(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 178 999 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
14.06.2017 Bulletin 2017/24

(51) Int Cl.:
E02F 9/08 *(2006.01)*

(21) Application number: **16002502.9**

(22) Date of filing: **24.11.2016**

(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

(30) Priority: **08.12.2015 GB 201521570**

(71) Applicant: **Caterpillar Global Mining LLC**
South Milwaukee, Wisconsin 53172 (US)

(72) Inventor: **Capraro, Sebastian**
Peoria, Illinois 61629-9510 (US)

(74) Representative: **Kramer Barske Schmidtchen**
Patentanwälte PartG mbB
European Patent Attorneys
Landsberger Strasse 300
80687 München (DE)

(54) MOUNTING BLOCK FOR HYDRAULIC MINING SHOVEL

(57) A mounting block (114) for a hydraulic mining shovel (100) is disclosed. The mounting block (114) is provided to couple a module (110) to a superstructure (106) of the hydraulic mining shovel (100). The mounting block (114) includes a first surface (202) that engages with the module (110) and a second surface (204) that engages with the superstructure (106) via a weld (400). The mounting block (114) further includes a peripheral surface (206) extending between the first surface (202) and the second surface (204). The peripheral surface (206) includes a first portion (208) having a first tapering cross section (209). The first tapering cross section (209) tapers inwardly towards the first surface (202) in a first direction (210) defined from the second surface (204) to the first surface (202).

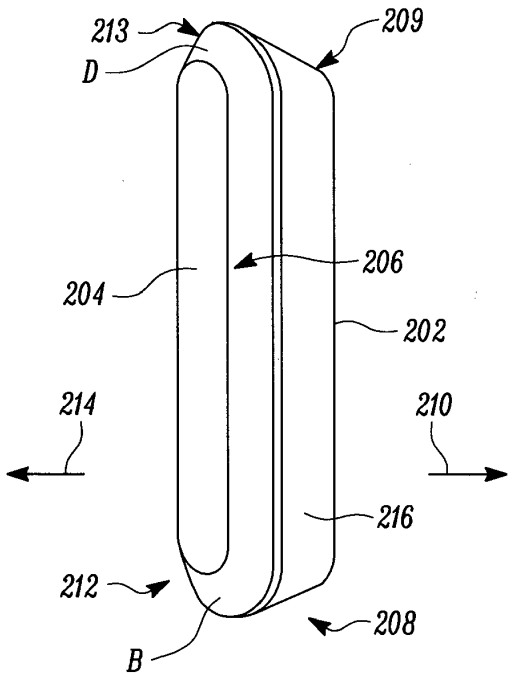

FIG. 2

EP 3 178 999 A1

Description

Technical Field

[0001] The present disclosure relates, generally, to a superstructure of a hydraulic mining shovel, and more particularly to a mounting block for the superstructure.

Background

[0002] Construction and earth working machines, such as excavators, cranes, and hydraulic mining shovels, employ a platform, commonly referred to as a superstructure, mounted on a mobile undercarriage. The superstructure normally supports booms, masts, and other suitable structures which normally support tools and implements for handling and manipulating construction materials and articles. For example, one or more arms are pivotally mounted on the superstructure. In addition, certain modules, such as an operator cabin and oil cooler system, of the earth working machines are coupled to the superstructure via multiple mounting blocks. Typically, current design of the mounting blocks fails to aid in providing durability of the mounting or coupling of the modules to the superstructure.

Summary of the Disclosure

[0003] According to an aspect of the present disclosure, a mounting block for a hydraulic mining shovel is provided. The mounting block is provided to couple a module to a superstructure of the hydraulic mining shovel. The mounting block includes a first surface that engages with the module and a second surface that engages with the superstructure via a weld. The mounting block further includes a peripheral surface extending between the first surface and the second surface. The peripheral surface includes a first portion having a first tapering cross section. The first tapering cross section tapers inwardly towards the first surface in a first direction defined from the second surface to the first surface.

[0004] In another aspect of the present disclosure, a method for engaging a mounting block with a superstructure of a hydraulic mining shovel is provided. The method includes coupling the mounting block with the superstructure via a weld. A first surface of the mounting block is engaged with a module and a second surface of the mounting block is engaged with the superstructure. The method further includes machining a surface of the weld to form a surface contour having a tapering cross section. The tapering cross section of the surface contour tapers outwardly in a direction towards the second surface.

[0005] Other features and aspects of this disclosure will be apparent from the following description and the accompanying drawings.

