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(54) **BLADE GUARD FOR MINING LOADER BUCKETS**

(57) The invention relates to a guard made up of a series of teeth that are bolted to the lip (2-2'-2") of the bucket, consist of three parts made of highly durable materials, are welded together and sit on the underside, side and top of the edge of said lip. Said teeth are secured by means of a set of bolts, washers and nuts, so that the latter are housed in the slotted holes (11) of the base plate to ensure that the bolts remain tight and the teeth do not fall out. The design of the teeth facilitates the entry of the bucket into the heaps of ore, reducing mechanical wear and consumption. The teeth are interchangeable, which significantly increases the durability of the assembly.

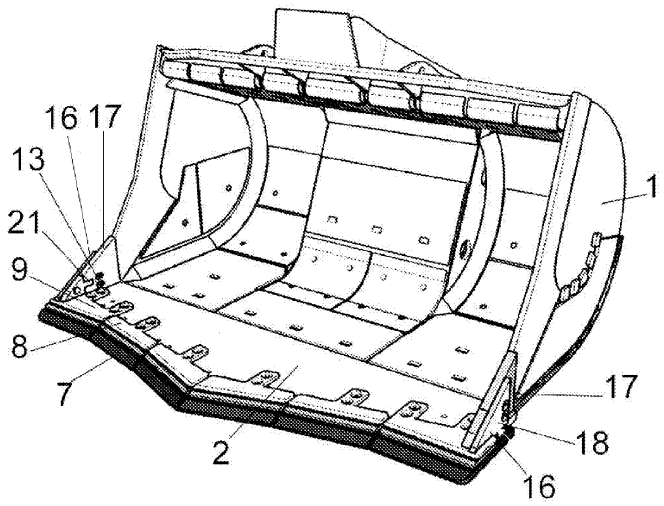

FIG. 7

EP 4 450 719 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to a blade guard for mining loader buckets, intended for increasing the durability of said blades, reducing replacement times, reducing mechanical wear in loaders, and reducing fuel and tire consumption.

[0002] Therefore, one object of the invention is to provide an efficient guard system which prevents having to constantly retighten the teeth and lip of the bucket by reducing vibrations and blows in their securing means, offering a self-sharpening system, favouring the entry into the heap of ore, which translates into lower mechanical wear of the loaders and a substantial reduction in fuel and tire consumption.

[0003] The invention is comprised in the field of industrial machinery used in mining and is applicable both in material dragline buckets and in excavator buckets.

BACKGROUND OF THE INVENTION

[0004] In the scope of practical application of the invention, i.e., the mining sector, excavator machines which include a bucket or a shovel on the main edge of which teeth are installed to help penetrate the material to be extracted, are used.

[0005] As is evident, these teeth are subject to intense wear, so they must be replaced on a regular basis.

[0006] Teeth retaining devices which are attached to the main edge of the bucket and have mechanisms which secure the teeth individually, allowing the release and the replacement of said teeth, which elements are likewise subjected to intense wear, so they must also be regularly replaced, are known.

[0007] These devices are usually welded together with the teeth to the bucket, so replacement manoeuvres may take up to two shifts.

[0008] Although there are systems in which the teeth together with their guard are mechanically attached to the lip of the bucket, as in the case of patents US 6848203 and US 2004/009888, the assembly is bolted exclusively to the lip upper face, so that said bolts tend to loosen due to vibrations and must be periodically retightened, which represents an unwanted loss of time and the possibility of a tooth being lost, with the blade being exposed and subsequently deteriorated.

[0009] At the same time, such devices are usually made of cast manganese steel, a material that rarely reaches a hardness of about 550 HB, so that if they do reach that value, they only do so under exposure to extreme impact wear, but not sliding wear.

[0010] In the case of sliding wear, they typically have a moderate hardness of 400-500 HB.

DESCRIPTION OF THE INVENTION

[0011] The proposed blade guard for mining loader buckets solves in a fully satisfactory manner the drawbacks set forth above in relation to the different aspects discussed.

[0012] To that end, starting from the conventional structuring of a bucket, in the guard of the invention there are a series of novel elements from which the advantages set forth below are derived.

[0013] The first of the elements having a novel structuring is the lip which is welded to the lower and main edge of the bucket.

[0014] Said lip is made up of a wear-resistant rolled steel plate, in which there is defined a rectangular main sector, which is prolonged in the front forming a triangular sector, being able to have several shapes according to the use for which the bucket is intended, and is equipped with a plurality of through holes for the mechanical securing of the assembly of the teeth with their guard elements, and have different angles of attack, with the particularity that on the underside of its edge there is established a step extending along the entire width of the lip, or independent stepped notches for each tooth which, in both cases, the vertical wall of which defines a support and stabilisation element for the base plate where the teeth are located, releasing shear stressing on the securing bolts for securing the teeth to the lip.

[0015] More specifically, each tooth is formed from three parts having a different thickness and composition which are welded to one another forming a one-piece assembly which is secured by means of sets of bolts and nuts to the lip described above.

[0016] Said teeth include a base plate, an intermediate part, and an upper part.

[0017] The base plate is manufactured in wear-resistant rolled steel. The upper middle area of the trailing edge of this part is supported on the step provided on the lower face of the lip, such that this plate protrudes vertically with respect to same, protecting the lip from wear.

[0018] This part includes on the lower face thereof through bores, ending in the lower portion in notches in the form of a slotted hole having a width in accordance with the width of the securing nuts provided for the teeth, preventing said nuts from being able to rotate with the vibrations generated in the tooth, thereby preventing the bolts having to be periodically retightened.

[0019] The intermediate part is manufactured in wear-resistant rolled steel and supported against the outer edge of the lip, including rear openings offering additional areas for welding said part to the lower part or base plate.

