

(19)



(11)

EP 3 919 681 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
08.12.2021 Bulletin 2021/49

(51) Int Cl.:
E01B 2/00 (2006.01) E01B 3/22 (2006.01)

(21) Application number: **20177925.3**

(22) Date of filing: **03.06.2020**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
 GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
 PL PT RO RS SE SI SK SM TR**
 Designated Extension States:
BA ME
 Designated Validation States:
KH MA MD TN

(71) Applicant: **Lövgren, Sten
826 32 Söderhamn (SE)**

(72) Inventor: **Lövgren, Sten
826 32 Söderhamn (SE)**

(74) Representative: **Bjerkéns Patentbyrå KB (Gävle)
Box 1274
801 37 Gävle (SE)**

(54) **RAILWAY SECTION**

(57) A railway section (6), comprising a support arrangement (8), and a rail (9) supported by the support arrangement (8). The support arrangement (8) comprises at least one box girder (10, 11), and a U-girder (12),

having a U-shaped cross section and being attached to an upper surface of said at least one box girder (10, 11) and having its opening directed upwards, and the rail (9) is inserted into and supported by the U-girder (12).

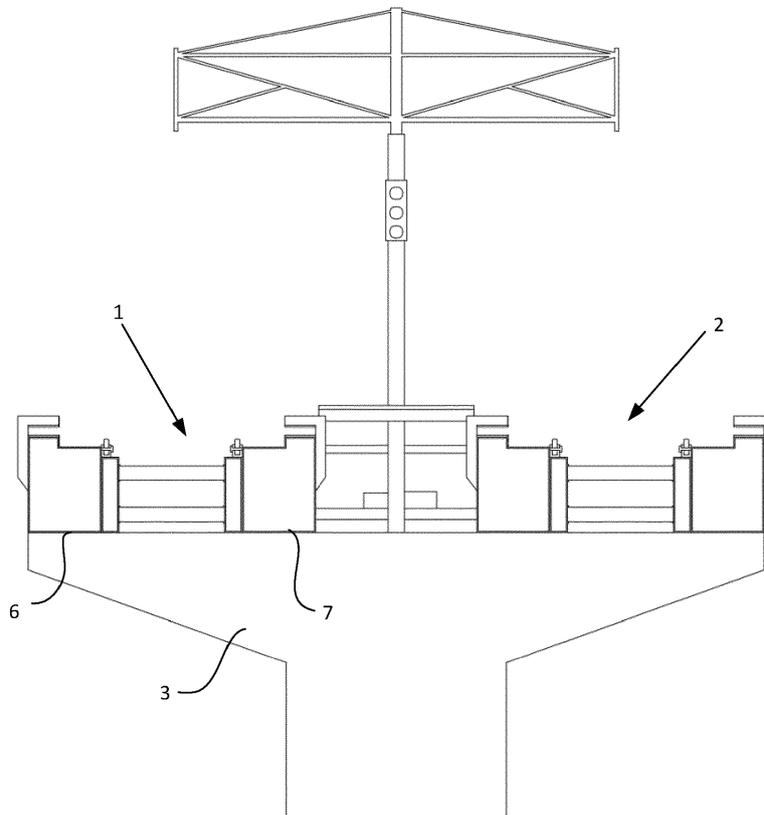


Fig. 1

EP 3 919 681 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to a railway section, comprising a support arrangements and a rail supported by the support arrangement.

[0002] The invention also relates to a railway comprising at least two such railway sections arranged in parallel with and beside each other.

[0003] The rail is a rail configured to be contacted by wheels of a train travelling on the railway.

BACKGROUND

[0004] Railway sections aimed in particular for the building of bridges and comprising a rail supported by a support arrangement are well known. The support arrangement may thereby be configured to be attached to and bear on pillar arrangements. A railway built on pillars may comprise a plurality of interconnected sections of support arrangements, wherein each individual section extends from one pillar to a neighbouring pillar.

[0005] The support arrangement may comprise a box-like steel structure, as for example disclosed in CN107447599, or a concrete structure, or combinations of a concrete structure and steel structures. The rail aimed for contacting the wheels of a train is attached to an upper surface of the box-like steel structure or to an upper surface of a concrete structure.

[0006] Building railway bridges instead of building the railway directly on ground may often be advantageous. In connection to the building of railway bridges, huge pre-built railway sections, extending from one pillar to the next, may be lifted into position by means of correspondingly huge machines, constructed particularly for the purpose. One railway section extending approximately 30 meters between two neighbouring pillars may weigh up to as much as approximately 900 tons. Needless to say, it is a technical challenge to install such sections.

THE OBJECT OF THE INVENTION

[0007] It is an object of the present invention to suggest a railway section and a railway that enables cost-efficient building and maintenance of railways, in particular railway bridges.

SUMMARY

[0008] The object of the invention is achieved by a railway section, comprising

- a support arrangement, and
- a rail supported by the support arrangement, said railway section being **characterised in** that the support arrangement comprises
- at least one box girder, and

- a U-girder, having a U-shaped cross section and being attached to an upper surface of said at least one box girder and having its opening directed upwards, and that the rail is inserted into and supported by the U-girder.