Brief Description of the Drawings

[0006]

FIG. 1 is a perspective view of a portion of a hydraulic mining shovel showing a superstructure, according to an embodiment of the present disclosure;

FIG. 2 is a perspective view of a mounting block of the superstructure, according to an embodiment of the present disclosure;

FIG. 3 is a front view of the mounting block, according to an embodiment of the present disclosure;

FIG. 4 is a side view of the mounting block, according to an embodiment of the present disclosure;

FIG. 5 is side views of the mounting block showing a welding process used to engage the mounting block with the superstructure, according to an embodiment of the present disclosure; and

FIG. 6 is a flowchart of a method for engaging the mounting block with the superstructure of the hydraulic mining shovel, according to an embodiment of the present disclosure.

Detailed Description

[0007] Reference will now be made in detail to specific embodiments or features, examples of which are illustrated in the accompanying drawings. Wherever possible, corresponding or similar reference numbers will be used throughout the drawings to refer to the same or corresponding parts. Moreover, references to various elements described herein, are made collectively or individually when there may be more than one element of the same type. However, such references are merely exemplary in nature. It may be noted that any reference to elements in the singular may also be construed to relate to the plural and vice-versa without limiting the scope of the disclosure to the exact number or type of such elements unless set forth explicitly in the appended claims.

[0008] FIG. 1 illustrates a perspective view of a portion of a hydraulic mining shovel 100. The hydraulic mining shovel 100 includes an arm assembly 102. The arm assembly 102 includes multiple linkages, such as an arm 104 and a work tool (not shown) attached to an end of the arm 104 for carrying work aggregate from a location at a worksite, or scooping the work aggregate from the worksite. The arm 104 may be pivotally connected to a superstructure 106 of the hydraulic mining shovel 100. One or more hydraulic cylinder actuators 116 may be coupled between the super structure 106 and the arm 104, to move the arm 104 relative to the superstructure 106, and accordingly operate a work tool. The hydraulic mining shovel 100 may also include a drive unit, such as tracks 108 for propelling the hydraulic mining shovel 100 and a module 110, such as an operator cabin 111 (shown in dotted line), for hosting user interface devices for controlling the arm 104 and the drive unit. The module 110 may be secured to, and constituting a part of, frame 112

of the hydraulic mining shovel 100. Joysticks or operating levers may be provided within the module 110 and may be adapted to control operation of the hydraulic cylinder actuators 116.

[0009] The frame 112 may be configured to support various components of the hydraulic mining shovel 100 including, but not limited to, an engine, a hydraulic system, and various other operating systems of the hydraulic mining shovel 100. The frame 112 may be supported by, and may be transportable on, the tracks 108. The superstructure 106 is attached to the frame 112 and protrudes in a direction away from the frame 112 to support the arm assembly 102. The superstructure 106 is also configured to couple various modules including, but not limited to, the operator cabin 111, and an oil cooler system of the hydraulic mining shovel 100. In one embodiment of the present disclosure, the module 110 is engaged with the superstructure 106 via multiple mounting blocks 114. In an installed condition of the module 110, the mounting blocks 114 lie between the superstructure 106 and the module 110. The structure of the mounting blocks 114 will be described in detail with reference to FIG. 2.

[0010] It will be appreciated by the person skilled in the art that the mounting blocks 114 may be employed in various machines including, but not limited to, an excavator, a material handler, a long reach excavator, a foundation drill, a rock drill, a piling machine, and a tunneling machine. The mounting block 114 may also be employed in machines that may be used in industrial applications including, but not limited to, mining, construction, farming, transportation, or any other industrial applications known in the art. Further, in various embodiments, the mounting block 114 may be employed for connecting a first component to a second component at a desired gap in various industrial applications known in the art.

[0011] FIG. 2 illustrates a perspective view of the mounting block 114, according to an embodiment of the present disclosure. The mounting block 114 includes a first surface 202 for engaging with the module 110, such as the operator cabin 111, and a second surface 204 for engaging with the superstructure 106. Specifically, according to an embodiment of the present disclosure, the second surface 204 is engaged with the superstructure 106 via a weld, which would be described later with reference to FIG. 4. The first surface 202 and the second surface 204 define a thickness 'X' of the mounting block 114 therebetween, as shown in FIG. 4. In other words, the first surface 202 is provided distant from the second surface 204, and accordingly the distance between the first surface 202 and the second surface 204 forms the thickness 'X' of the mounting block 114.