[0020] In turn, the upper part is manufactured in wear-resistant rolled steel and is flush with the upper surface of the lip, including rear extensions with holes coinciding with the holes provided on the lip, as well as with the holes of the base plate, for stabilising the teeth by means of bolts which are inserted in the upper portion and stabilised by means of nuts which are housed in the slotted

holes of the base plate.

[0021] It also includes holes for offering additional areas for welding said part to the intermediate part.

[0022] The device is complemented with corner pieces made up of two elements which are attached to one another through a tongue and groove coupling, a thicker corner piece which is welded to the side wall of the bucket and to the lip, and a second corner piece that is not as thick welded to the upper part of each lateral tooth, which externally and laterally fit on the thicker corner piece to which it is bolted, and said corner piece includes a front and inner extension in the form of a male element that fits in a groove established on the leading edge of the corner piece welded to the lip and to the bucket.

[0023] The lower faces of the base plates are covered with a hard metal material, suitable for very highly abrasive wear and applications with moderate to high impacts based on hard metal carbides. The covering is configured as a pattern of welding beads which increases the surface of the lower part of the tooth and constitutes a support so that the ore itself adheres to that area, creating an additional guard shield with the ore itself, therefore reducing the wear of the tooth itself and increasing its service life.

[0024] According to an embodiment variant, the invention is likewise applicable in excavator buckets, so that conventional claws are arranged between the material dragline teeth, secured by means of pins to respective claw bars welded to the lip, for which purpose the lip will include on the lower face with respect to its leading edge a plurality of independent steps, suitable in terms of shape for receiving the respective teeth which are secured to the latter through complementary bolts, which lip does not include the lateral corner pieces described above.

[0025] As for the materials used, wear-resistant rolled steel has a hardness that is more homogeneous with respect to the different types of wear, whether it is sliding wear or impact wear. For example, Hardox 550 wear-resistant rolled steel has a hardness that is never less than 550 HB, regardless of the type of wear.

[0026] In addition to optimising its service life, the homogeneity of this material predicts said duration, and the wear service life of the components can be very accurately estimated.

[0027] Due to its high shape stability, it withstands intense wear conditions without cracking, expansion, or distortion, thereby simplifying and optimising production and preventing wear parts from being damaged during use.

[0028] It is a material that, unlike manganese steels, can be profiled, machined, and welded with the suitable means and methods.

[0029] Finally, the use of this material contributes to a healthier working environment than manganese steel, as welding and cutting are carried out without any major smoke emissions.

[0030] Based on this structuring, improvements of up to 20% have been achieved in the duration of the buckets, and of up to 65% by interchanging the central teeth with the intermediate teeth and replacing the lateral teeth with others referred to as half-used teeth, all with a structuring and design that facilitates the entry of the bucket into the heaps of ore, reducing mechanical wear and consumption, as well as ensuring that the bolts remain tight and the teeth do not fall out.

DESCRIPTION OF THE DRAWINGS

[0031] To complement the description that will be made below and for the purpose of helping to better understand the features of the invention, according to a preferred example of practical embodiment thereof, attached as an integral part of said description there is a set of drawings in which the following is depicted in an illustrative and non-limiting manner:

Figure 1 shows an exploded perspective view of the three elements included in the teeth of a blade guard for mining loader buckets carried out according to the object of the present invention.

Figure 2 shows a perspective view of the device of the preceding figure duly assembled.

Figure 3 shows a profile detail of the relative arrangement of the three elements included in the tooth and the lip on which they are mechanically secured.

Figure 4 shows a plan view of the lip included in the guard of the invention.

Figure 5 shows a side perspective view of the lip of the preceding figure.

Figure 6 shows a perspective view of the corner piece associated with the lateral tooth of the bucket.

Figure 7 shows a perspective view of the assembly of the invention duly assembled.

Figure 8 shows a view similar to that of Figure 7, but corresponding to the second assembly of the teeth provided for the device, in which once the central teeth are partially worn, they are interchanged with the intermediate teeth.

Figure 9 shows a lower plan view of the assembly formed by the teeth and the lip.

Figure 10 shows a lower lateral perspective view of an embodiment variant of the device of the invention in which the lip holding the teeth has a trapezoidal configuration.

Figure 11 shows a perspective view of an embodi-

ment variant of the invention in which the device is arranged on an excavator bucket.

Figures 12 and 13 show to details in different exploded and perspective views of the configuration of the lip and teeth of the embodiment variant of Figure 11.

PREFERRED EMBODIMENT OF THE INVENTION

[0032] In view of the mentioned figures, and particularly Figure 7, it can be seen how the blade guard for mining loader buckets starts from a conventional structuring of a bucket (1), to the lower and leading edge of which there is attached a lip (2), welded thereto, and which, as shown in Figures 4 and 5, has a rectangular main sector (3), which is prolonged in the front forming a triangular sector (4) and is equipped with a plurality of through holes (5) for the mechanical securing of the assembly of the teeth.

[0033] Said lip (2) includes, in correspondence with its lower and leading edge, a step (6) the vertical wall of which defines a support and stabilisation element for the base plates included in the teeth, thereby releasing stresses on the securing bolts for securing the teeth to the lip.

[0034] Said step (6) may extend along the entire width of the lip, as shown in Figures 3, 5 and 9, or else be carried out as independent stepped notches for each tooth, as shown in Figure 13, according to an embodiment variant which will be described below.

[0035] As shown in Figures 1, 2 and 3, each tooth is made up of three parts with a different thickness and composition which are welded to one another, forming a one-piece assembly which is secured by means of sets of bolts and nuts to the lip described above.

