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(54) **LINER PLATE FOR A RIM OF CRUSHER CHAMBER**

(57) A liner plate (10) for lining and protecting a rim (61) of a chamber of a crusher (60), the liner plate (10) having a front surface (17) configured to engage material to be processed and a back surface (18) facing oppositely to the front surface, the liner plate (10) comprising: a first

material on a first portion (20) of the liner plate (10); and a second material on a second portion (30) of the liner plate (10), the second material is the same as or different than the first material.

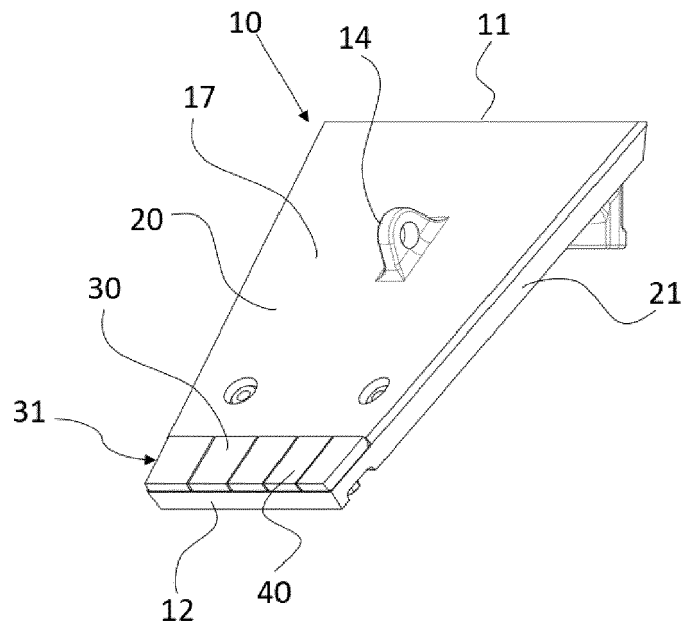


Fig. 1

Description

Field of invention

[0001] The present invention relates to rock crushing equipment and in particular, although not exclusively, to a crusher for processing material to be processed, a liner plate for lining and protecting a rim of a chamber of a crusher, and a wear plate.

Background art

[0002] Rock crushing systems, such as cone crushers, generally break rock, stone, or other material apart in a crushing chamber between a stationary element and a moving element. In particular, the gyrational motion of the crushing head with respect to the stationary bowl crushes rock, stone or other material within the crushing chamber. Usually, the rock, stone or other material is fed onto a feed unit that directs the material toward the crushing chamber where the material is crushed as it travels through the crushing chamber. The rim of crushing chamber may be in the form of an oblique surface adapted to engage material to be processed, thus is subject to constant wear during continued use of the cone crusher, usually the rim is protected from wear by a rim liner.

[0003] CN212040626U discloses a gyratory crusher having a liner plate 1 for spider rim 10, the application relates to a solution on how to install the liner plate on the spider rim, in particular, it includes a joint edge 9 to cooperate with recess 12.

[0004] US6536694 describes a gyratory crusher using a new spider arm guard and rim liner arrangement. The spider arm guard and rim liner are retained on the spider by means of a dowel and recess system. In its figures 4 and 5, the application describes the rim liner segments 59 which are used to protect the spider rim 53.

[0005] Crushing chamber wear components are consumable items that are replaced once a maximum wear is achieved. It becomes a costly and time-consuming issue when wear parts, such as liner plates, have to be replaced, irrespective of whether in a mine site or in a manufacturing facility, as the manufacturing and transportation costs of liner plates is expensive. Further, the operating cost dramatically increases due to increased machine down-time as a result of the increased frequency that the liner plates need to be replaced. Accordingly, what is required is a liner plate that addresses these problems.

Summary of the Invention

[0006] A liner plate suffers from non-uniform wear over the entire surface, the upper portion experiences less wear than the lower portion (especially lower edge), the objective of the present application is to delay the need to replace the upper portion until the upper portion is substantially worn-out.

