

(19)



(11)

**EP 3 332 879 A1**

(12)

**EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**13.06.2018 Bulletin 2018/24**

(51) Int Cl.:  
**B07B 1/36 (2006.01) B07B 1/46 (2006.01)**  
**B65G 27/08 (2006.01) B07B 1/28 (2006.01)**

(21) Application number: **16202690.0**

(22) Date of filing: **07.12.2016**

(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:  
**MA MD**

• **Università degli studi di Bergamo**  
**24129 Bergamo (IT)**

(72) Inventors:  
• **Baragetti, Sergio**  
**24129 Bergamo (IT)**  
• **Carlotto, Mario Flavio**  
**4900 Langenthal (CH)**

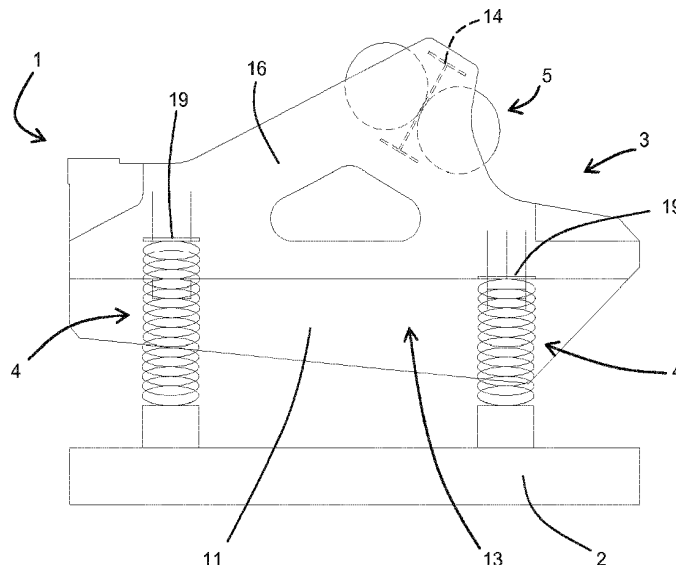
(71) Applicants:  
• **Ammann Switzerland Ltd.**  
**4900 Langenthal (CH)**

(74) Representative: **Ponchiroli, Simone et al**  
**Ruffini Ponchiroli e Associati S.r.l.**  
**Via Caprera, 6**  
**37126 Verona (IT)**

(54) **VIBRATING SCREEN**

(57) A vibrating screen comprising a base (2), an upper vibrating structure (3), a plurality of elastic elements (4) interposed between the base (2) and the vibrating structure (3) for connecting them and allowing the vibrating structure (3) to elastically oscillate relative to the base (2), and at least one vibrating unit (5) mounted on the vibrating structure (3); the vibrating structure (3) comprising a supporting frame (6) on which a plurality of screening elements (7) is mounted and which comprises two lateral walls (11) and, for each lateral wall (11), at least

one box-shaped reinforcing structure (16) applied to said wall; the lateral walls (11) each comprising an inner main surface (12) facing the other lateral wall (11) and an outer main surface (13) positioned on the opposite side to the inner main surface (12), the screening elements (7) being positioned between the inner main surfaces (12); and each box-shaped reinforcing structure (16) being hollow inside and being applied to the outer main surface (13) of the related lateral wall (11).



**FIG. 1**

**EP 3 332 879 A1**

## Description

**[0001]** This invention relates to a vibrating screen of the type comprising a base positioned in a lower part and a vibrating structure positioned in an upper part, with a plurality of elastic elements interposed between them, for connecting them and allowing the vibrating structure to elastically oscillate relative to the base. A vibrating unit is mounted on the vibrating structure to make the latter vibrate relative to the base. The upper structure comprises a plurality of sieves that are angled or parallel relative to a horizontal plane. They are positioned in such a way as to cause the outfeed of the material divided into different particle size measurement ranges.

**[0002]** In particular, this invention can be applied for vibrating screens intended for selecting aggregates to be used in applications such as the production of bituminous macadams and the production of concretes.

**[0003]** In order to be able to achieve high levels of productivity and good screening results, on one hand the screen must have relatively large dimensions and on the other hand a suitable vibration and acceleration must be imparted to it, which may therefore reach even very high values (preferably using a small slope for the various sieves).

**[0004]** Patent application EP 1 719 560 A2, which relates to the same type of screens as this invention, gives a rapid overview of known vibrating screen sizing and design problems.

**[0005]** As indicated in that patent application, in particular, without changing the overall structure too much, in order to be able to increase the performance of the vibrating screens, it would be necessary to pursue two contradictory courses of action. In fact, whilst on one hand it would be necessary to considerably stiffen their structure, on the other hand it would be appropriate to reduce their mass.

**[0006]** Whilst in traditional vibrating screens the vibrating structure comprises two mainly flat walls constituted of a single metal plate that is relatively thick, in an attempt to improve performance, patent application EP 1 719 560 A2 proposed an embodiment in which the walls are at least partly constituted of two plate sheets positioned side by side and close to each other for forming a narrow hollow space between them. A plurality of interconnecting elements is present in the hollow space. The two plate sheets also have different thicknesses. Preferably, one of the two sheets is twice as thick as the other.

**[0007]** Moreover, according to that document, the wall only comprises two sheets in the upper half, whilst only the outer sheet is present in the lower half. The beam that supports the vibrating unit is connected only to the outer sheets of the two walls.

**[0008]** Therefore, in other words, patent application EP 1 719 560 A2 suggests that the previously known screens be changed by applying on the upper part of the inner side of each wall a reinforcement constituted of an additional plate sheet drawn near to the self-same wall and

connected to it by means of various elements.

**[0009]** Although patent application EP 1 719 560 A2 boasts presumed advantages of the embodiment which forms its subject matter compared with prior art screens, on one hand as yet there are no known industrial applications that can effectively demonstrate actual achievement of such advantages, and on the other hand it has several obvious disadvantages at a construction level.