[0036] The first one of the parts, i.e., the lower part, is carried out as a base plate (7) manufactured in Hardox 550 and having a thickness that may range between 40 and 50 mm, as will be seen below. The upper middle area of the trailing edge of this part is supported on the step (6) provided on the lower face of the lip (2), such that this plate protrudes on the underside and vertically with respect to same.

[0037] This part or base plate (7) includes on the lower face thereof through bores (10) ending in the lower portion in notches in the form of slotted hole (11) having a width in accordance with the width of the securing nuts provided for the teeth, which prevent said nuts from being able to rotate with the vibrations generated in the tooth, thereby preventing the bolts having to be periodically retightened.

[0038] The second part included in the teeth is an intermediate part (8) which is manufactured in Hardox 450 and supported against the outer edge of the lip (2). It has a thickness of the order of 30 mm. This part will incorporate channels (12) for reinforcing the welded attachment of the parts and preventing said parts from detaching when the welding becomes worn over working hours. As can be seen in Figures 1 and 2, this intermediate part (8) has channels (12) for reinforcing the welded attachment of the parts, which channels (12) are present in all the intermediate parts (8) for all the embodiment variants of the invention, although for the sake of simplicity of the figures, they are not depicted in Figures 6, 7, 8, 11 and 12.

[0039] The third part consists of an upper part (9), manufactured in Hardox 450, with a thickness of the order of 20 mm, and flush with the upper surface of the lip (3), including one or more rear extensions (13) with holes (14) coinciding with the through holes (5) provided on the lip as well as with the through bores (10) of the base plate (7), for stabilising the teeth with respect to the lip (2) by means of hex bolts inserted in the upper portion together with washers and stabilised by means of nuts which are housed in the slotted holes (11) of the base plate. These holes (14) have a perimeter notch having a height according to the head of the mentioned bolt in order to protect said head from wear and facilitate subsequent removal.

[0040] As can be seen in Figures 1 and 2, this part includes additional holes (15) defining areas for welding the part to the intermediate part, in addition to the perimeter weld thereof. These additional holes (15) are present in all the upper parts (9) of all the embodiment variants of the invention, so that although they are not depicted in Figures 6, 7, 8, 11 and 12, it is for the sake of simplification of the figures.

[0041] The parts are cut by means of plasma cutting to minimise temperature input and thereby achieve minimum variation of the physicochemical properties of the parts. Once all the parts have been cut, the entire intermediate part (thickness of 30 mm) is bevelled on the perimeter so as to be welded, and front bevelling is also performed to impart the necessary shape.

[0042] The parts are assembled on a mould, secured by means of standard bolts and arranged in dots for subsequent welding.

[0043] As can be seen in Figures 6 and 7, the device is complemented with corner pieces (16-17) made up of two laminar elements so that the corner piece (17) has a thickness of the order of 50 mm and is welded to the side wall of the bucket (1) and to the lip (2), whereas the corner piece (16) with a thickness of the order of 30 mm is welded to the upper part (9) of each lateral tooth so that said upper part externally and laterally fits on the corner piece thicker to which it is bolted by means of holes (18), and said corner piece includes a front and inner extension (19) from which there emerges a male element (20) that fits in a groove (21) established on the leading edge of the corner piece of (17).

[0044] The triangular configuration of the front sector of the lip (2) defines the seating for a series of teeth that are flush with one another, although the inclination of their leading edges does not have to be parallel to the sides of said triangle, as shown in Figures 7 and 9, there being defined central teeth forming with one another a more acute angle than that of the lip, which in turn defines

a more prominent central sector, intermediate teeth, parallel to the lip, and lateral or end teeth forming a more obtuse angle.

[0045] This design facilitates the entry of the bucket into the heaps of ore, reducing mechanical wear and consumption.

[0046] However, the lip (2') does not have to have a triangular front end and can have other configurations, such as the trapezoidal configuration shown in the example of embodiment of Figure 10, or a completely rectangular configuration, without this affecting the essence of the invention.

[0047] The central and lateral teeth are subjected to greater wear than the intermediate teeth are, so to even further extend the service life of the assembly of teeth, this design allows interchanging the teeth (Figure 8), because in the rear part for the attachment to the lip, the intermediate teeth and the central teeth are the same (with two symmetrical groups being defined on either side of the vertex of the triangle of the lip), and the position of the central teeth can be interchanged with the position of the intermediate teeth halfway through their service life such that, although this modifies the plan profile of the edge of attack of the bucket, defining a less sharp or prominent profile, it allows considerably extending the service life of the assembly of teeth.

[0048] At the same time, it is provided that the lateral teeth, which are also subjected to intense wear, can be replaced with the half-used lateral teeth having a similar configuration to those being replaced, but in which the base plate is not as thick, i.e., 40 mm thick, compared to the base plate of the rest of teeth which is 50 mm thick, because at the time of the replacement thereof, the thickness of the base plate of the rest of teeth will have obviously been reduced due to wear.

[0049] Even though in the examples of the practical embodiments of Figures 7 to 10 it has been provided that six teeth are assembled on the lip (3), the number of teeth may be increased depending on the size of the bucket, or even be reduced (five in the case of the example of practical embodiment of Figure 11), without this affecting the essence of the invention.

[0050] According to the embodiment variant of Figures 11 to 13, the invention is likewise applicable in excavator buckets (1'), so that between the material dragline teeth there are arranged conventional claws (22), which are secured by means of pins to a respective claw bars (23) welded to the lip (2"), for which purpose and as mentioned above, the lip (3') will include on the lower face with respect to its leading edge a plurality of independent steps (6), suitable in terms of shape for receiving the respective teeth which are secured to the latter through complementary bolts (24).

[0051] In buckets of this type, the use of the lateral corner pieces described above and depicted in Figures 3, 6, 7, 8 and 10 is optional, although the edges of the side walls of the bucket could incorporate conventional reinforcement elements (25).