[0009] The U-girder will enable rapid and precise positioning of the rail on the support structure. Individual support arrangements, including the U-girder, are pre-built and connected to each other. The rail is continuous and therefore much longer than the individual support arrangements. The rail is therefore put in position in the U-girder after the connection of the individual support arrangements.

[0010] The use of a box-girder as a support for the U-girder provides for a stable support having a relatively low weight compared to most prior art. Support arrangements extending approximately 30 meters between neighbouring pillars and having the design according to the invention (thereby comprising four sections according to the invention arranged in parallel, and forming two parallel tracks) may weigh approximately 75 tons, which is far less than the 900 ton sections of prior art mentioned above. The U-girder may be attached to the box-girder by means of weld-joints or bolt-joints.

[0011] According to one embodiment, the U-girder has an inner width corresponding to the width of the rail. Thereby, the stability of the rail is improved. The height of the rail is larger than the depth of the U-girder.

[0012] According to one embodiment, the rail has a through hole extending in a lateral direction through the rail, and that there is provided a bolt or pin that extends through the opposite lateral walls of the U-girder and through the through hole of the rail. Thereby, the rail is effectively prevented from being displaced in relation to the U-girder. Bolts or pins may be arranged in the suggested way with suitable distances to each other in the longitudinal direction of the rail and the U-girder.

[0013] According to one embodiment, the through hole of the rail is elongated in a longitudinal direction of the rail. Thereby, changes of the length of the rail due to temperature changes may be adopted by a relative motion of the rail in relation to the bolt or pin in the longitudinal direction of the rail.

[0014] According to one embodiment, the rail has an upper end and a lower end said upper end and lower end having the same geometry. When an end of the rail is worn down, the rail may be turned upside-down and the opposite end may be used for direct contact with train wheels. The rail may also be moved to a neighbouring, opposite railway section of a railway comprising two parallel railway sections according to the invention.

[0015] According to one embodiment, the rail has a generally rectangular cross section, with rounded corners. Thereby, the lateral sides of the rail will find good support against the U-girder.

[0016] According to one embodiment, the U-girder is filled with a filler of a solid material which fills voids be-

tween rail and the U-girder. The filler should be of a material which is softer than the material of the U-girder and the material of the rail, such that it will have a sound-dampening effect.

[0017] According to one embodiment, said solid filler comprises a mouldable material which forms a homogeneous body that has been generated by being moulded in a fluid state into the U-girder after insertion of the rail into the U-girder and has been permitted to solidify therein. The filler preferably comprises a polymer as its main constituent.

[0018] According to one embodiment, said filler comprises a thermoplastic. Thereby, the filler may easily be heated, recycled and possibly reused for the same purpose.

[0019] According to one embodiment, the at least one box girder defines a lateral wall surface against which the U-girder bears. According to one embodiment, the lateral wall surface is arranged on a side of the U-girder and the rail which is distant from a centre line of a railway comprising the railway section. A train having wheels with a flange on the inside of the wheel, in accordance practice, will apply substantial lateral forces on the rail and the U-girder in curved sections. The lateral wall surface of the box-girder will adopt at least a part of such forces and may thus reduce the strain on the U-girder and the rail.

[0020] According to one embodiment, the box girder comprises walls of steel and it is filled with a filler configured to reduce corrosive effect of ambient atmosphere on said walls. The filler may also have a sound-dampening effect. According to one embodiment, the filler fills the whole interior of the box-girder.

[0021] According to one embodiment, said filler comprises a polymer, preferably poly urethane.

[0022] According to one embodiment, the railway section comprises a permanent magnet arranged on an upper surface of and supported by said at least one box girder, said permanent magnet extending in parallel with the rail in a longitudinal direction of the railway section. The permanent magnet is configured to interact with a magnet provided on train, thereby inducing a lifting force on the train.

[0023] According to one embodiment, the railway section also comprises a second permanent magnet arranged opposite to and with a distance to the permanent magnet arranged on the upper surface of the box-girder. The second permanent magnet is carried by an arm attached to the box-girder and extend in the longitudinal direction of the rail. The first and second magnets have the same polarity. The magnet carried by a train should have a repelling polarity in relation to first and second magnets. The first and second magnets should be arranged such that the magnet of the train traveling on the railway will be positioned between the first and second magnet of a railway section according to the present invention.

[0024] The object of the invention is also obtained by

means of a railway, **characterised in** that it comprises two railway sections as disclosed hereinabove or hereinafter extending in parallel to and beside each other. The railway preferably comprises a plurality of such pairs of railway sections, interconnected with each other.

[0025] According to one embodiment, the railway comprises a first pillar arrangement and a second neighbouring pillar arrangement, wherein each railway section extends from the first pillar arrangement to the second pillar arrangement and is attached to and supported by the respective pillar arrangement, wherein said at least one box girder of each support arrangement rests on an upper surface of each of the first pillar arrangement and the second pillar arrangement.

[0026] According to one embodiment, the railway comprises at least one cross bar extending between and connected to each of said two railway sections. Preferably, there is provided a plurality of cross bars between two adjacent railway sections according to the present invention, distributed with distance to each other in the longitudinal direction of the railway.