[0007] It is an objective of the present invention to provide an improved crusher, with minimized operating and maintenance cost, and reduced machine downtime (e.g. due to less replacement of liner plate). In one aspect, the idea is to avoid the use of extreme hard material for the entire liner plate whilst ensuring that the liner plate works for a lengthened time before replacement is required. The associated solution is to use a material being more wear resistant at the lower portion, the advantage of this is that it reduces the number of times the machine needs to be shut down for machine maintenance, and to reduce the number of times or frequency that the liner plate needs to be replaced. In another aspect, the idea is to replace a worn-out lower portion of the liner plate and to reuse an upper portion of the liner plate that is not substantially worn-out, thereby to minimize manufacturing and transportation costs.

[0008] The objectives are achieved by providing a liner plate that is divided into at least two separate portions, for instance an upper portion and a lower portion. This is based on the finding that lower portion suffers from more severe wear than upper portion and in many cases there may only be the need to replace the lower, worn out portion and the upper portion can be reused and does not need to be replaced, thereby considerably saving consumable costs. The liner plate includes a wear portion that is releasably secured thereon.

[0009] In general, the lower portion can be made of a material that is the same as or different than the material of the upper portion. The upper portion is preferably made of a manganese steel. The lower portion can be made of any suitable material, for example, rubber, manganese steel, hardened steel, white iron, or cemented carbide such as HX900.

[0010] According to a first aspect of the present invention, there is provided a liner plate for lining and protecting a rim of a chamber of a crusher, the liner plate having a front surface (also referred to as material-contact surface) configured to engage material to be processed and a back surface facing oppositely to the front surface, the liner plate comprising a first material on a first portion of the liner plate, and a second material on a second portion of the liner plate, the second material is the same as or different to the first material.

[0011] The rim of a chamber may be interpreted as or include a rim of a spider, where the chamber is covered on top by a spider (having an annular rim) which is supported by a crusher frame (or shell).

[0012] In one embodiment, the liner plate includes an attaching means on the back surface, e.g. brackets with holes, for attaching itself to a rim of a crusher chamber, for example, at least one lug and/or screw projecting backwards may be included for supporting and securing the liner plate onto the rim.

[0013] In one preferred embodiment, the liner plate comprising: a first portion that comprises a first material, and a second portion that comprises a second material, wherein the second material may be the same as or dif-

ferent than the first material. The first portion and the second portion are arranged or positioned in the same plane e.g. in the plane of the material-contact surface.

[0014] In one preferred embodiment, the second portion (also called lower portion) can be made of a material that has the same or lower wear resistance than the material of the first portion (also called upper portion), then there maybe the need to replace a worn-out lower portion more frequently and keep the upper portion for reuse, until the upper portion is worn-out.

[0015] In one preferred embodiment, the lower portion can be made of a material that is more wear resistant than the material of the upper portion, then the upper portion and lower portion may get worn-out simultaneously, and may need to be replaced at the same time; or the time required to replace a worn-out lower portion may be reduced before the upper portion is replaced by a new one.

[0016] The upper portion and lower portion may be separately mounted onto the rim; alternatively, the lower portion may include two layers - with upper layer being made of the second material, the bottom layer being made of the first material, and the bottom layer of the lower portion is formed as an integral part with the upper portion of the liner plate, in this case, the integral part (also referred to as base portion) is mounted onto the rim. Preferably, the liner plate is substantially planar or flat, or slightly concave towards the material-contact surface, for example, it is curvilinear in cross-section view; preferably, the liner plate is of rectangular form or tapered to the lower edge. The wear portion extends up to 150 mm, preferably 100 mm, or up to one-fourth of the height of the base portion measured from upper edge to lower edge.

[0017] The side edges of the liner plate are machined to present chamfers in order to cooperate with the adjacent liner plates, so that the liner plates cover the exposed outer peripheral annular rim, or a 360 degree arc of the outer peripheral annular rim except for the area covered by a spider arm.

[0018] Preferably, the liner plate has a first edge and a second edge at opposite ends, the second edge is at downstream of the material flow in relation to the first edge, the second portion is located at the second edge, or extends from the second edge towards the first edge.

[0019] Preferably, the second material is more wear resistant than the first material.

[0020] Preferably, the second portion comprises a wear portion that comprises the second material, the wear portion is configured to be releasably attached to and be removable from the first portion, for instance removable from a base portion that comprises the first material.

[0021] Preferably, the wear portion is situated on the material-contact surface, the wear portion is made of one or more pieces of wear plates, preferably each wear plate has a bolt on its back surface. Releasable bolting connection is advantageous in saving time against welding

the wear portion onto a base portion.