[0052] Lastly, as mentioned above, the teeth are covered with a Duroxite type hard metal material, which is based on hard metal carbides, suitable for very highly abrasive wear and applications with moderate to high impacts. This covering is made of a material that is even more wear-resistant than the material of the tooth itself.

[0053] In Figure 9, it can be seen how this material is applied on the lower face of the teeth in the form of beads, forming an array which facilitates the adherence of ore under the tooth, which reduces direct friction against the tooth itself, therefore increasing its durability.

Claims

1. A blade guard for mining loader buckets which, starting from the conventional structuring of a bucket (1), to the lower and leading edge of which there is attached a lip (2-2'-2"), welded thereto, there being attached thereto teeth and a lip (2-2'-2") which is equipped, in correspondence with its free and leading edge, with a plurality of through holes (5) for the mechanical securing of the teeth by means of sets of bolt-washer-nut, **characterised in that** the lip (2-2'-2") includes, in correspondence with the lower and leading edge thereof, a common step (6) or several independent steps (6) the vertical wall of which defines a support and stabilisation element for the teeth, which teeth are made up of three elements, that is, a base plate (7) with an upper middle area of the trailing edge thereof supported on the step (6) provided on the lower face of the lip (2-2'-2") protruding from the underside and vertically with respect to same, an intermediate part (8) supported against the outer edge of the lip (2-2'-2") and an upper part (9) that is flush with the upper surface of the lip (3), which are secured to one another by means of welding.

2. The blade guard for mining loader buckets according to claim 1, **characterised in that** the base plate (7) is manufactured in wear-resistant rolled steel, including on the lower face thereof through bores (10) ending in the lower portion in notches in the form of a slotted hole (11) having a width in accordance with the width of the securing nuts provided for the teeth; the intermediate part (8) is manufactured in wear-resistant rolled steel and includes channels (12) for reinforcing the attachment between the parts by means of welding; the upper part (9) is manufactured in wear-resistant rolled steel, including holes (15) defining areas for the welding of said part to the intermediate part (8), as well as one or more rear extensions (13) with holes (14) coinciding with the through holes (5) provided on the lip (2-2'-2"), as well as with the through bores (10) of the base plate (7), for stabilising the teeth with respect to the lip (2-2'-2") by means of bolts inserted in the upper portion together

with washers and stabilised by means of nuts which are housed in the slotted holes (11) of the base plate.

3. The blade guard for mining loader buckets according to claim 1, **characterised in that** the device is complemented with pairs of corner pieces (16-17) that can be coupled to one another, wherein the corner pieces (17) are attached to the side wall of the bucket (1) and to the lip (2-2') by means of welding, whereas the corner pieces (16) are welded to the upper part (9) of each lateral tooth.

4. The blade guard for mining loader buckets according to claim 1, **characterised in that** the lip (2) has a rectangular main sector (3), which is prolonged in the front forming a triangular sector (4).

5. The blade guard for mining loader buckets according to claim 1, **characterised in that** there are defined at least three types of teeth with different angles from its leading edge with respect to the angle formed in the triangular sector of the lip, that is, central teeth the leading edge of which has a more acute angle than that of the lip, intermediate teeth the leading edge of which is parallel to the leading edge of the lip, and lateral or end teeth forming a more obtuse angle with the edge of said lip, the intermediate and central teeth being interchangeable, whereas the lateral teeth can be replaced with half-used teeth, with the same structural configuration, but in which the base plate is not as thick.

6. The blade guard for mining loader buckets according to claim 1, **characterised in that** the lip (2') has a trapezoidal plan configuration.

7. The blade guard for mining loader buckets according to claim 1, **characterised in that** the lip has a rectangular plan configuration.

8. The blade guard for mining loader buckets according to claim 1, **characterised in that** the corner pieces (16-17) are made up of two laminar elements of different thicknesses, in which the corner piece (17) welded to the side wall of the bucket (1) and to the lip (2-2'-2") is thicker than the corner piece (16) welded to the upper part (9) of each lateral tooth, it having been provided for the latter to externally and laterally fit on the corner piece (17) to which it is bolted by means of holes (18), said corner piece (16) including a front and inner extension (19) from which there emerges a male element (20) that fits in a groove (21) established on the leading edge of the corner piece (17).

9. The blade guard for mining loader buckets according to claims 1, 3 and 4, **characterised in that** the base plate (7) has a thickness of the order of 50 mm for the teeth initially installed in the bucket, whereas in the half-used teeth it has a thickness of the order of 40 mm.

10. The blade guard for mining loader buckets according to claim 1, **characterised in that** the intermediate part (8) has a thickness of the order of 30 mm.

11. The blade guard for mining loader buckets according to claim 1, **characterised in that** the upper part (9) has a thickness of the order of 20 mm.

12. The blade guard for mining loader buckets according to claim 1, **characterised in that** the lower face of the teeth is covered with a hard metal based on hard metal carbides, applied in the form of beads, forming an array.

13. The blade guard for mining loader buckets according to claim 1, **characterised in that** the lip (2") includes on the lower and front face thereof a plurality of independent steps (6), suitable in terms of shape for receiving the respective teeth which are secured to the latter through complementary bolts (24), with the particularity that in the space that is defined between the independent steps, the lip (2") incorporates claw bars (23) welded thereto, where the corresponding claws (22) are secured by means of pins.

