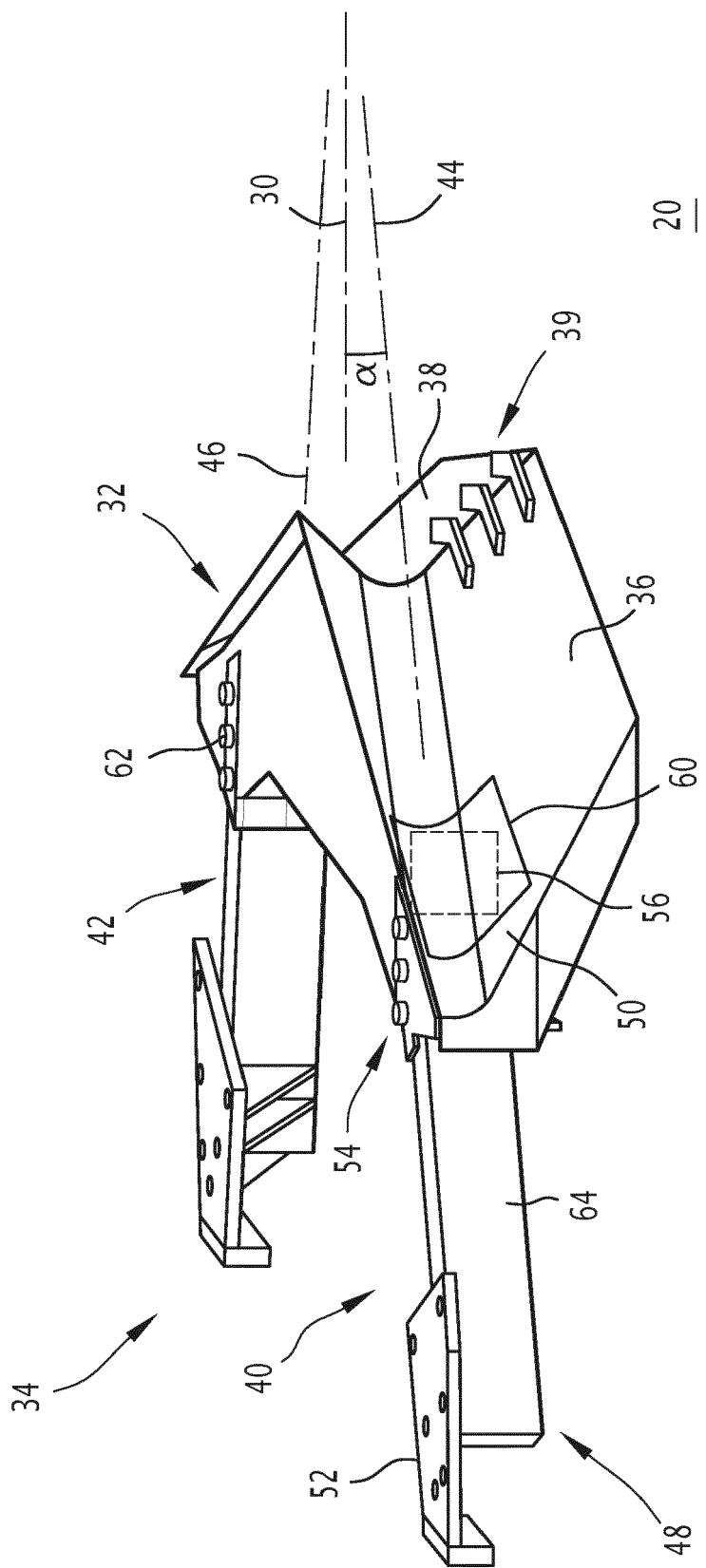


FIG.2



EUROPEAN SEARCH REPORT

Application Number

EP 23 30 5779

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
10	<p>X JP H07 6025 U (NIPPON SHARYO MANUFACTURING CO., LTD.) 27 January 1995 (1995-01-27) A * figures 1-4 *</p> <p>-----</p> <p>X CN 110 329 302 A (CRRC QINGDAO SIFANG CO LTD) 15 October 2019 (2019-10-15) A * figures 1-4 *</p> <p>-----</p> <p>X FR 399 017 A (EMILE MORIN [FR]) 21 June 1909 (1909-06-21) A * the whole document *</p> <p>-----</p> <p>X WO 2020/133936 A1 (CRRC TANGSHAN CO LTD [CN]) 2 July 2020 (2020-07-02) A * figures 2-13 *</p> <p>-----</p>	<p>1, 5, 6, 8-10 2-4, 7</p> <p>1, 6</p> <p>3, 5</p> <p>1, 2, 6</p> <p>3</p> <p>1, 3, 6, 8, 10</p>	<p>INV. B61F19/06 E01H8/10</p>
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30			<p>TECHNICAL FIELDS SEARCHED (IPC)</p> <p>B61F E01H</p>
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50	<p>1 The present search report has been drawn up for all claims</p>		
55	<p>Place of search Munich</p> <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p>	<p>Date of completion of the search 11 October 2023</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>	<p>Examiner Crama, Yves</p>

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

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