[0022] Optionally, the wear portion extends over the full width of the second edge of the base portion and configured to cover the entire second edge of the liner plate. A width is measured as a length of the second edge.

[0023] Optionally, the liner plate includes a groove at the second edge for accommodating the wear portion.

[0024] Optionally, the second portion is coplanar with the first portion, or protruding in height beyond the first portion. Preferably the wear portion has a thickness in the range of 16 to 25 mm, or has a thickness amounting to up to 50% of the thickness of the liner plate.

[0025] Optionally, the second material may be rubber, hardened steel, white iron, or cemented carbide such as HX900. Preferably the first material is manganese steel.

[0026] Optionally, the wear portion is welded to a base portion of the liner plate, or the wear portion includes at least one bolt on its back for cooperating respectively with at least one through hole of a base portion of the liner plate for fixing the wear portion onto the base portion.

[0027] According to a second aspect of the present invention, there is provided with a wear plate adapted to be attached onto a liner plate that is for lining and protecting a rim of a chamber of a crusher, the wear plate configured to be releasably attached onto the liner plate, preferably the wear plate comprising hardened steel, white iron, or cemented carbide such as HX900, preferably the wear plate has a bolt on its back surface such that the wear plate is adapted to be releasably attached onto the liner plate.

[0028] According to a third aspect of the present invention, there is provided with a crusher comprising a chamber where the material is crushed, the chamber has a rim where the material to be crushed enters the chamber, the crusher comprising at least one liner plate in accordance with any one of preceding embodiments, for lining and protecting the rim of the chamber of the crusher.

[0029] Preferably, the crusher comprising a spider situated on the top of the chamber, at least a portion of the rim adjacent an arm of the spider is covered by the at least one liner plate in accordance with any one of preceding embodiments. The rest portion of the rim that is located further from spider arms may be covered by other kind of liner plates.

Brief description of drawings

[0030] A specific implementation of the present invention will now be described, by way of example only, and with reference to the accompanying drawings in which:

Figure 1 is a front perspective view of a liner plate, according to a specific implementation of the present invention;

Figure 2 is a rear perspective view of the liner plate of figure 1;

Figure 3 is perspective view of a base portion of a liner plate of figure 1;

Figure 4 is a magnified perspective view of a wear plate;

Figure 5 is a side elevation view of a cone crusher in accordance with one embodiment of the present invention;

Figure 6 is a cross-section view of the cone crusher of figure 5 along cross-section G-G of figure 5;

Figure 7 is a top view of the cone crusher of figure 5.

Detailed description of preferred embodiment of the invention

[0031] Referring to figures 1 and 2, a liner plate 10 is shown in perspective view from the front and from the rear respectively. The liner plate is in substantially planar and rectangular form and slightly tapered toward the lower edge 12. The plate having a material-contact surface facing to the front (or called front surface) configured to engage material to be processed and a back surface facing oppositely to the material-contact surface. The plate having a first edge 11 (or upper edge) and a second edge 12 (or called lower edge) at opposite ends, the second edge 12 is at downstream of the material flow in relation to the first edge 11.

[0032] As shown in figures 1 and 3, the liner plate 10 includes a base portion 21 that is made of manganese steel, and a wear portion 31 that is releasably attached onto the top of the base portion 21 at the lower edge. The base portion 21 includes, on the second edge 12, a groove 22 for accommodating the wear portion 31. In this embodiment, wear portion 31 is shown to consist of 5 pieces of wear plate 40 arranged side by side in the groove 22. The liner plate extends about 500 mm high from upper edge 11 to lower edge 12, and 50 mm thick. Wear portion 31 is about 100 mm in height and in the range of 16 to 20 mm thick. The side edges of the liner plate are machined to present chamfers 24 in order to cooperate with the adjacent liner plates.

[0033] An individual wear plate 40 is illustrated in figure 4, it can be square or rectangular in form, with a thickness of 16 to 20 mm. For fixing the wear plate 40 onto the base portion 21, there is provided a through hole 23 on the base portion 21. Each wear plate 40 includes a bolt 41 on its back for passing through a through hole 23 of the base portion 21. A washer and nut 16 can be used to cooperate with a bolt 41 to fasten the wear plate 40 onto the base portion 21. The wear plate 40 can be made of rubber, hardened steel, white iron, or cemented carbide such as HX900.