**[0010]** In particular, the disadvantages are first linked to the need to apply a second plate sheet on the inner side of the vibrating structure, while leaving the structural functions (such as sustaining the beam that supports the vibrating unit or sustaining the sieves) to be performed by only the outer plate. In fact, to do that, the inner plate has to be prepared with a whole series of openings to allow the passage of the beam and of the supporting elements for the sieves. Moreover, inevitably, the presence of two sheets on the inner sides of the walls, however close they may be to the outer sheets, reduces the working width of the sieves.

**[0011]** Moreover, tests and simulation performed by the Applicant have allowed it to be established that the solution described in that patent application would not, in reality, be able to achieve the vibrating structure rigidity results claimed.

**[0012]** In this context the technical purpose which forms the basis of this invention is to provide a vibrating screen which overcomes the above-mentioned disadvantages.

**[0013]** In particular, the technical purpose of this invention is to provide a vibrating screen with simple construction and that has a structural rigidity considerably greater than the screens currently on the market and which can, therefore, be made to operate with performance that is better than the performance of prior art screens.

**[0014]** The technical purpose specified and the aims indicated are substantially achieved by a vibrating screen made as described in the appended claims.

**[0015]** Further features and the advantages of this invention are more apparent in the detailed description, with reference to the accompanying drawings which illustrate several preferred, non-limiting embodiments of a vibrating screen, in which:

- Figure 1 is a schematic side view of a vibrating screen made in accordance with this invention;
- Figure 2 is an axonometric view of a vibrating structure of the screen of Figure 1, longitudinally sectioned at a middle plane of it;
- Figure 3 is an axonometric view of the sectioned vibrating structure of Figure 2 from an opposite viewpoint;
- Figure 4 is a side view of the sectioned vibrating structure of Figure 2, highlighting with dashed lines a plurality of screening elements;
- Figure 5 is a side view of the sectioned vibrating structure of Figure 2, highlighting in transparency several inner reinforcing parts;

- Figure 6 is an axonometric view of a box-shaped reinforcing structure of the vibrating structure of Figure 3;
- Figure 7 is a side view of the box-shaped reinforcing structure of Figure 6, highlighting with dashed lines the inner parts;
- Figure 8 is a schematic cross-section of a preferred form of the box-shaped reinforcing structure; and
- Figures 9 and 10 are side views of two alternative embodiments of the vibrating structure, highlighting with dashed lines possible limited zones of application of a box-shaped reinforcing structure.

**[0016]** With reference to the above-mentioned figures, the numeral 1 denotes in its entirety a vibrating screen according to this invention.

**[0017]** Similarly to prior art screens, even the screen that forms the subject matter of this invention comprises a base 2 positioned in a lower part, a vibrating structure 3 positioned in an upper part, and a plurality of elastic elements 4 interposed between the base 2 and the vibrating structure 3 for connecting them and allowing the vibrating structure 3 to elastically oscillate relative to the base 2. In the preferred embodiment, in particular, there are four elastic elements 4 positioned at the four vertices of a rectangle, each of which comprises one or more helical springs placed side by side.

**[0018]** At least one vibrating unit 5 is mounted on the vibrating structure 3 for, in use, causing the vibrating structure 3 to vibrate relative to the base 2. In the preferred embodiment the vibrating unit 5 is of the mechanical type with eccentric rotating masses. But in general, it may be made in any way suitable for the purpose. However, preferably, it is a vibrating unit 5 able to generate reciprocating vibration. In the known way, it is also advantageously mounted in the highest part of the vibrating structure 3.

**[0019]** The vibrating structure 3 in turn comprises a supporting frame 6 which supports a plurality of screening elements 7 (typically perforated plates or nets that act as a sieve). The screening elements 7 are positioned on multiple levels one above the other and are vertically spaced. Moreover, a screening element 7 positioned at one level comprises screening openings having a size smaller than those of the screening elements 7 positioned at the higher levels. In this way, the screen causes division of the various particle size measurements of the aggregates being processed on the different levels with decreasing size from top to bottom.

**[0020]** Advantageously, the screening elements 7 are each supported by a plurality of elongate supporting elements 8 positioned substantially horizontally and perpendicular to a main line of extension of the vibrating screen 1 (the length in the accompanying figures). The elongate supporting elements 8 of each screening element 7 are also positioned in such a way that the respective screening element 7 has a predetermined slope from the infeed section 9 of the vibrating screen 1 located near

to one of the smaller sides, towards the outfeed section 10 located at the other small side (Figure 4).

**[0021]** The supporting frame 6 comprises two lateral walls 11. Each lateral wall 11 comprises an inner main surface 12 facing towards the other lateral wall 11, and an outer main surface 13 positioned on the opposite side to the inner main surface 12. The screening elements 7 are positioned between the inner main surfaces 12. Moreover, in the embodiment illustrated, the elongate supporting elements 8 are fixed to the lateral walls 11 at the inner main surfaces 12.

**[0022]** The vibrating structure 3 also comprises a load-bearing beam 14, which is rigidly interconnected between the lateral walls 11 and which extends horizontally above all of the screening elements 7. The vibrating unit 5 is advantageously mounted on the load-bearing beam 14. In particular, the load-bearing beam 14 is fixed to the lateral walls 11 at supporting portions 15 of the related inner main surfaces 12.

**[0023]** Moreover, according to a first innovative aspect of this invention, for each lateral wall 11 the supporting frame 6 comprises at least one box-shaped reinforcing structure 16 that is hollow inside and that is applied to the outer main surface 13 of the related lateral wall 11.

**[0024]** According to the preferred embodiment of this invention, each box-shaped reinforcing structure 16 is applied exclusively to a limited part 17 of the related outer main surface 13, in particular to a limited part 17 of the outer main surface 13 that forms at least one ring surrounding a portion of the self-same outer main surface 13 to which, in contrast, the box-shaped reinforcing structure 16 is not applied.