[0027] The assembly of the railway comprises the steps of providing a plurality of railway sections according to the invention, except for the rail, arranging the railway sections in pairs, each railway extending from a first pillar arrangement to a second pillar arrangement, and interconnecting the two rail arrangements by means of cross bars.

30 BRIEF DESCRIPTION OF THE DRAWING

[0028] Exemplifying embodiments of the invention will be described with reference to the annexed drawing, on which:

Fig. 1 is a partly cut end view of a part of a railway according to the invention,

Fig. 2 is a view from above of a part of a railway according to the invention,

Fig. 3 is a side view of the part of railway shown in fig. 2

Fig. 4 is a partly cut end view of a railway section according to the invention, and

Fig. 5 is a cross section through a part of the railway section shown in fig. 4,

50 DETAILED DESCRIPTION OF EMBODIMENTS

[0029] Fig. 1 shows a part of a railway according to the invention. The shown railway comprises two track 1, 2, thereby defining a double track. The tracks 1, 2 are arranged on and supported by pillar arrangements 3, 4, 5 as can also be seen in fig. 3.

[0030] Each track 1, 2 comprises a two railway sections

6, 7 extending in parallel and beside each other.

[0031] In the following, only one of the sections 6, 7 will be described more in detail, but it should be understood that the other section, extending in parallel with and beside the described section has a corresponding design.

[0032] The railway section 6 comprises a support arrangement 8, and a rail 9 supported by the support arrangement 8. The support arrangement 8 comprises a first box girder 10, a second box girder 11 and a U-girder 12 having a U-shaped cross section and being attached to an upper surface of first box girder 10. The U-girder 12 has its opening directed upwards, and the rail 9 is inserted into and supported by the U-girder 12.

[0033] The U-girder 12 has an inner width corresponding to the width of the rail 9. The rail 9 has through holes 13 extending in a lateral direction through the rail 9, and there are provided bolts 14 that extend through the opposite lateral walls of the U-girder 12 and through the through holes 13 of the rail 9. A plurality of through holes 12 and the bolts 13 are arranged in the suggested way with suitable distances to each other in the longitudinal direction of the rail 9 and the U-girder 12.

[0034] Each through hole 13 is elongated in a longitudinal direction of the rail 9, so that changes of the length of the rail 9 due to temperature changes may be adopted by a relative motion of the rail 9 in relation to the bolt 14 in the longitudinal direction of the rail 9.

[0035] The rail 9 has an upper end 9a and a lower end 9b. The upper end 9a and the lower end 9b have the same geometry. When an end of the rail 9 is worn down, the rail may be turned upside-down and the opposite end may be used for direct contact with train wheels. The rail 9 may also be moved to a neighbouring, opposite railway section 7 of the track 1 of a railway comprising two parallel railway sections 6, 7 according to the invention.

[0036] The rail 9 has a generally rectangular cross section, with rounded corners. The lateral sides of the rail 9 are supported by the corresponding lateral sides of the U-girder 12.

[0037] The U-girder 12 is filled with a filler 15 of a solid material which fills voids between rail and the U-girder, see fig. 5. The filler 15 is softer than the material of the U-girder 12 and the material of the rail 9, such that it will have a sound-dampening effect. The solid filler 15 comprises a mouldable material which forms a homogenous body that has been generated by being moulded in a fluid state into the U-girder 12 after insertion of the rail 9 into the U-girder 12 and has been permitted to solidify therein. The filler 15 preferably comprises a polymer as its main constituent. According to one embodiment, the filler 15 comprises a thermoplastic.

[0038] The second box girder 11 defines a lateral wall surface 16 against which the U-girder 12 bears. The lateral wall surface 16 is arranged on a side of the U-girder 12 and the rail 9 which is distant from a centre line of a railway track 1 comprising the railway section 6, 7. A train having wheels with a flange on the inside of the wheel,

in accordance with common practice, will apply substantial lateral forces on the rail 9 and the U-girder 12 in curved sections. The lateral wall surface 16 of the box-girder 12 will adopt at least a part of such forces and may thus reduce the strain on the U-girder 12 and the rail 9.

[0039] Each box girder 10, 11 comprises walls of steel and is filled with a filler 17, 18 configured to reduce corrosive effect of ambient atmosphere on said walls. The filler 17, 18 may also have a sound-dampening effect. The filler 17, 18 fills the whole interior of the respective box-girder 10, 11. The filler 17, 18 comprises a polymer, preferably poly urethane.

[0040] The railway section 6 comprises a permanent magnet 19 arranged on an upper surface of and supported by the second box girder 11. The permanent magnet 19 extends in parallel with the rail in a longitudinal direction of the railway section. The permanent magnet 19 is configured to interact with a magnet provided on train, thereby inducing a lifting force on the train.

[0041] The railway section 6 also comprises a second permanent magnet 20 arranged opposite to and with a distance to the permanent magnet 19 arranged on the upper surface of the second box-girder 11. The second permanent magnet 20 is carried by an arm 21 attached to the second box-girder 11 and extend along the railway in the longitudinal direction of the rail 9 and the railway. The first and second magnets 19, 20 have the same polarity. The magnet carried by a train should have a repelling polarity in relation to the first and second magnets 19, 20. The first and second magnets should be arranged such that the magnet of the train traveling on the railway will be positioned between the first and second magnet of a railway section according to the present invention. The repelling force of the first magnet will induce a lifting force on the train, while the repelling force from the second magnet, which is smaller, will counteract excessive lifting forces on the train, for example caused by wind during travel at high speed.