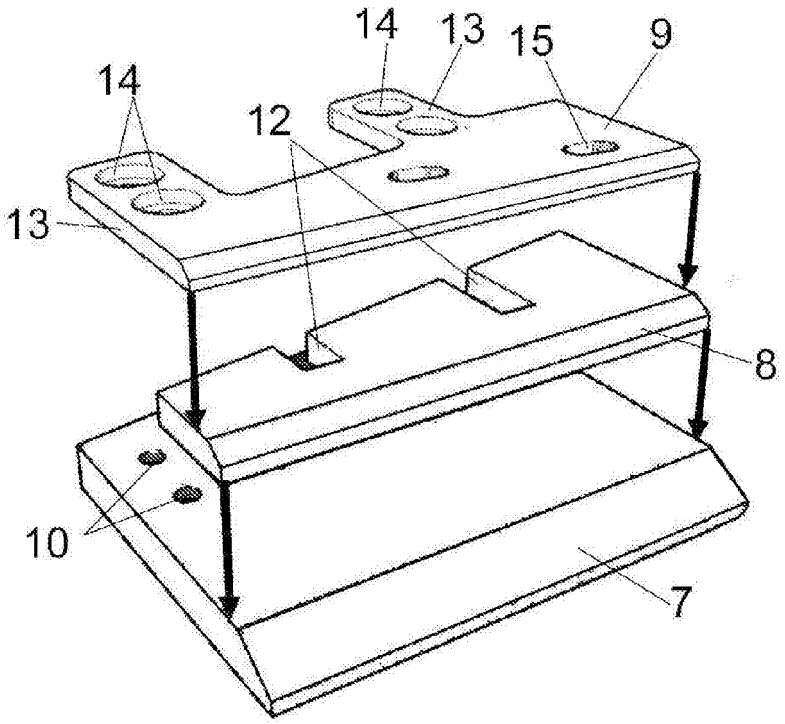

FIG. 1

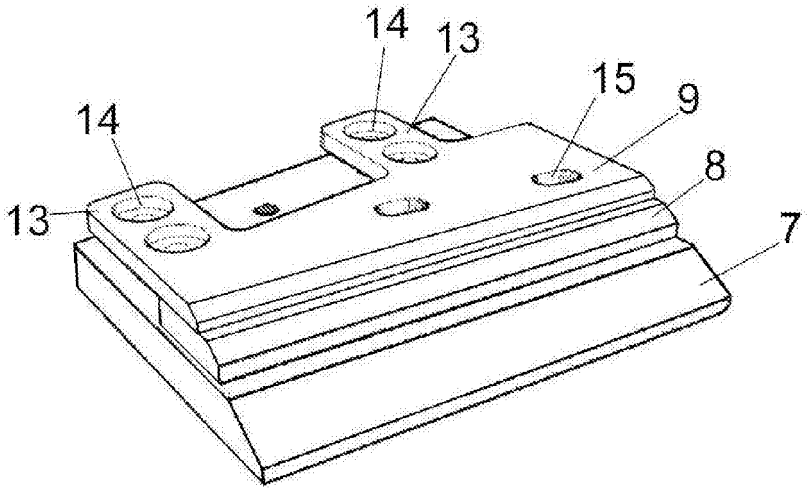

FIG. 2

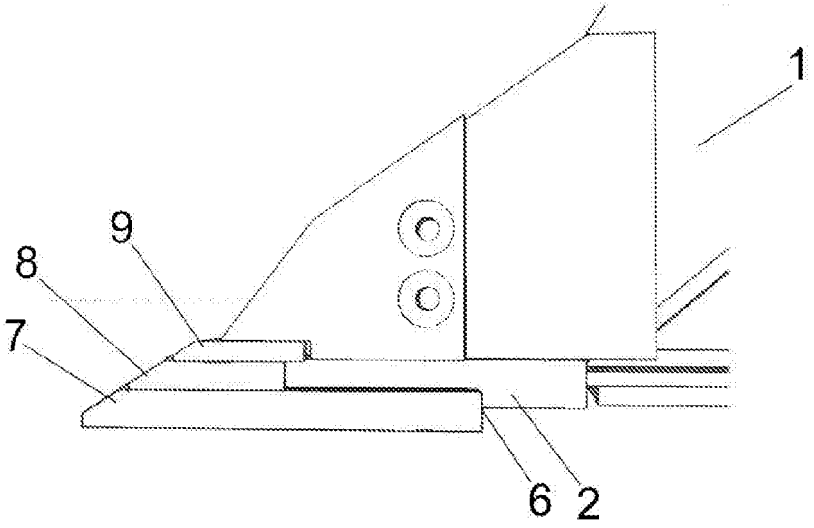

FIG. 3

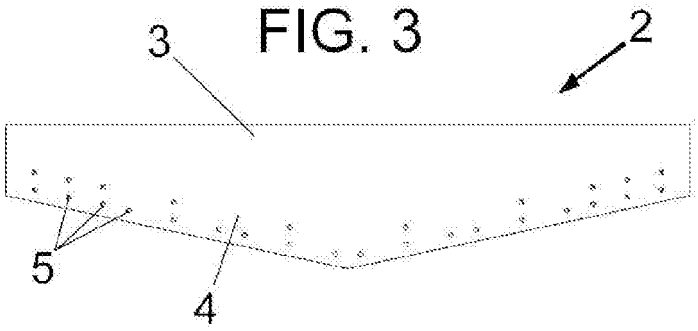

FIG. 4

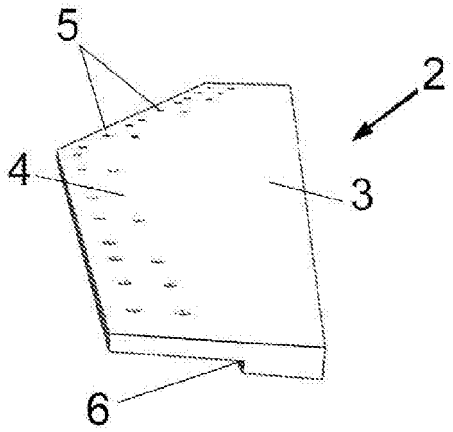

FIG. 5

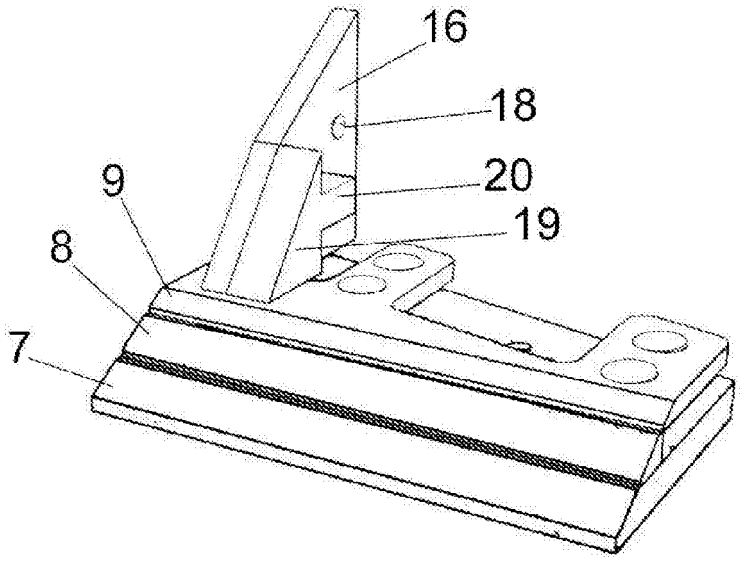

FIG. 6

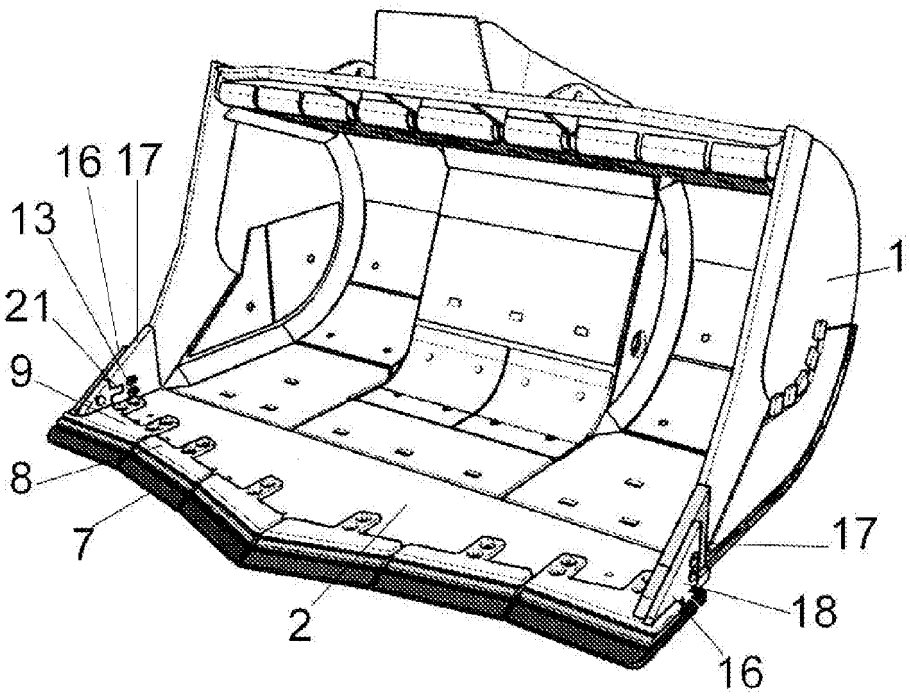

FIG. 7

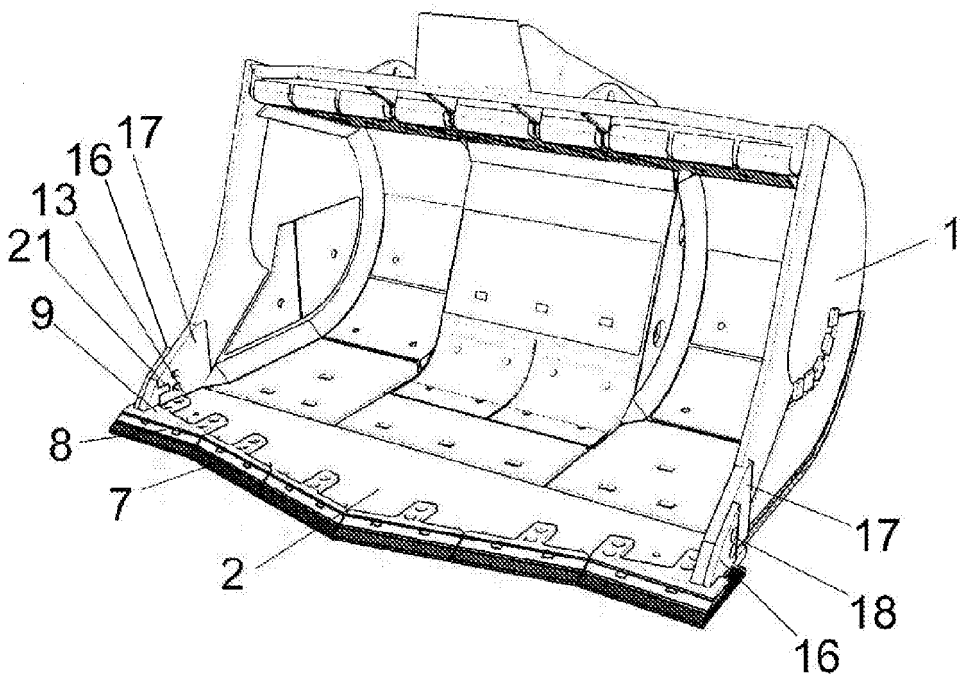

FIG. 8

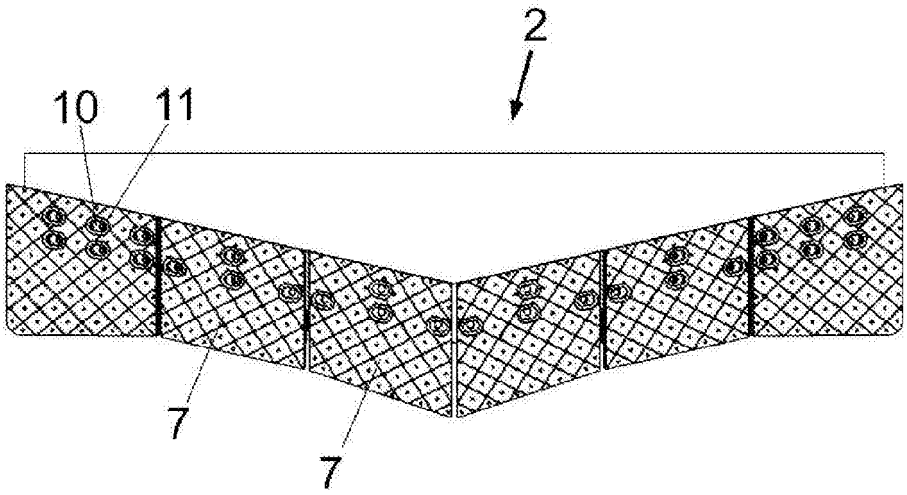

FIG. 9

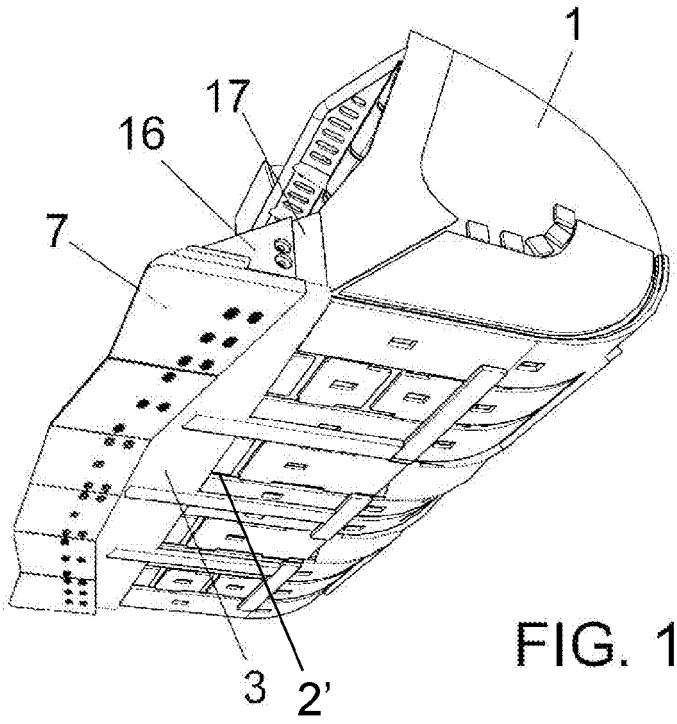

FIG. 10

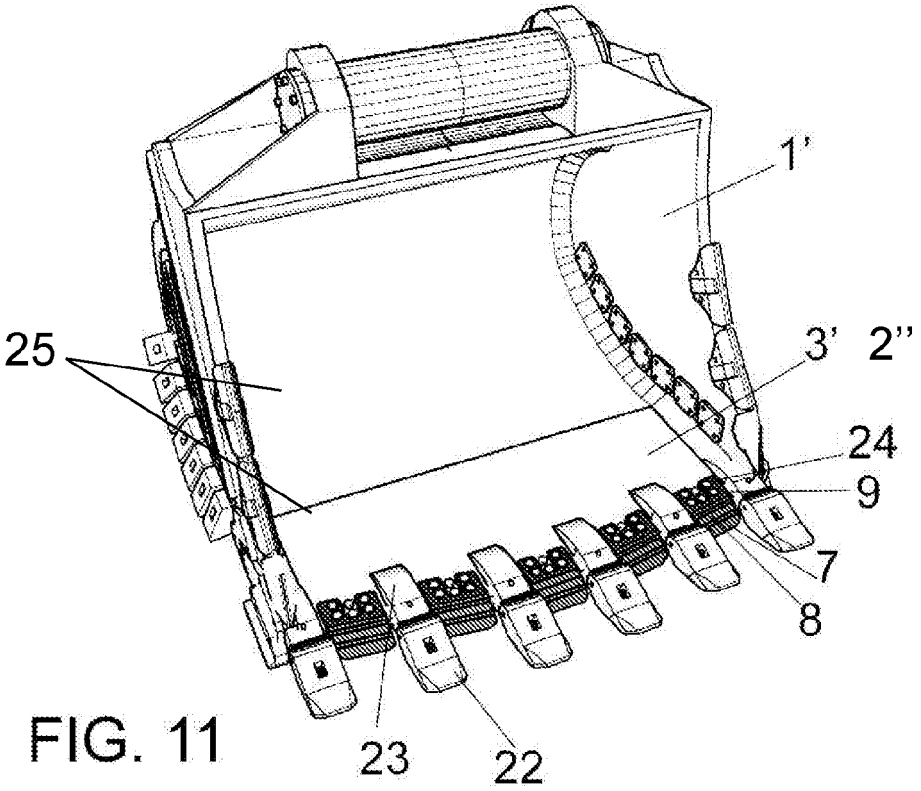

FIG. 11

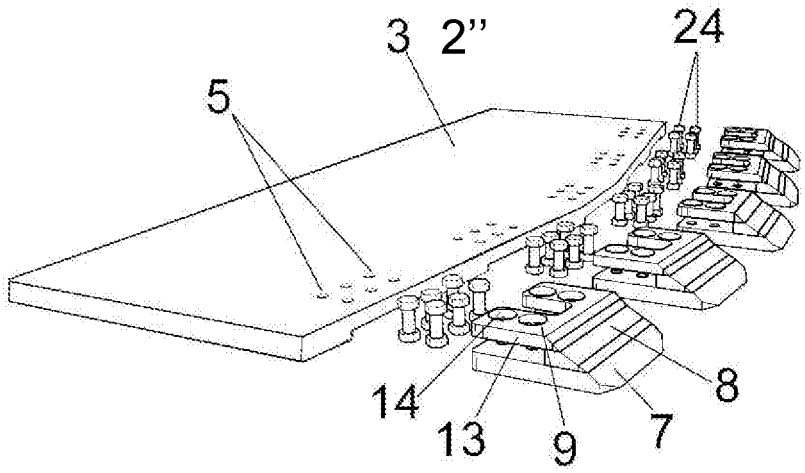

FIG. 12

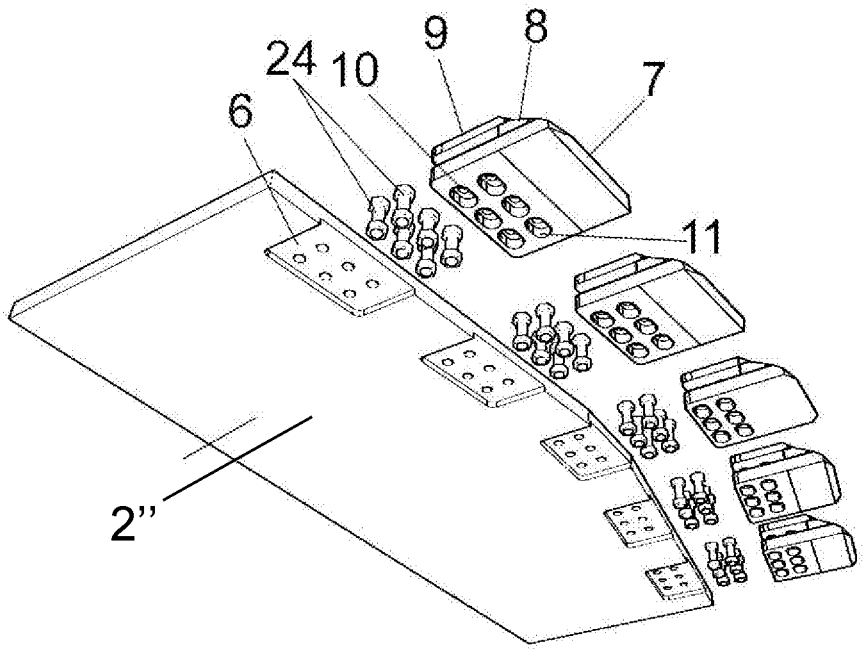

FIG. 13

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2022/070787

A. CLASSIFICATION OF SUBJECT MATTER

E02F9/28 (2006.01)