**[0025]** Depending on the embodiments, that limited part 17 of each outer main surface 13 may form either a single ring 18 or a plurality of rings 18 that each surround a portion of the self-same outer main surface 13 to which the box-shaped reinforcing structure 16 is not applied.

**[0026]** Therefore, seen from the side (as in Figures 7, 9 and 10), each box-shaped reinforcing structure 16 in turn also has a shape that forms at least one ring 18 (only one in Figures 7 and 10, but five in Figure 9). Depending on the embodiments, the reinforcing structure may be located only on part of the respective lateral wall 11 (in the upper part in Figure 7) or may affect the entire lateral wall as in Figures 9 and 10.

**[0027]** Moreover, advantageously, the box-shaped reinforcing structure 16 is present at supporting flanges 19 by means of which the vibrating structure 3 is connected to the elastic elements 4, and/or to the zones of the outer main surfaces 13 positioned at the supporting portions 15 made on the inner main surfaces 12. Those zones are therefore part of the respective limited part 17 of the outer main surface 13 that forms at least one ring 18.

**[0028]** In the preferred embodiment, each box-shaped reinforcing structure 16 is connected to the related lateral wall 11 by means of a plurality of bolts 20. In particular, advantageously, for each box-shaped reinforcing structure 16, at least several bolts 20 connect the box-shaped

reinforcing structure 16 both to the related lateral wall 11 and to one of the elongate supporting elements 8 of at least one screening element 7. In particular, in the preferred embodiment, two or more bolts 20 connect the box-shaped reinforcing structure 16 to the same elongate supporting element 8.

**[0029]** Also, preferably, at least several, but preferably all of the bolts 20 completely pass through the related box-shaped reinforcing structure 16. Furthermore, in this case, advantageously, at least for several of the bolts 20 that completely pass through the box-shaped reinforcing structure 16, the box-shaped reinforcing structure 16 internally comprises a tubular insert 21 extending perpendicularly to a main plane of extension of the lateral wall 11, the bolt 20 being positioned through the inside of this insert. Advantageously, the tubular insert 21 is welded to the rest of the box-shaped reinforcing structure 16.

**[0030]** As regards the form of each box-shaped reinforcing structure 16, in the preferred embodiment illustrated in the accompanying figures it comprises first a main reinforcing body 22 which, in a plane perpendicular to the main plane of extension of the outer main surface 13, has a C-shaped cross-section (the shape and the size of the C may vary from one zone to the next). In particular, the central part of the C is applied to the related outer main surface 13 whilst the two arms of the C extend substantially perpendicularly to, and away from, the main plane of extension of the related outer main surface 13. The box-shaped reinforcing structure 16 also comprises at least one closing element 23 applied to the main reinforcing body 22 so that together with the latter it forms a box-shaped element. Seen in cross-section, as in Figure 8, the closing element 23 is fixed to the arms of the C advantageously by welding.

**[0031]** To allow the passage of the bolts 20, suitable through holes are made in the main reinforcing body 22, the closing element 23, the lateral wall 11 and if necessary in the elongate element.

**[0032]** In general, both the main reinforcing body 22 and the closing element 23 may be made either as one piece or as a plurality of pieces that are drawn near each other and interconnected if necessary.

**[0033]** Depending on requirements and on the shape of the box-shaped reinforcing structure 16, there may be additional reinforcing and/or stiffening elements inside it.

**[0034]** For example, each box-shaped reinforcing structure 16 may comprise a plurality of stiffening walls 24 mounted inside the main reinforcing body 22 and welded to it. Advantageously, the stiffening walls 24 extend perpendicularly to the related outer main surface 13, preferably from one arm of the C to the opposite arm.

**[0035]** Furthermore, advantageously, the box-shaped reinforcing structure 16 comprises a plurality of stiffening walls 24 that are angled relative to one another and constrained to each other in order to form a stiffening frame 25, at the supporting flanges 19 and/or at the zones of the outer main surfaces 13 positioned at the supporting portions 15 made on the inner main surfaces 12.

**[0036]** Depending on requirements, the thicknesses of the various parts of the box-shaped reinforcing structure 16 may be different to one another (for example, in the same box-shaped reinforcing structure 16, 3 mm, 5 mm and 14 mm thicknesses may be used simultaneously).

**[0037]** Operation of the screen according to this invention is similar to that of conventional screens.

**[0038]** However, this invention brings important advantages.

**[0039]** Preliminary checks and tests carried out by the Applicant allowed it to be established that thanks to this invention it is possible to significantly increase the performance of a vibrating screen.

**[0040]** Moreover, it was possible to increase the structural resistance to fatigue of the screen without excessively altering its mass.

**[0041]** In particular, by applying a box-shaped reinforcing structure such as that in the figures to an existing vibrating screen having the following limit performance values (dictated by mechanical resistance):

- maximum acceleration achievable 4.8 g (where g, obviously, indicates the acceleration of gravity);
- mass (screen + material) 3446 kg;
- maximum intensity of the sinusoidal force applicable by the vibrating unit 85 kN;
- it has been possible to increase those limit performance values to the following values:
  - maximum acceleration achievable 12 g;
  - mass (screen + material) 5240 kg;
  - maximum intensity of the sinusoidal force applicable by the vibrating unit 220 kN.

**[0042]** Finally, it should be noticed that this invention is relatively easy to produce and that even the cost linked to implementing the invention is not very high. The invention described above may be modified and adapted in several ways without thereby departing from the scope of the inventive concept.

**[0043]** All details may be substituted with other technically equivalent elements and the materials used, as well as the shapes and dimensions of the various components, may vary according to requirements.