[0042] Reference is made to figs. 1-3. The railway comprises a plurality of first and a second neighbouring pillar arrangements 3, 4. Each railway section 6, 7 extends from a first pillar arrangement 3 to a second pillar arrangement 4 and is attached to and supported by the respective pillar arrangement 3, 4. The first and second box girders 10, 11 of each support arrangement 8 rests on an upper surface a first pillar arrangement 3 and a second pillar arrangement 4. The support arrangements 8 are prefabricated units, each having a length corresponding to the distance between the centre points of the neighbouring pillar arrangements 3, 4 to which they are attached and be supported by. The railway is thus built by interconnecting railway sections to each other in the longitudinal direction of the railway.

[0043] Each track 1, 2 comprises a plurality of cross bars 22 extending between and connected to each of two parallel railway sections 6, 7, in order to provide for stability.

Claims

1. A railway section (6), comprising
- a support arrangement (8), and
 - a rail (9) supported by the support arrangement (8), said railway section (6) being **characterised in that** the support arrangement (8) comprises
 - at least one box girder (10, 11), and
 - a U-girder (12), having a U-shaped cross section and being attached to an upper surface of said at least one box girder (10, 11) and having its opening directed upwards, and that the rail (9) is inserted into and supported by the U-girder (12).
2. A railway section (6) according to claim 1, **characterised in that** the U-girder (12) has an inner width corresponding to the width of the rail (9).
3. A railway section (6) according to claim 1 or 2, **characterised in that** the rail (9) has a through hole (13) extending in a lateral direction through the rail (9), and that there is provided a bolt or pin (14) that extends through the opposite lateral walls of the U-girder (12) and through the through hole (13) of the rail (9).
4. A railway section (6) according to claim 3, **characterised in that** the through hole (13) of the rail (9) is elongated in a longitudinal direction of the rail (9).
5. A railway section (6) according to any one of claims 1-4, **characterised in that** the rail (9) has an upper end (9a) and a lower end (9b), said upper end and lower end having the same geometry.
6. A railway section (6) according to claim 5, **characterised in that** the rail (9) has a generally rectangular cross section, with rounded corners.
7. A railway section (6) according to any one of claims 1-6, **characterised in that** the U-girder (12) is filled with a filler (15) of a solid material which fills voids between rail (9) and the U-girder (12).
8. A railway section (6) according to claim 7, **characterised in that** said solid filler (15) comprises a mouldable material which forms a homogenous body that has been generated by being moulded in a fluid state into the U-girder (12) after insertion of the rail (9) into the U-girder (12) and has been permitted to solidify therein.
9. A railway section (6) according to claim 7, **characterised in that** said filler (15) comprises a thermoplastic.
10. A railway section (6) according to any one of claims 1-9, **characterised in that** the at least one box girder (10, 11) defines a lateral wall surface (16) against which the U-girder (12) bears.
11. A railway section (6) according to any one of claims 1-10, **characterised in that** the box girder (10, 11) comprises walls of steel and that it is filled with a filler (17, 18) configured to reduce corrosive effect of ambient atmosphere on said walls.
12. A railway section (6) according to claim 11, **characterised in that** said filler (17, 18) comprises a polymer, preferably poly urethane.
13. A railway section (6) according to any one of claims 1-12, **characterised in that** it comprises a permanent magnet (19) arranged on an upper surface of and supported by said at least one box girder (10, 11), said permanent magnet (19) extending in parallel with the rail (9) in a longitudinal direction of the railway section (6).
14. A railway, **characterised in that** it comprises two railway sections (6, 7) according to any one of claims 1-13 extending in parallel to and beside each other.
15. A railway according to claim 14, **characterised in that** it comprises a first and a second neighbouring pillar arrangements (3, 4), and that each railway section (6, 7) extends from the first pillar arrangement (3) to the second pillar arrangement (4) and is attached to and supported by the respective pillar arrangement, wherein said at least one box girder (10, 11) of each support arrangement (8) rests on an upper surface of each of the first pillar arrangement (3) and the second pillar arrangement (4).
15. A railway according to claim 13 or 14, **characterised in that** it comprises at least one cross bar (21) extending between and connected to each of said two railway sections (6, 7).