[0012] The mounting block 114 further includes a peripheral surface 206 extending between the first surface 202 and the second surface 204, as shown in FIG. 2. The peripheral surface 206 includes a first portion 208 having a first tapering cross section 209. The first portion 208 is so formed, such that the first tapering cross section 209 tapers inwardly towards the first surface 202 in a first direction 210. A direction defined from the second surface 204 to the first surface 202 is referred to as the first direction 210. Further, the peripheral surface 206 includes a second portion 212 having a second tapering cross section 213. The second portion 212 is so formed, such that the second tapering cross section 213 tapers inwardly towards the second surface 204 in a second direction 214. A direction defined from the first surface 202 to the second surface 204 is referred to as the second direction 214.

[0013] Furthermore, the peripheral surface 206 includes a third portion 216 that extends between the first portion 208 and the second portion 212 in a direction perpendicular to at least one of the first surface 202 and the second surface 204. In an example, the mounting block 114 may be a solid block made of hard material, such as a metal or an alloy, so that the mounting block 114 provides sufficient strength to hold the module 110 while engaging the module 110 with the superstructure 106. In one example, the material may be structural steel S355. Further, in another example, the mounting block 114 may be casted and machined thereafter to obtain the structure described hereinabove.

[0014] For instance, the mounting block 114 may be casted as a rectangular block. Width and position of the third portion 216 may be predetermined, and may be accordingly marked on the casted rectangular block. Subsequently, the rectangular block may be machined, by a surface grinding process, from either sides of the third portion 216 thus marked on the rectangular block, to obtain the first tapering cross section 209 and the second tapering cross section 213. In an example, the taper of the second tapering cross section 213 may extend from the third portion 216 till the second surface 204 along a periphery of the third portion 216. In such a case, a width 'W1' of the second surface 204, as shown in FIG. 3, would be lesser than a width 'W2' of the third portion 216 or the rectangular block. Alternatively, the rectangular block may be so machined, such that the taper of the second tapering cross section 213 is formed on a top portion 'D' and a bottom portion 'B' of the peripheral surface 206. In such a case, the width 'W1' of the second surface 204 remains substantially equal to the width 'W2' of the third portion 216 or the rectangular block. In an example, the width 'W1' of the second surface 204 may be in a range from 10mm to 50mm and the width 'W2' of the third portion 216 or the mounting block 114 may be in a range from 100mm to 400mm. It may also be understood that, depending on various applications, the mounting block 114 may be made in various cross sectional shape, such as a circle, square, elliptical, polygonal or any other shape known in the art.

[0015] Additionally, in such cases, the sides adjacent to the top portion 'D' and the bottom portion 'B' remain to be in plane with the third portion 216. It will be appreciated that similar structure and machining may be provided on another side of the third portion 216 to form the first tapering cross section 209. In addition, it will be ap-

preciated that such variation may be employed by the person skilled in the art with respect to a length of the second surface 204 and the third portion 216. In other words, a length 'L1' of the second surface 204 may be varied with respect to a length 'L2' of the third portion 216 or the rectangular block by machining.

[0016] FIG. 4 illustrates a side view of the mounting block 114, according to an embodiment of the present disclosure. As described earlier, the first surface 202 and the second surface 204 define the thickness 'X' of the mounting block 114. In an example, the thickness 'X' of the mounting block 114 may be in a range from 40 millimeters (mm) to 200mm. Further, as shown in FIG. 2, the third portion 216 defines a thickness 'T' between the first portion 208 and the second portion 212. In an example, the thickness 'T' of the third portion 216 may be in a range from 5mm to 30mm. Furthermore, a depth 'D1' of the first portion 208 with respect to the first surface 202 may be in a range from 40mm to 80mm and a depth 'D2' of the second portion 212 with respect to the second surface 204 may be in a range from 5mm to 30mm. The length 'L2' of the mounting block 114, defined by the third portion 216, may be in a range from 150mm to 400mm.

[0017] Further, the first tapering cross section 209 is inclined at a first angle of inclination 'α' with respect to a horizontal plane 300 and the second tapering cross section 213 is inclined at a second angle of inclination 'β' with respect to the horizontal plane 300. The horizontal plane 300 may be understood as a plane that is perpendicular to the module 110 and the superstructure 106. In an example, the first angle of inclination 'α' may be in a range from 20 degrees to 70 degrees and the second angle of inclination 'P' may be in a range from 30 degrees to 60 degrees.

[0018] The mounting block 114 further includes a plurality of holes 302 extending from the first surface 202 in the second direction 214. Each of the plurality of holes 302 is adapted to receive a fastening member (not shown) therein to couple the mounting block 114 with the module 110, or vice-versa. The holes 302 may be formed once the machining of the mounting block 114 is completed. In an example, threads may be provided in each of the holes 302 to accommodate the fastening member into the holes 302. The holes 302 may be formed in a manner, such that a depth 'D3' of the holes 302 is less than the thickness 'X' of the mounting block 114. In an example, two to seven holes may be formed in the mounting block 114.