## Claims

### 1. A vibrating screen comprising:

- a base (2) positioned in a lower part;
- a vibrating structure (3) positioned in an upper part;
- a plurality of elastic elements (4) interposed between the base (2) and the vibrating structure (3) for connecting them and allowing the vibrating structure (3) to elastically oscillate relative to the base (2); and
- at least one vibrating unit (5) mounted on the

vibrating structure (3);

wherein:

the vibrating structure (3) in turn comprises a supporting frame (6) on which a plurality of screening elements (7) is mounted, the screening elements being arranged on multiple levels one above another and vertically spaced, a screening element (7) positioned at one level comprising screening openings having a size smaller than those of the screening elements (7) positioned at higher levels;

the supporting frame (6) comprises two lateral walls (11) and, for each lateral wall (11), at least one box-shaped reinforcing structure (16) applied to that lateral wall;

the lateral walls (11) each comprising an inner main surface (12) facing towards the other lateral wall (11) and an outer main surface (13) positioned on the opposite side to the inner main surface (12), the screening elements (7) being positioned between the inner main surfaces (12); and

each box-shaped reinforcing structure (16) being hollow inside and being applied to the outer main surface (13) of the related lateral wall (11).

2. The vibrating screen according to claim 1, **characterised in that** each box-shaped reinforcing structure (16) is applied exclusively to a limited part (17) of the related outer main surface (13).
3. The vibrating screen according to claim 2, **characterised in that** said limited part (17) of each outer main surface (13) forms at least one ring (18) surrounding a portion of the self-same outer main surface (13) to which the box-shaped reinforcing structure (16) is not applied.
4. The vibrating screen according to claim 3, **characterised in that** said limited part (17) of each outer main surface (13) forms a plurality of rings (18) each surrounding a portion of the self-same outer main surface (13) to which the box-shaped reinforcing structure (16) is not applied.
5. The vibrating screen according to any of the preceding claims, **characterised in that** the vibrating structure (3) also comprises a load-bearing beam (14), rigidly interconnected between the lateral walls (11) and extending horizontally above all of the screening elements (7), the vibrating unit (5) being mounted on the load-bearing beam (14).
6. The vibrating screen according to claim 5 when it is dependent on claim 3, **characterised in that** the load-bearing beam (14) is fixed to the lateral walls

(11) at supporting portions (15) of the related inner main surfaces (12), and **in that** on each outer main surface (13), at said supporting portions (15), it is possible to identify a zone that is part of said limited part (17) that forms at least one ring (18), and to which the box-shaped reinforcing structure (16) is applied.

7. The vibrating screen according to any of the preceding claims, **characterised in that** each box-shaped reinforcing structure (16) is connected to the related lateral wall (11) by means of a plurality of bolts (20).
8. The vibrating screen according to claim 7, **characterised in that** for each box-shaped reinforcing structure (16), at least several bolts (20) connect the box-shaped reinforcing structure (16) both to the related lateral wall (11) and to an elongate supporting element that rigidly connects the inner main surfaces to each other and supports at least one screening element (7).
9. The vibrating screen according to claim 7 or 8, **characterised in that** at least several of said bolts (20) completely pass through the related box-shaped reinforcing structure (16), and **in that**, at least for several of the bolts (20) that completely pass through it, the box-shaped reinforcing structure (16) also comprises, for each bolt (20), at least one tubular insert (21) that extends perpendicularly to a main plane of extension of the lateral wall (11) and inside which the bolt (20) is positioned.
10. The vibrating screen according to any of the preceding claims, **characterised in that** each box-shaped reinforcing structure (16) comprises a main reinforcing body (22) that, in a plane perpendicular to a main plane of extension of the outer main surface (13), is C-shaped with a central part of the C applied to the related outer main surface (13) and arms of the C extending substantially perpendicularly to, and away from, the main plane of extension of the related outer main surface (13), and at least one closing element (23) applied to the main reinforcing body (22) between the arms of the C.
11. The vibrating screen according to claim 10, **characterised in that** each box-shaped reinforcing structure (16) also comprises a plurality of stiffening walls (24) mounted inside the main reinforcing body (22) and welded to it, the stiffening walls (24) extending perpendicularly to the related outer main surface.
12. The vibrating screen according to claim 11 when it is dependent on claim 6, **characterised in that** each reinforcing structure comprises a plurality of stiffening walls (24) at the related supporting portion of the inner main surface (12), the stiffening walls (24) of

said plurality being angled relative to one another and constrained to each other in order to form a stiffening frame (25).