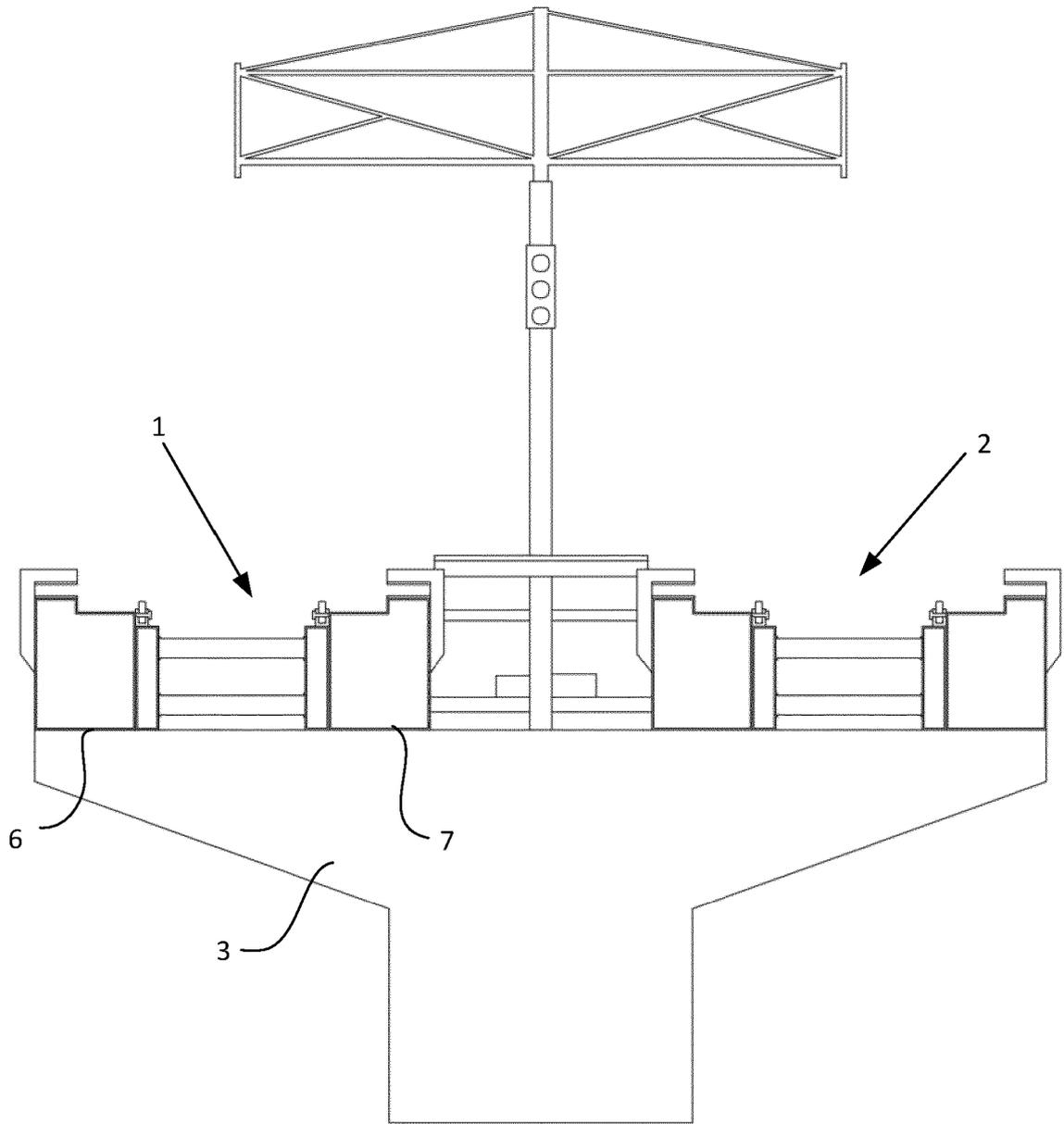


Fig. 1

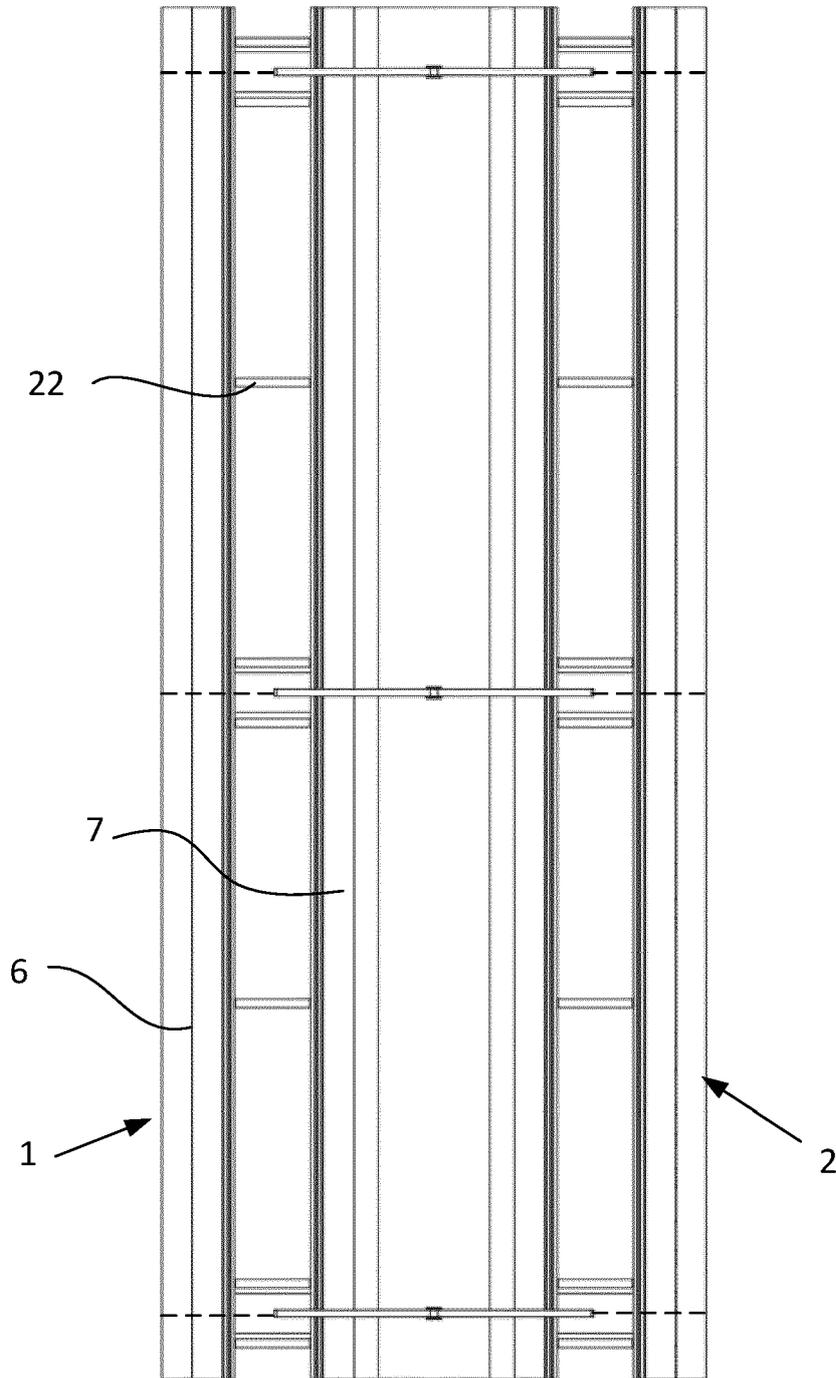


Fig. 2

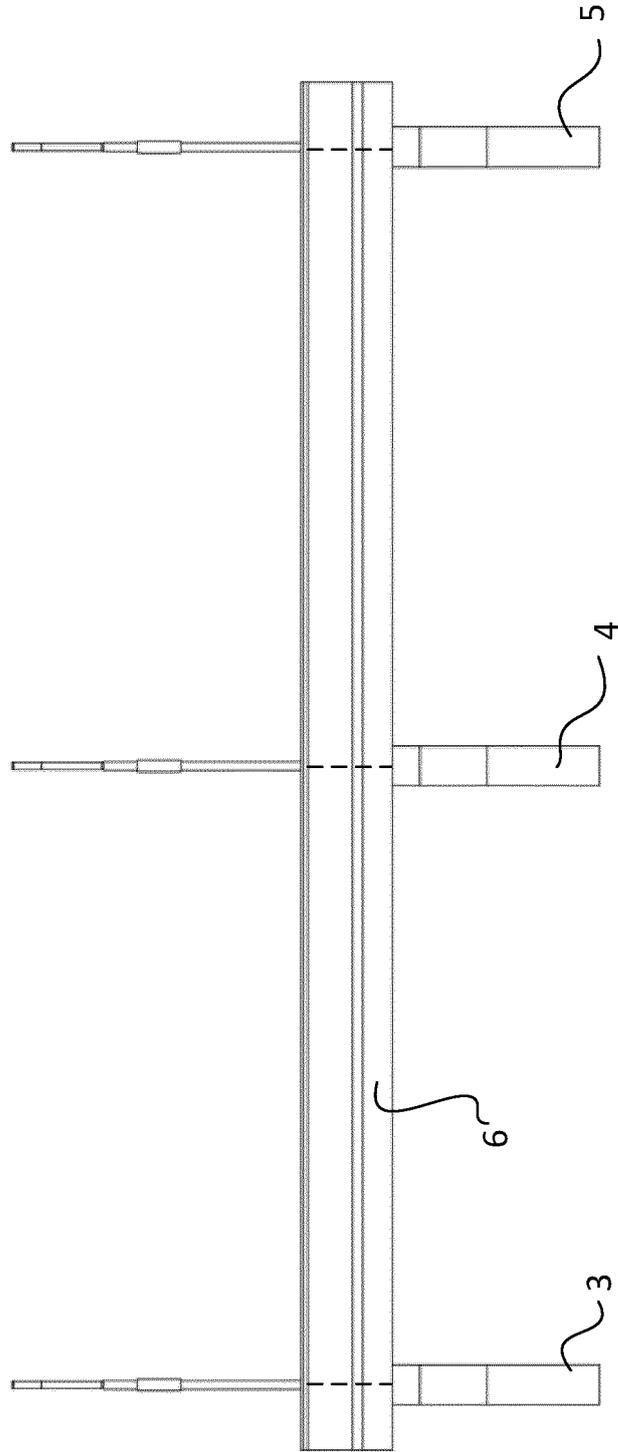


Fig. 3

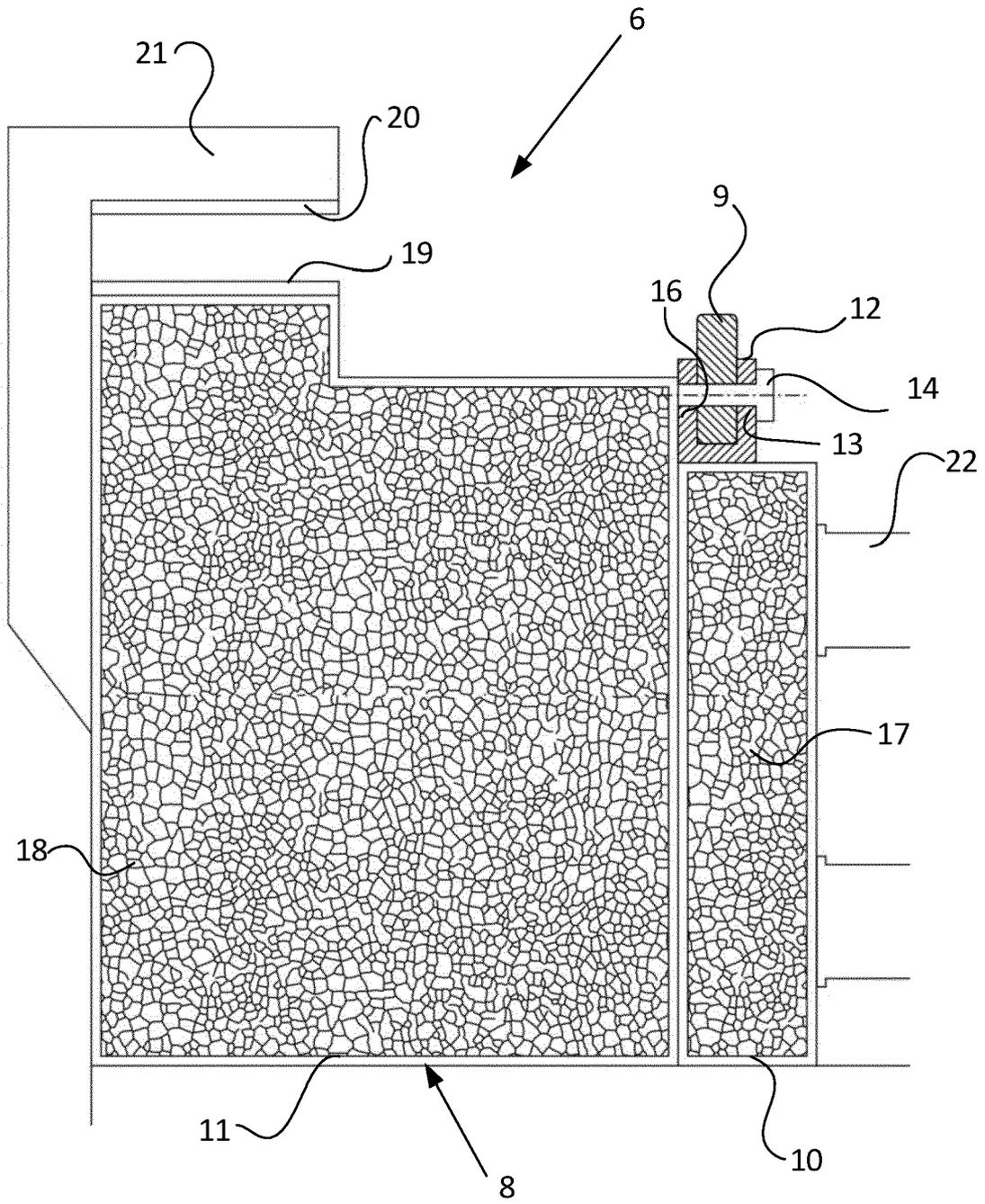


Fig. 4

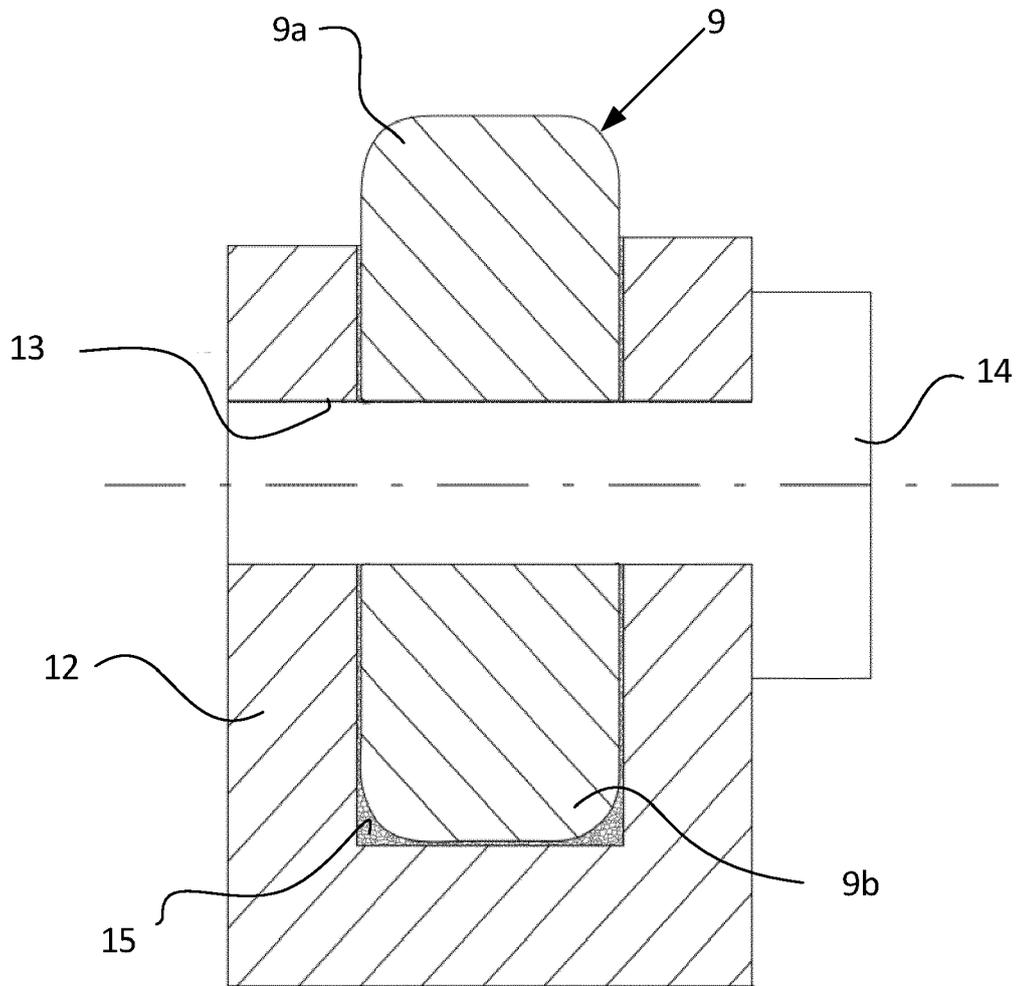


Fig. 5



EUROPEAN SEARCH REPORT

Application Number
EP 20 17 7925

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 4 313 383 A (PARAZADER STEPHEN) 2 February 1982 (1982-02-02)	1,2,4, 7-11,14, 15	INV. E01B2/00 E01B3/22
Y	* columns 2-4; figures *	5,6	
X	CN 101 768 899 A (HONGSHENG YAN) 7 July 2010 (2010-07-07) * paragraphs [0023] - [0040]; figures *	1-4	
X	EP 0 771 908 A1 (STICHTING GELUIDARME SPOORBRUG [NL]) 7 May 1997 (1997-05-07)	1,2,7-9	