[0019] FIG. 5 illustrates side views of the mounting block 114 showing a weld 400 used to engage the mounting block 114 with the superstructure 106, according to an embodiment of the present disclosure. In one embodiment, the mounting block 114 may be positioned at a desired location on the superstructure 106 with the second surface 204 of the mounting block 114 abutting the surface of the superstructure 106. Subsequently, the mounting block 114 may be welded to the superstructure 106. In another embodiment, the mounting block 114 may be welded to the superstructure 106 and the holes 302 may be formed in the mounting block 114 thereafter. The weld 400 may be provided on the second portion 212 along the periphery of the mounting block 114. For instance, initially a bevel weld layer 402 may be formed on the second portion 212 of the mounting block 114 followed by a fillet weld layer 404 thereon. The bevel weld layer 402 and the fillet weld layer 404 aids in coupling the mounting block 114 with the superstructure 106. During welding, the third portion 216 aids in providing a reference to an operator, so that the layers of the weld 400 are not deposited beyond the third portion 216.

[0020] Subsequently, the weld 400 may be machined to form a surface contour on the weld 400. In an example, the weld 400 may be grinded so that the surface contour of the weld 400 is provided with a tapering cross section 406. The tapering cross section 406 tapers outwardly with respect to the second surface 204 in the second direction 214. In an example, the machining of the weld 400 may be performed until the third portion 216 is merged with the tapering cross section 406, as shown in FIG. 4, such that the tapering cross section 406 of the weld 400 may align with the first tapering cross section 209 of the first portion 208. In another example, the tapering cross section 406 of the weld 400 may vary from the first tapering cross section 209 of the first portion 208.

[0021] Various embodiments disclosed herein are to be taken in the illustrative and explanatory sense, and should in no way be construed as limiting of the present disclosure.

Industrial Applicability

[0022] The present disclosure relates to the mounting block 114 of the superstructure 106 of the hydraulic mining shovel 100 and a method 600 for engaging the mounting block 114 with the superstructure 106 of the hydraulic mining shovel 100. FIG. 6 illustrates a flowchart of the method 600 for engaging the mounting block 114 with the superstructure 106 of the hydraulic mining shovel 100, according to an embodiment of the present disclosure. Steps in which the method 600 is described are not intended to be construed as a limitation, and any number of additional steps can be combined in any order to implement the method 600. Further, the method 600 may be implemented in any suitable hardware, such that the hardware employed can perform the steps of the method 600 readily and on a real-time basis.

[0023] For the purpose of illustration, various steps of the method 600 are described in conjunction with FIGS. 1 to 4 of the present disclosure. At step 602, the method 600 includes coupling the mounting block 114 with the superstructure 106 via the weld 400, such that the first surface 202 of the mounting block 114 is engaged with the module 110 and the second surface 204 is engaged with the superstructure 106. Further, at step 604, the method 600 includes machining the surface of the weld 400 to form the surface contour having the tapering cross

section 406. The tapering cross section 406 of the surface contour tapers outwardly in the second direction 214 towards the second surface 204.

[0024] It will be appreciated that the method 600 is not limited to the mounting block 114 described in FIGS. 1 to 5. Rather, it will be understood by a person skilled in the art that the method 600 may be suitably implemented, albeit with few variations to the mounting block 114 or the method 600 described herein. In one example, the method 600 may be implemented in a hardware module for performing the method 600. For instance, step 602 and step 604 of the method 600 can be performed by the hardware module.

[0025] The mounting block 114 of the present disclosure allows the module 110 to efficiently engage with the superstructure 106. For instance, the first tapering cross section 209 of the first portion 208 and the second tapering cross section 213 of the second portion 212 aids in distribution of stresses when the module 110 is engaged with the superstructure 106 via the mounting block 114. In addition, any stress developed in the mounting block 114 from welding the mounting block 114 and machining the weld 400, is distributed along the tapering surfaces of the first portion 208 and the second portion 212. Accordingly, the mounting block 114 can withstand high load, thereby minimizing possibility of development of cracks along the weld 400 and, therefore enhancing the life of the mounting block 114. In addition, the thickness 'T' of the third portion 216 restricts the weld 400, such as the bevel weld layer 402 and the fillet weld layer 404, within the second portion 212 and the third portion 216. In other words, the thickness 'T' of the third portion 216 indicates to an operator that the weld 400 should not be extended beyond the thickness 'T'.