5

10

15

20

25

30

35

40

45

50

55

6

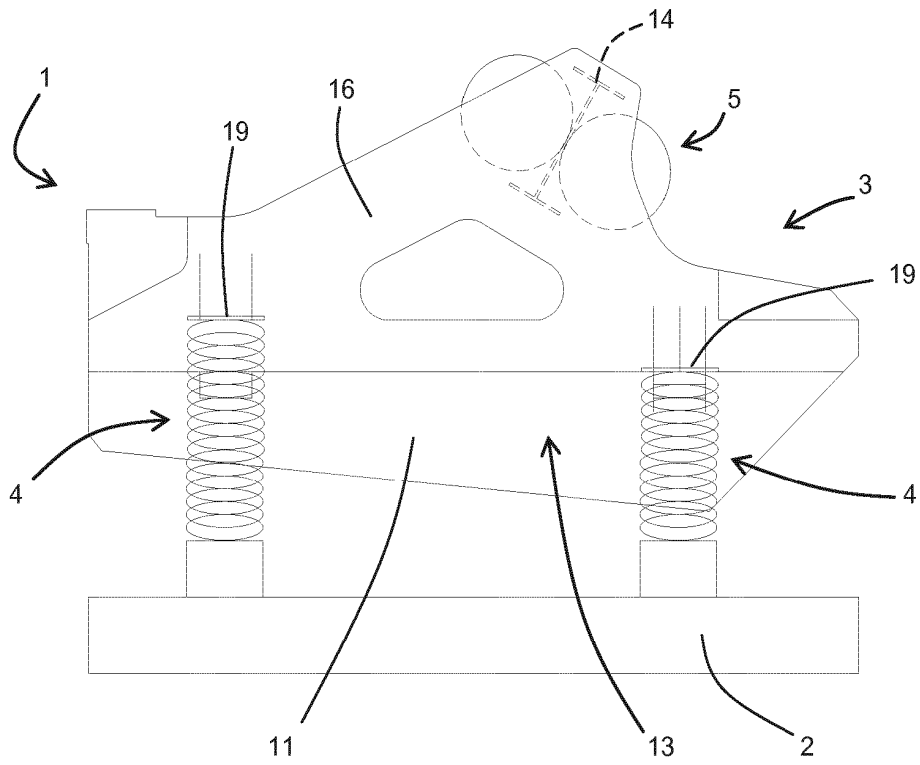


FIG. 1

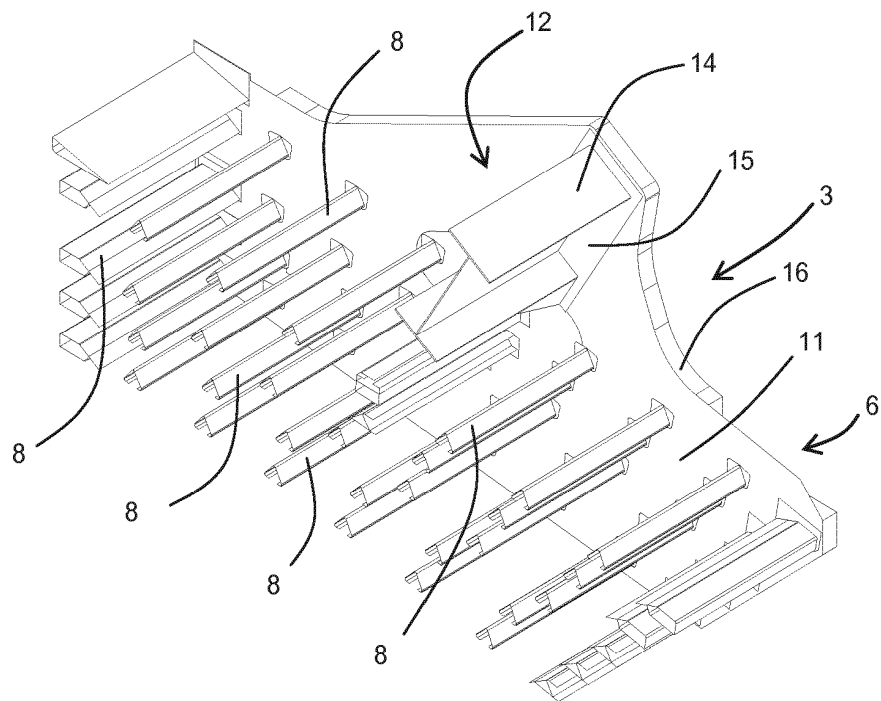


FIG. 2

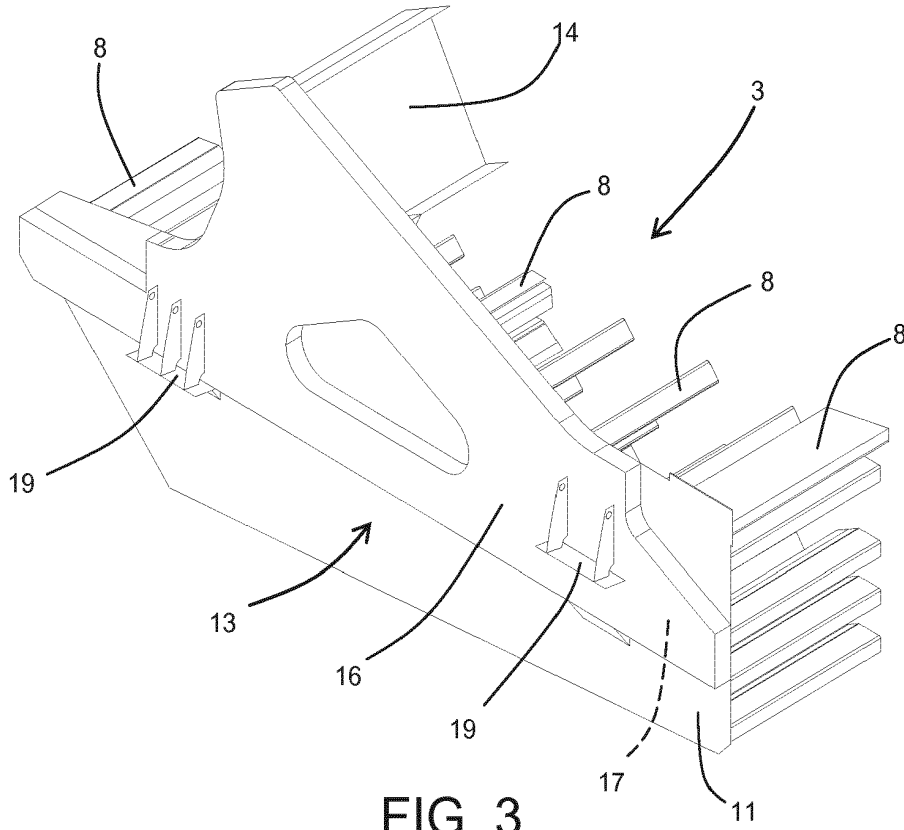


FIG. 3

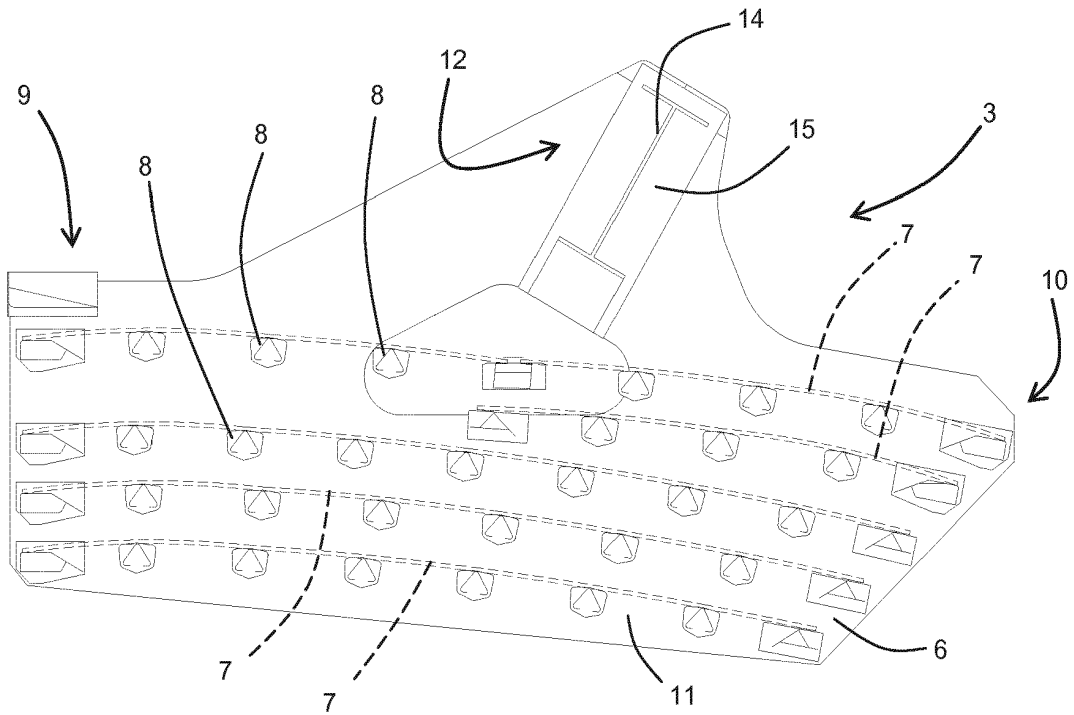


FIG. 4



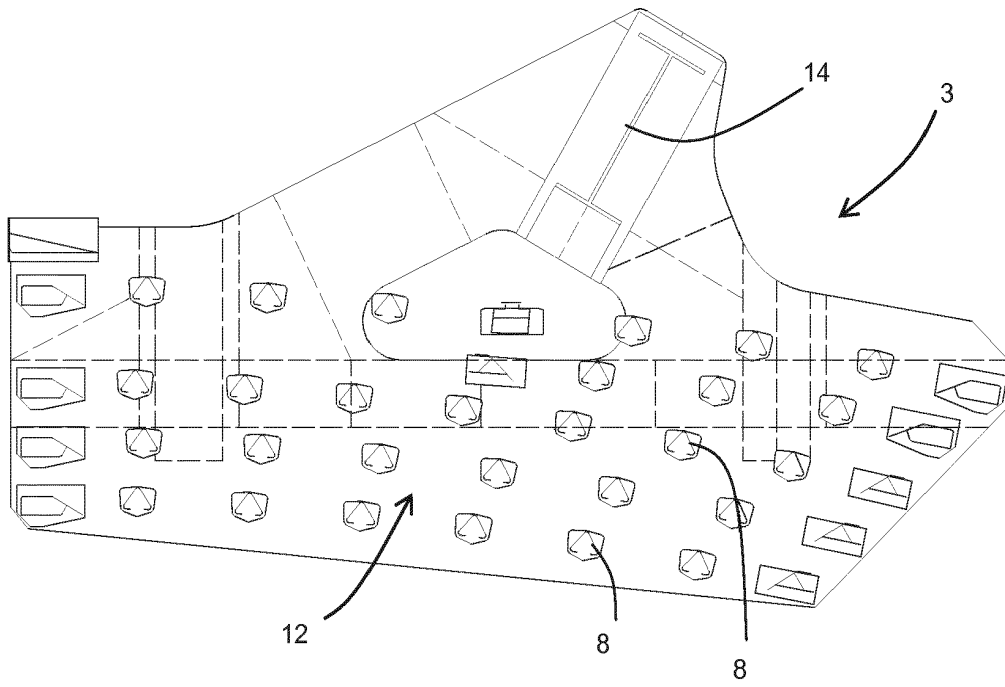


FIG. 5

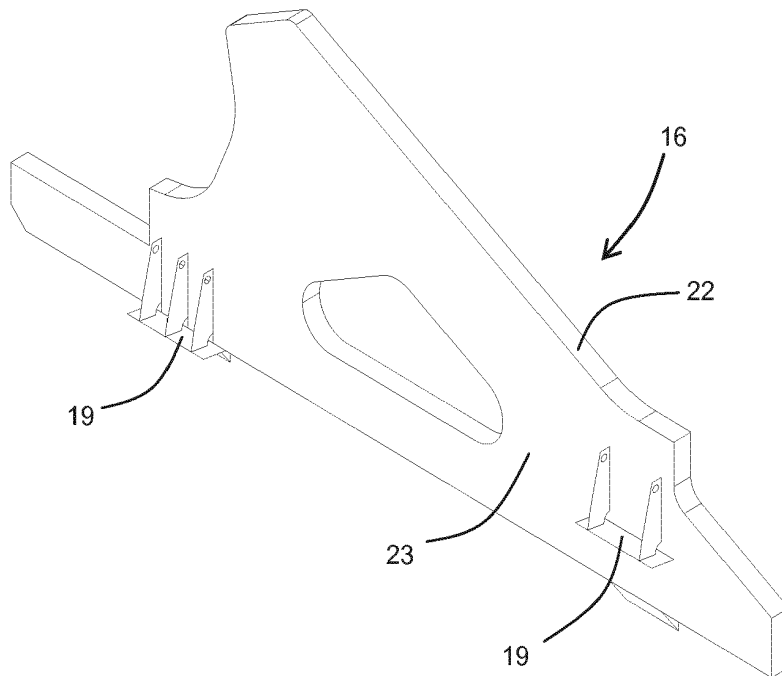


FIG. 6

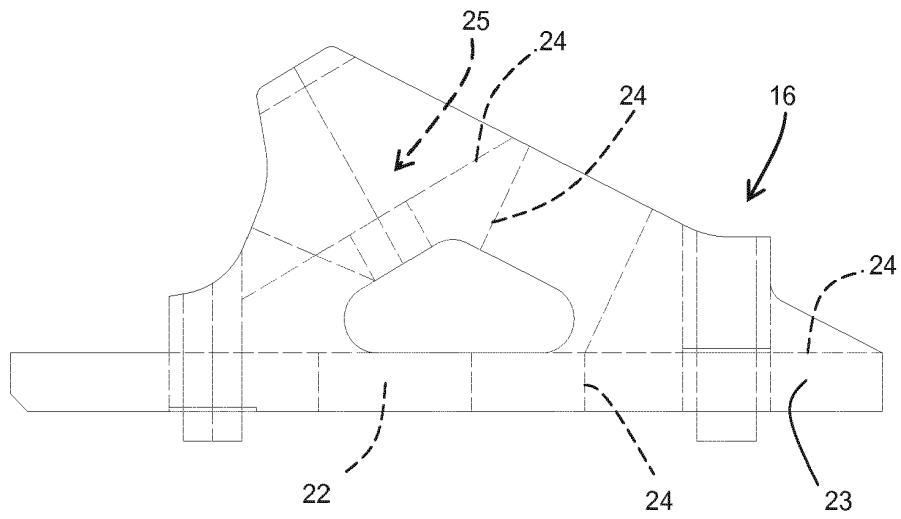


FIG. 7

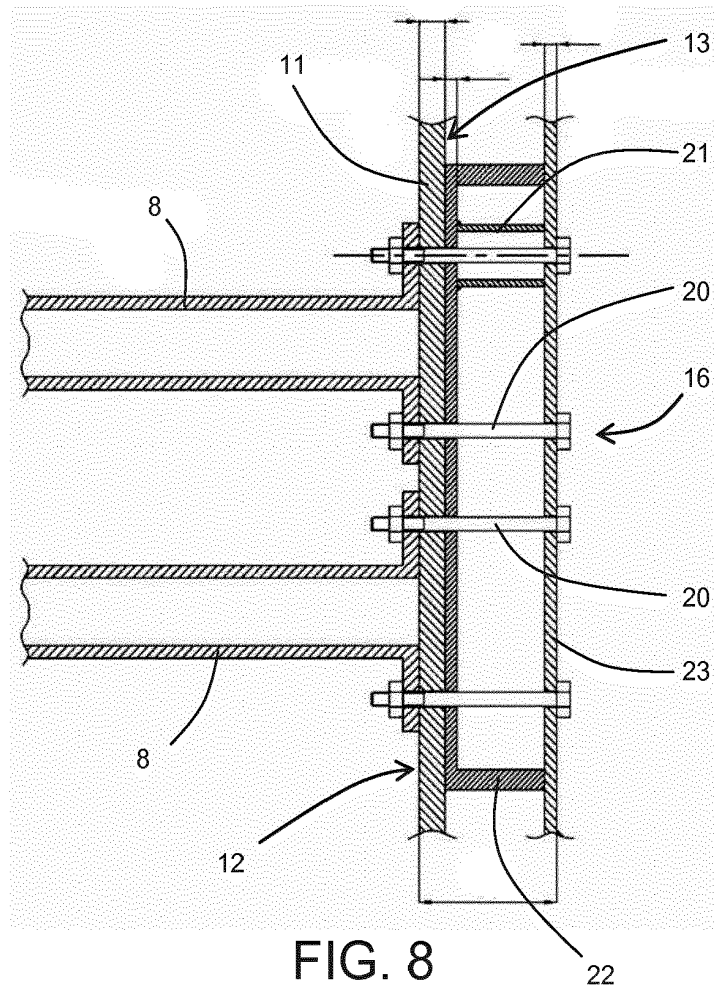


FIG. 8

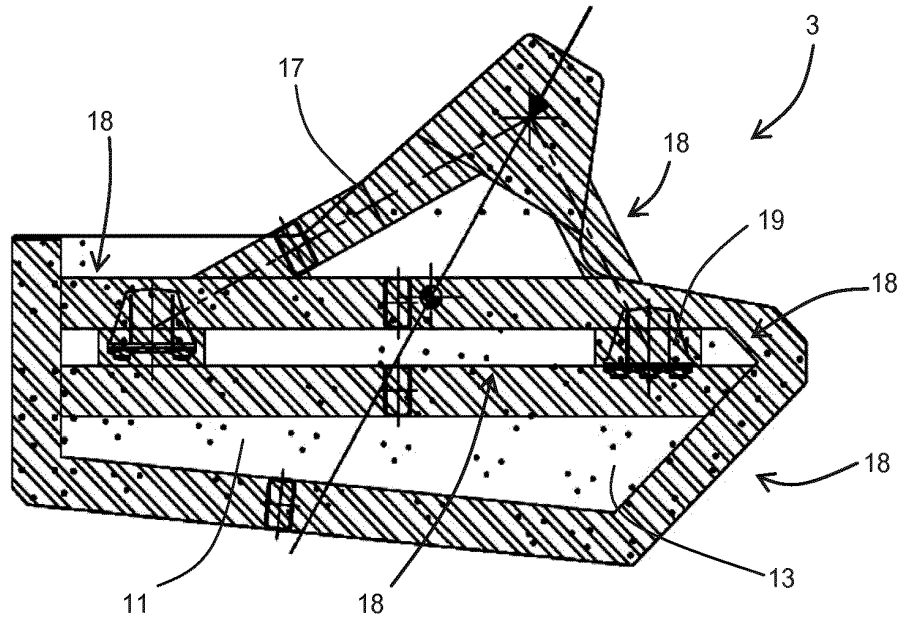


FIG. 9

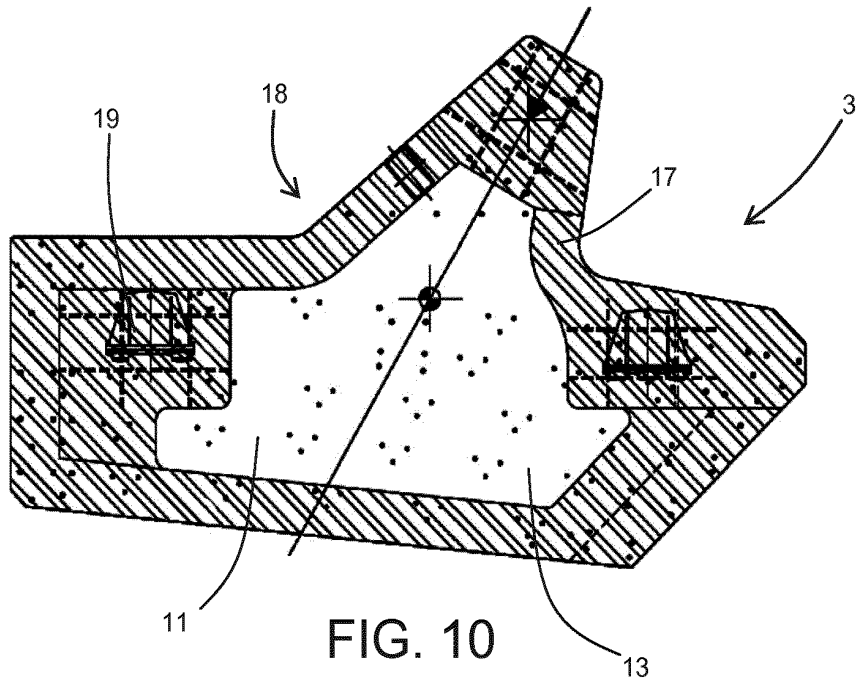


FIG. 10



EUROPEAN SEARCH REPORT

Application Number  
EP 16 20 2690

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,D	EP 1 719 560 A2 (BERNARDI IMPIANTI INTERNAT S P [IT]) 8 November 2006 (2006-11-08) * paragraphs [0001] - [0022]; claims 1-17; figures 1-3 *	1,2,5, 7-12	INV. B07B1/36 B07B1/46 B65G27/08