E02F3/40 (2006.01)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E02F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, INVENES, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2005172524 A1 (GRANT JAMES) 11/08/2005, the whole document	1-13
A	US 4238896 A (LANZ WILLIAM E ET AL.) 16/12/1980, the whole document	1-13
A	US 2011119964 A1 (KARLSSON KJELL) 26/05/2011, the whole document	1-13
A	US RE47477E E (VAUGHAN ALLEN) 02/07/2019, the whole the document	1-13

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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"O" document referring to an oral disclosure use, exhibition, or other means.
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other documents , such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
09/03/2023	**(10/03/2023)**
Name and mailing address of the ISA/ OFICINA ESPAÑOLA DE PATENTES Y MARCAS Paseo de la Castellana, 75 - 28071 Madrid (España) Facsimile No.: 91 349 53 04	Authorized officer F. Olalquiaga del Prado Telephone No. 91 3498598

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/ES2022/070787

Patent document cited in the search report	Publication date	Patent family member(s)	Publication date
US2005172524 A1	11.08.2005	US7266914 B2	11.09.2007
		CA2531473 A1	28.06.2006
		CA2531473 C	12.04.2011
US4238896 A	16.12.1980	NONE	
US2011119964 A1	26.05.2011	PL2227603T T3	31.08.2016
		CL2008003836 A1	07.08.2009
		ZA201004522 B	28.09.2011
		ES2564328T T3	21.03.2016
		BRPI0821550 A2	16.06.2015
		BRPI0821550 B1	02.01.2019
		RU2010130460 A	27.01.2012
		RU2480558 C2	27.04.2013
		US8281505 B2	09.10.2012
		MX2010006682 A	20.10.2010
		CN101903602 A	01.12.2010
		CN101903602B B	07.11.2012
		CA2709196 A1	02.07.2009
		CA2709196 C	10.05.2016
		SE533207 C2	22.06.2009
		SE0702860L L	22.06.2009
		AU2008341192 A1	02.07.2009
		AU2008341192B B2	07.08.2014
		PE20091604 A1	09.11.2009
		WO2009082317 A1	02.07.2009
		EP2227603 A1	15.09.2010
		EP2227603 A4	19.06.2013
USRE47477E E	02.07.2019	US2009205227 A1	20.08.2009
		US8776408 B2	15.07.2014
		AU2008207519 A1	12.03.2009
		AU2008207519B B2	02.10.2014
		CA2639138 A1	23.02.2009
		CA2639138 C	10.10.2017

Form PCT/ISA/210 (patent family annex) (July 2022)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 6848203 B **[0008]**
- US 2004009888 A **[0008]**