[0034] Further, as shown in figure 2, at the first edge the liner plate provides two lugs 13 projecting backward for supporting the liner plate onto the rim 61 of crusher

chamber. In another embodiment, the lug may securely engage with corresponding slots formed in the rim 61, the lug and slot may have matching shapes to provide for a form-fit therebetween.

[0035] Each liner plate 10 is provided with noses 14 on both front surface and back surface, said noses 14 facilitate the removal of the liner plate 10 from the frame so that it can be exchanged for a new liner plate. The liner plate can e.g. be lifted by crane or by human via the noses 14. Further, the liner plate 10 may include two grub screws 15 between the upper edge and lower edge, for creating support and/or securing the liner plate 10 on the crusher. The screws 15 are adapted to be adjusted so that the nut 16 and bolt 41 are not in contact with the rim 61 and chamber frame.

[0036] Referring to figures 5, 6, and 7, a cone crusher 60 is schematically illustrated respectively in elevation view, cross-section view, and top view in accordance with one embodiment of the present invention, the crusher having liner plates 10 mounted in place. The purpose of this illustration is to explain the basic design principle of a cone or gyratory crusher. It is not to be understood to imply any limitation of the present invention.

[0037] Crusher 60 comprises a crusher frame or shell in which the various parts of the crusher are mounted. Crusher 60 comprises an upper frame portion 62 and a lower frame portion 63. The upper frame portion 62 has the shape of a bowl and is provided with a flange which rests on and is bolted to a flange 10 of the lower frame portion 63. The inside thereof includes a concave 64 which is a wear part and is typically formed from a manganese steel. Lower frame portion 63 supports an inner crushing shell arrangement represented generally by reference 65. Inner shell arrangement 65 comprises a crushing head 66, having a generally coned shape profile and supporting a mantle 67 that is similarly a wear part and typically formed from a manganese steel, the crushing head 66 is mounted on a crushing shaft 68. Shaft 68 and crushing head 66 are supported on oil cylindrical base 59 e.g. via a bearing, oil cylindrical base 59 is configured to allow the shaft 68 to perform an eccentric rotation. A spider 70 rides over the upper frame portion 62, and holds the head from the top, and is configured to allow the shaft to perform an eccentric rotation.

[0038] Shaft 68 is surrounded by an eccentric 69, such that, when driven by a power source (e.g. via pinion and countershaft assembly), the eccentric 69 imparts the gyrational eccentric motion to the crushing head for crushing rock.

[0039] The concave 64 and mantle 67 form between them a crushing chamber, to which material that is to be crushed is supplied. the material to be crushed enters the chamber from the rim 61 of the crushing chamber. Figure 7 shows a rim 61 being covered by liner plates 10.

[0040] Figure 7 provides a top view of the crusher, the spider 70 is comprised of spider arms 71 radially extending outward from the centre to spider rim 61. Crusher 60 comprises several liner plates 10 covering the exposed

outer peripheral annular rim 61, e.g. four pieces of liner plates are placed on either side of the spider arms. The liner plates close to the spider arm shall be covered by liner plates having stronger wear resistant wear portion 31, since these get more easily worn-out than those located further from spider arms.

Claims

1. A liner plate (10) for lining and protecting a rim (61) of a chamber of a crusher (60), the liner plate (10) having a front surface (17) configured to engage material to be processed and a back surface (18) facing oppositely to the front surface, the liner plate (10) comprising:

a first material on a first portion (20) of the liner plate (10);

a second material on a second portion (30) of the liner plate (10), the second material is the same as or different than the first material.

2. A liner plate (10) according to claim 1, wherein the liner plate (10) has a first edge (11) and a second edge (12) at opposite ends, the second edge (12) is at downstream of the material flow in relation to the first edge (11), the second portion (30) is located at the second edge (12) or extends from the second edge towards the first edge.

3. A liner plate (10) according to claim 1 or claim 2, wherein the second material is more wear resistant than the first material.

4. A liner plate (10) according to any one of the preceding claims, wherein the second portion (30) comprises a wear portion (31) that comprises the second material, the wear portion (31) is configured to be releasably attached to the first portion (20).

5. A liner plate (10) according to any one of the preceding claims, wherein the wear portion (31) is situated on the front surface (17), the wear portion (31) is made of one or more pieces of wear plates (40).