Y	-----	6	ADD. B07B1/28
X	EP 1 946 851 A1 (HAVER & BOECKER OHG [DE]) 23 July 2008 (2008-07-23) * paragraphs [0001] - [0012], [0021] - [0046], [0048] - [0080]; claims 1-16; figures 1-9 *	1-4,7-12	
Y	-----	6	
X	GB 2 134 214 A (KINERGY CORP) 8 August 1984 (1984-08-08) * page 1, line 5 - page 4, line 5; claims 1-8; figures 1-4 *	1,2	
A	EP 2 850 938 A1 (DEERE & CO [US]) 25 March 2015 (2015-03-25) * claims 1-15; figures 1-13 *	1-12	
A	US 2012/111774 A1 (SAUSER EDWIN J [US] ET AL) 10 May 2012 (2012-05-10) * paragraphs [0013] - [0020], [0031] - [0036]; claims 1-19; figures 3-5 *	3,4	TECHNICAL FIELDS SEARCHED (IPC) B07B B65G
The present search report has been drawn up for all claims			
Place of search <b>The Hague</b>		Date of completion of the search <b>22 June 2017</b>	Examiner <b>Psoch, Christian</b>
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	

5  
EPO FORM 1503 03.02 (P04001)

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

EP 16 20 2690

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.

22-06-2017

10

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1719560 A2	08-11-2006	CN 1857797 A	08-11-2006
		EP 1719560 A2	08-11-2006
EP 1946851 A1	23-07-2008	AT 424941 T	15-03-2009
		CA 2618673 A1	17-07-2008
		DE 102007003359 A1	31-07-2008
		EP 1946851 A1	23-07-2008
		US 2008169223 A1	17-07-2008
GB 2134214 A	08-08-1984	AU 555371 B2	18-09-1986
		BR 8400358 A	04-09-1984
		CA 1191482 A	06-08-1985
		DE 3402861 A1	02-08-1984
		DE 8402377 U1	02-01-1986
		GB 2134214 A	08-08-1984
		IN 160314 B	04-07-1987
		JP S6365388 B2	15-12-1988
		JP S59186670 A	23-10-1984
		MX 157671 A	07-12-1988
		US 4492629 A	08-01-1985
ZA 8400510 B	31-10-1984		
EP 2850938 A1	25-03-2015	AR 099268 A1	13-07-2016
		BR 102014023084 A2	15-09-2015
		CA 2864220 A1	20-03-2015
		CN 104429401 A	25-03-2015
		EA 201400934 A1	31-03-2015
		EP 2850938 A1	25-03-2015
US 2015087365 A1	26-03-2015		
US 2012111774 A1	10-05-2012	CA 2756965 A1	08-05-2012
		US 2012111774 A1	10-05-2012
		US 2012111775 A1	10-05-2012
		US 2015108046 A1	23-04-2015

45

50

55

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**

- EP 1719560 A2 [0004] [0006] [0008] [0009]