Y	* the whole document *	11-13	
Y	JP S60 45716 U (JAPANESE) 30 March 1985 (1985-03-30)	11-13	
A	* the whole document *	1	
X	DE 12 41 476 B (RHEINSTAHL UNION BRUECKENBAU) 1 June 1967 (1967-06-01) * columns 3,4; claims; figures *	1,7,8, 14-16	
Y	WO 99/63160 A1 (PENNY CHARLES [GB]) 9 December 1999 (1999-12-09) * claims; figures 8,9 *	5,6	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 30 September 2020	Examiner Movadat, Robin
CATEGORY OF CITED DOCUMENTS 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 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			

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 20 17 7925

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.

30-09-2020

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4313383 A	02-02-1982	NONE	

CN 101768899 A	07-07-2010	NONE	

EP 0771908 A1	07-05-1997	AT 213294 T	15-02-2002
		DE 69619195 T2	26-09-2002
		DK 0771908 T3	18-03-2002
		EP 0771908 A1	07-05-1997
		ES 2170832 T3	16-08-2002
		NL 1001541 C2	02-05-1997
		PT 771908 E	31-07-2002
		SI 0771908 T1	30-06-2002

JP S6045716 U	30-03-1985	JP S6045716 U	30-03-1985
		JP S6346498 Y2	02-12-1988

DE 1241476 B	01-06-1967	NONE	

WO 9963160 A1	09-12-1999	AT 292710 T	15-04-2005
		AU 752198 B2	12-09-2002
		BG 63950 B1	31-07-2003
		BR 9910852 A	09-10-2001
		CA 2333559 A1	09-12-1999
		CN 1310775 A	29-08-2001
		CZ 20004406 A3	13-02-2002
		DE 69924646 T2	02-03-2006
		DK 1155194 T3	08-08-2005
		EE 200000715 A	15-08-2002
		EP 1155194 A1	21-11-2001
		ES 2239443 T3	16-09-2005
		HK 1041031 A1	30-06-2005
		HU 0104813 A2	29-04-2002
		JP 4256589 B2	22-04-2009
		JP 2004500496 A	08-01-2004
		MX PA00011902 A	17-10-2002
		PL 344582 A1	05-11-2001
		PT 1155194 E	31-08-2005
		RU 2238361 C2	20-10-2004
		SK 18042000 A3	03-12-2001
		TR 200003538 T2	21-06-2001
		UA 67777 C2	15-07-2002
		US 6616061 B1	09-09-2003
		WO 9963160 A1	09-12-1999

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- CN 107447599 [0005]