6. A liner plate (10) according to any one of the preceding claims, wherein the wear portion (31) extends over the full width of the second edge, and is configured to cover the entire second edge of the liner plate (10).

7. A liner plate (10) according to any one of the preceding claims, wherein the liner plate (10) includes a groove (22) at the second edge (12) for accommodating the wear portion (31).

8. A liner plate (10) according to any one of the preceding

ing claims, wherein the second portion (30) is coplanar with the first portion (20), or protruding in height beyond the first portion (20).

9. A liner plate (10) according to any one of the preceding claims, wherein the second material is hardened steel, white iron, or cemented carbide such as HX900.

10. A liner plate (10) according to any one of the preceding claims, wherein the wear portion (31) is welded to a base portion (21) of the liner plate (10), or the wear portion (31) includes at least one bolt (41) on its back for cooperating respectively with at least one through hole of a base portion (21) of the liner plate (10) for fixing the wear portion (31) onto the base portion (21).

11. A liner plate (10) according to any one of the preceding claims, the liner plate (10) being shaped generally planar or slightly concave towards the front surface (17).

12. A wear plate (40) adapted to be attached onto a liner plate (10) according to any of the preceding claims for lining and protecting a rim of a chamber of a crusher, the wear plate (40) is configured to be releasably attached onto the liner plate (10), the wear plate comprising hardened steel, white iron, or cemented carbide).

13. A crusher (60) comprising a chamber where the material is crushed, the chamber has a rim (61) where the material to be crushed enters the chamber, the crusher comprising
at least one liner plate in accordance with any one of claims 1 to 11 for lining and protecting the rim (61) of the chamber of the crusher.

14. A crusher (60) as claimed in claim 13, wherein the crusher (60) comprises a spider (62) situated on the top of the chamber, at least a portion of the rim (61) adjacent an arm of the spider (62) is covered by the at least one liner plate.