[0026] While aspects of the present disclosure have been particularly shown and described with reference to the embodiments above, it will be understood by those skilled in the art that various additional embodiments may be contemplated by the modification of the disclosed machines, systems and methods without departing from the spirit and scope of what is disclosed. Such embodiments should be understood to fall within the scope of the present disclosure as determined based upon the claims and any equivalents thereof.

Claims

1. A mounting block (114) for a hydraulic mining shovel (100), the mounting block (114) configured to couple a module (110) to a superstructure (106) of the hydraulic mining shovel (100), the mounting block (114) comprising:

a first surface (202) configured to engage with the module (110);
a second surface (204) configured to engage with the superstructure (106) via a weld (400); and
a peripheral surface (206) extending between the first surface (202) and the second surface (204), the peripheral surface (206) includes a first portion (208) having a first tapering cross section (209), wherein the first tapering cross section (209) tapers inwardly towards the first surface (202) in a first direction (210) defined from the second surface (204) to the first surface (202).

2. The mounting block (114) of claim 1, wherein the peripheral surface (206) comprises a second portion (212) having a second tapering cross section (213), wherein the second tapering cross section (213) tapers inwardly towards the second surface (204) in a second direction (214) defined from the first surface (202) to the second surface (204).

3. The mounting block (114) of claim 1, wherein the peripheral surface (206) comprises a third portion (216) extending between the first portion (208) and the second portion (212) in a direction perpendicular to at least one the first surface (202) and the second surface (204).

4. The mounting block (114) of claim 3, wherein the third portion (216) of the peripheral surface (206) defines a thickness (T) between the first portion (208) and the second portion (212) of the peripheral surface (206), and wherein the thickness (T) is configured to restrict the weld (400) within the second portion (212) and the third portion (216) of the peripheral surface (206).

5. The mounting block (114) of claim 4, wherein the thickness (T) is in a range of 5 millimeters (mm) to 30 millimeters (mm).

6. The mounting block (114) of claim 1 comprises a plurality of holes (302) extending from the first surface (202) in the second direction (214), wherein each of the plurality of holes (302) are configured to receive a fastening member therein to couple the mounting block (114) with the module.

7. The mounting block (114) of claim 6, wherein the first surface (202) and the second surface (204) define a thickness (X) of the mounting block (114) therebetween, wherein depth (D3) of the one or more holes (302) is less than the thickness (X) of the mounting block (114).

8. The mounting block (114) of claim 7, wherein the thickness (X) is in a range of 40mm to 200mm.

9. The mounting block (114) of claim 1, wherein the weld (400) comprises a surface contour having a ta-

pering cross section (406), wherein the tapering cross section (406) of the surface contour tapers outwardly in the second direction (214) from the first surface (202) to the second surface (204).

10. The mounting block (114) of claim 1, wherein the weld (400) comprises a bevel weld layer (402) and a fillet weld layer (404) on the bevel weld layer (402), wherein the bevel weld layer (402) and the fillet weld layer (404) are together configured to couple the mounting block (114) with the superstructure (106).

11. The mounting block (114) of claim 1, wherein the first tapering cross section (209) has a first angle of inclination (α) with respect to the first surface (202), and wherein the first angle of inclination (α) is in a range of 20 degrees to 70 degrees.

12. The mounting block (114) of claim 1, wherein the second tapering cross section (213) has a second angle of inclination (β) with respect to the second surface (204), and wherein the second angle of inclination (β) is in a range of 30 degrees to 60 degrees.

13. The mounting block (114) of claim 1, wherein depth (D1) of the first portion (208) of the peripheral surface (206) with respect to the first surface (202) is in a range of 40mm to 80 mm.

14. The mounting block (114) of claim 1, wherein depth (D2) of the second portion (212) of the peripheral surface (206) with respect to the second surface (204) is in a range of 5mm to 30mm.

15. A method (600) for engaging a mounting block (114) with a superstructure (106) of a hydraulic mining shovel (100), the method (600) comprising:

coupling the mounting block (114) with the superstructure (106) via a weld (400), wherein a first surface (202) of the mounting block (114) is engaged with a module (110) and a second surface (204) of the mounting block (114) is engaged with the superstructure (106); and

machining a surface of the weld (400) to form a surface contour having a tapering cross section (406), wherein the tapering cross section (406) of the surface contour tapers outwardly in a direction towards the second surface (204).

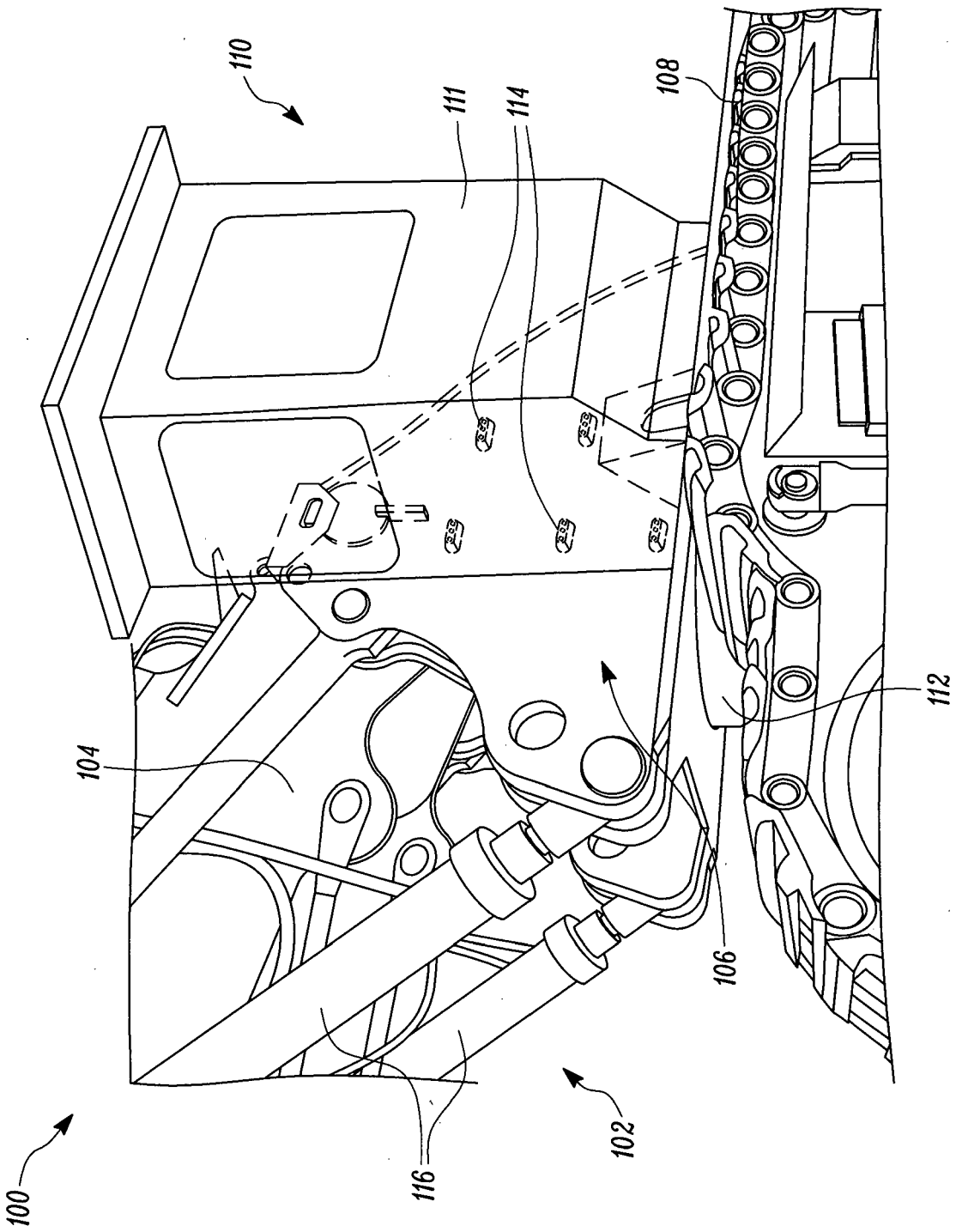

FIG. 1

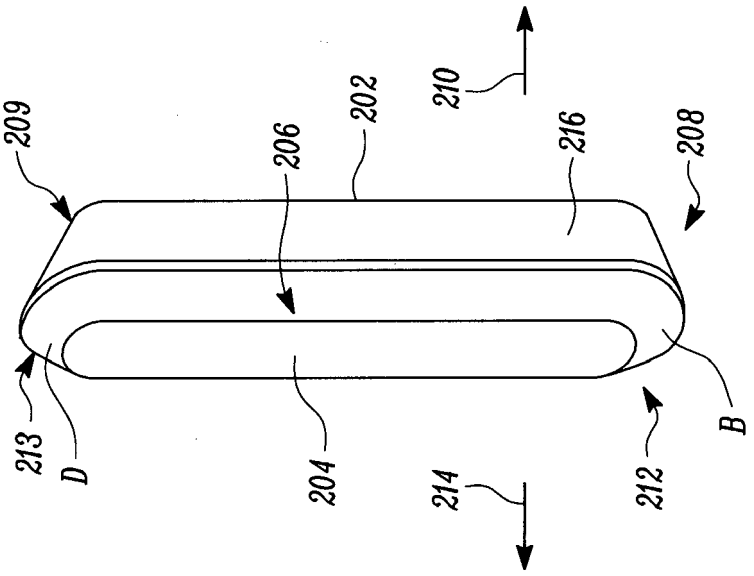

FIG. 2