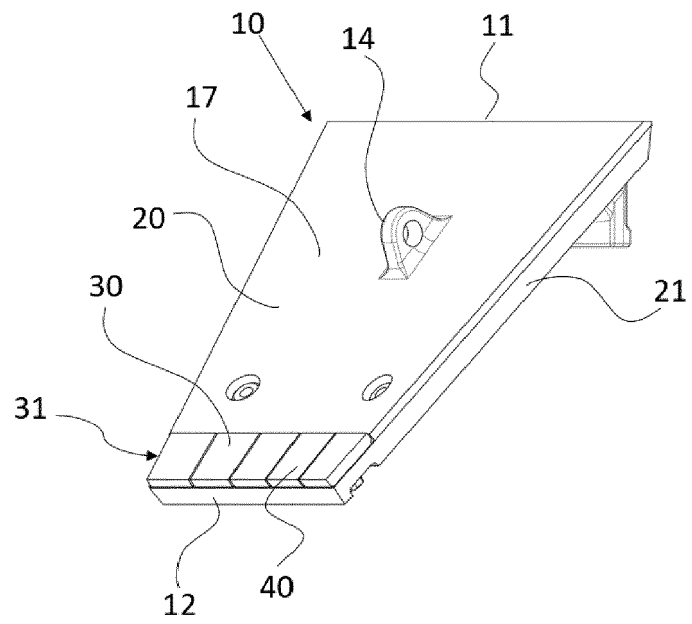


Fig. 1

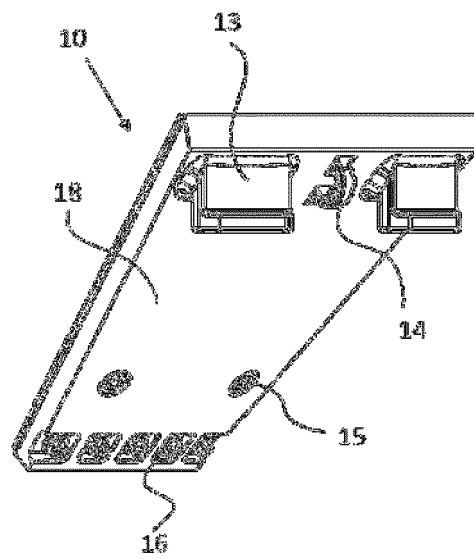


Fig. 2

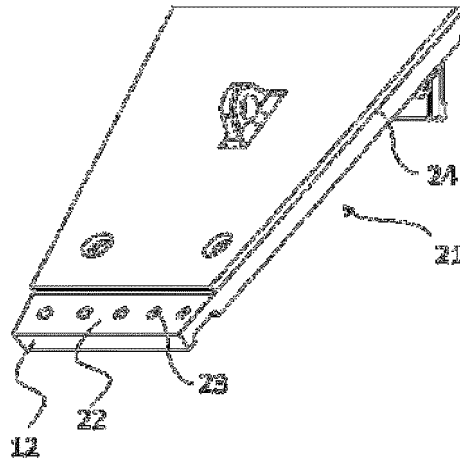


Fig. 3

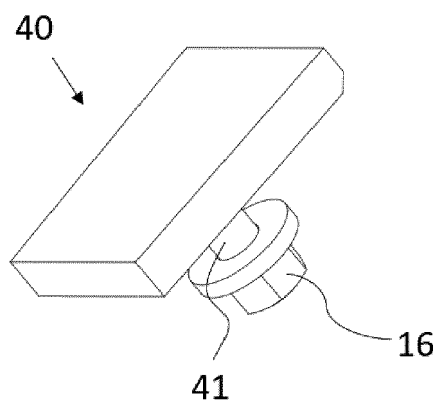


Fig. 4

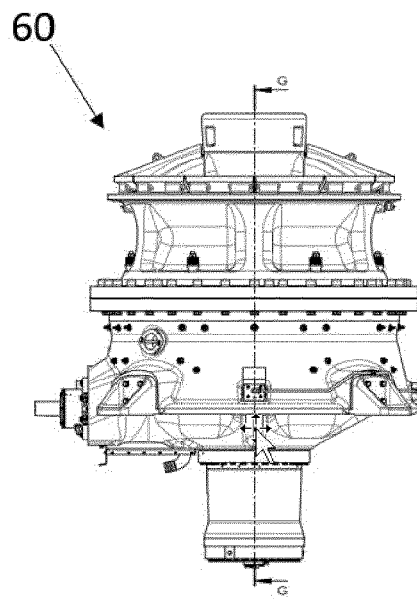


Fig. 5

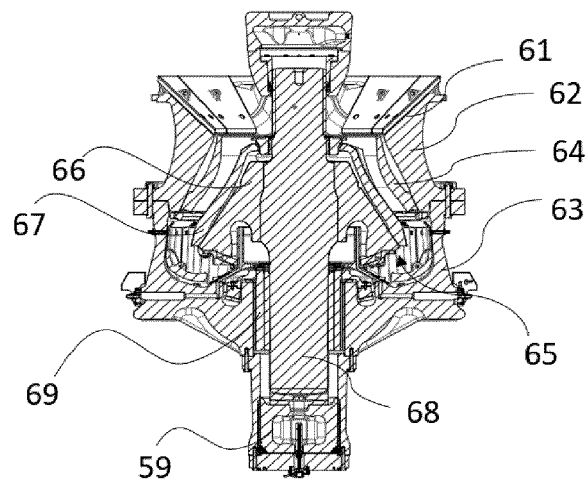


Fig. 6

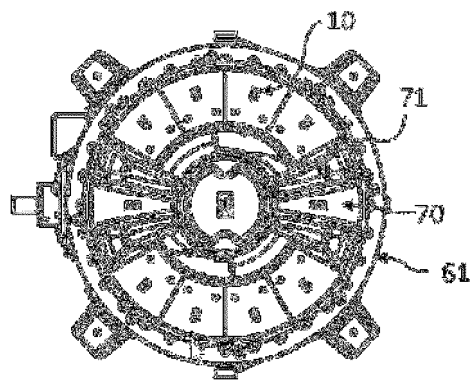


Fig. 7



EUROPEAN SEARCH REPORT

Application Number

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Y	* paragraphs [0008] - [0011], [0028] - [0031], [0033], [0036], [0038], [0042]; figures 1-15 *	10, 14	B02C2/02 B02C2/04
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A	EP 2 532 429 A1 (SANDVIK INTELLECTUAL PROPERTY [SE]) 12 December 2012 (2012-12-12) * paragraphs [0007] - [0021], [0025] - [0033]; figures 1-4 *	1-14	
			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 December 2021	Examiner Iuliano, Emanuela
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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