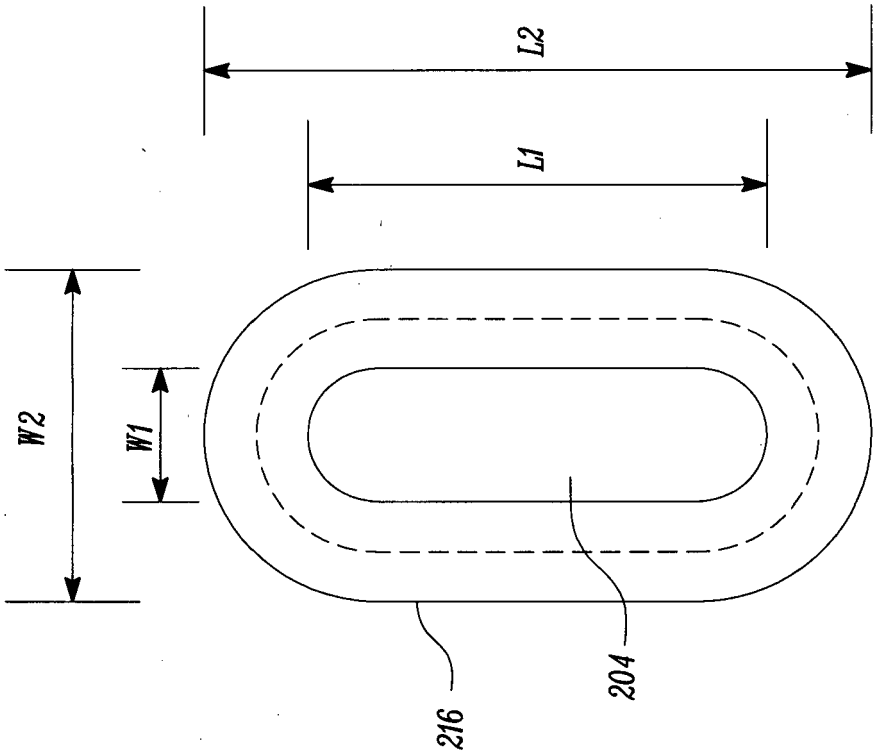

FIG. 3

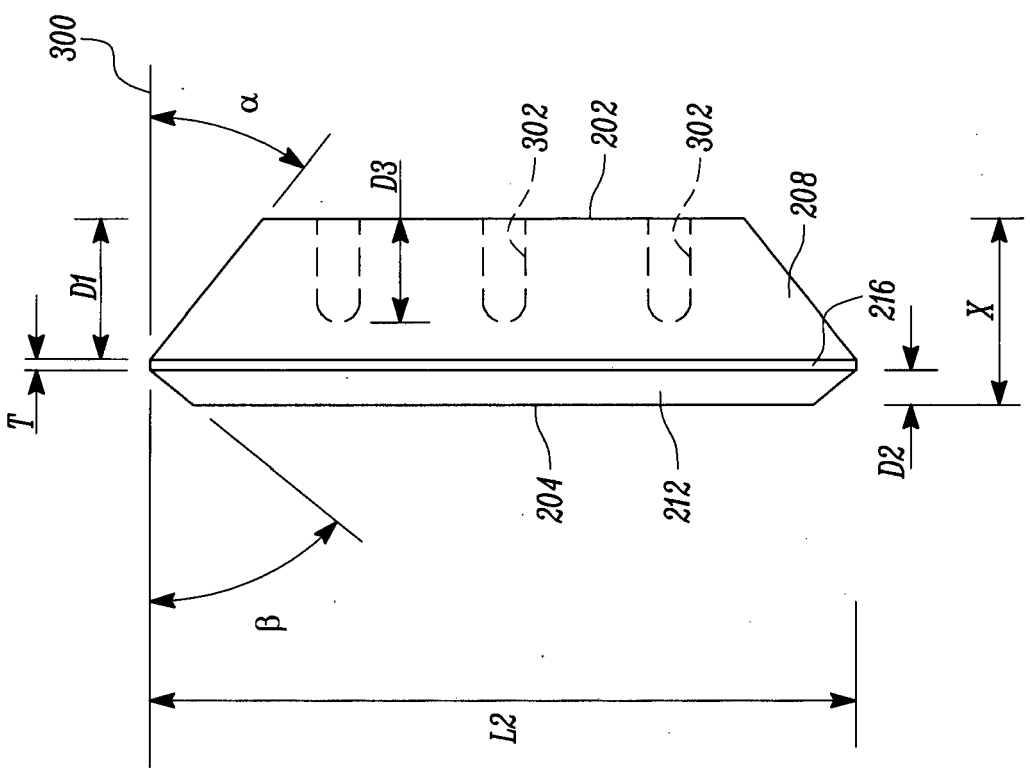

FIG. 4

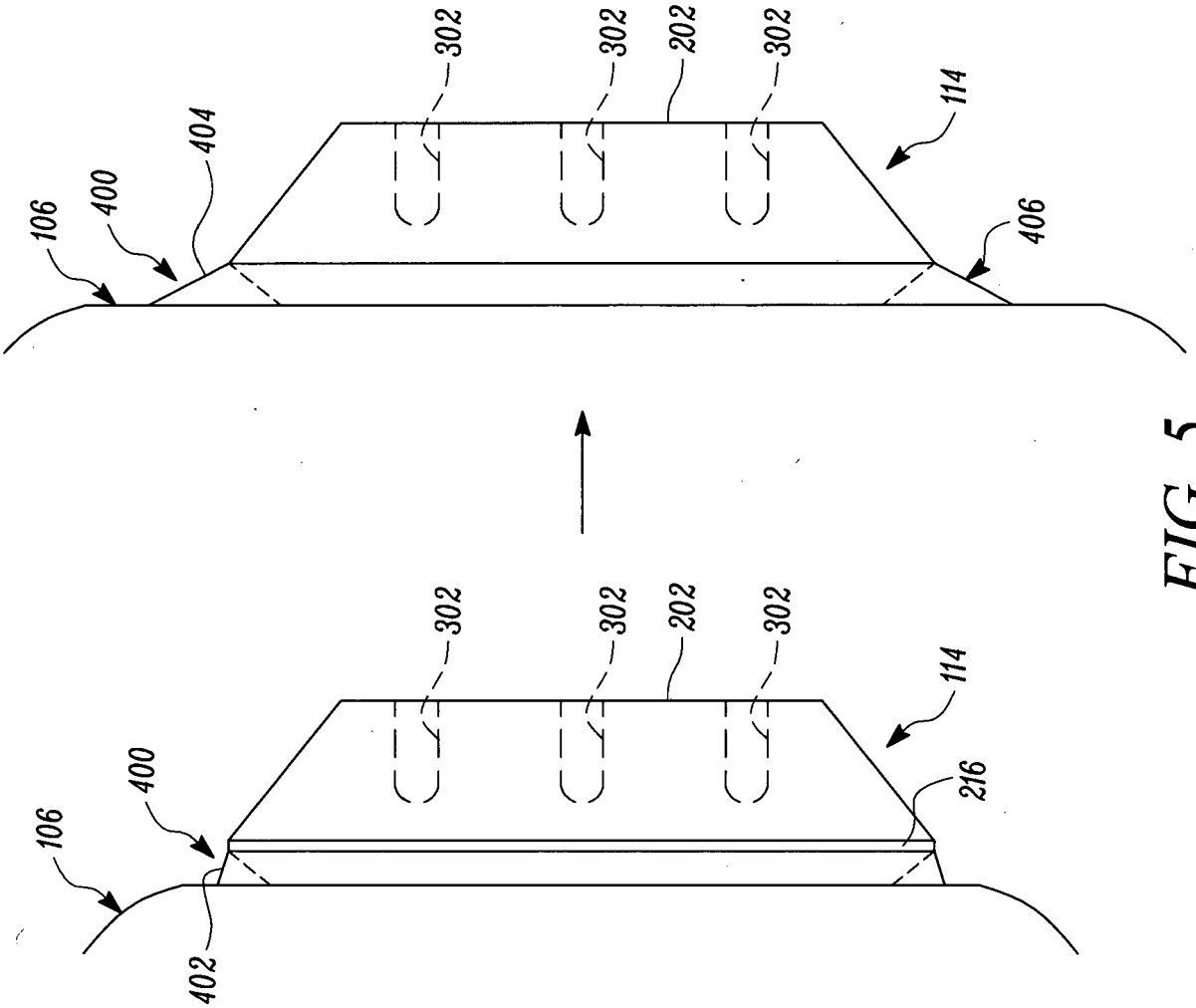
302
302
202
302
114
404
400
106
406
302
302
202
302
114
400
106
216
402

FIG. 5

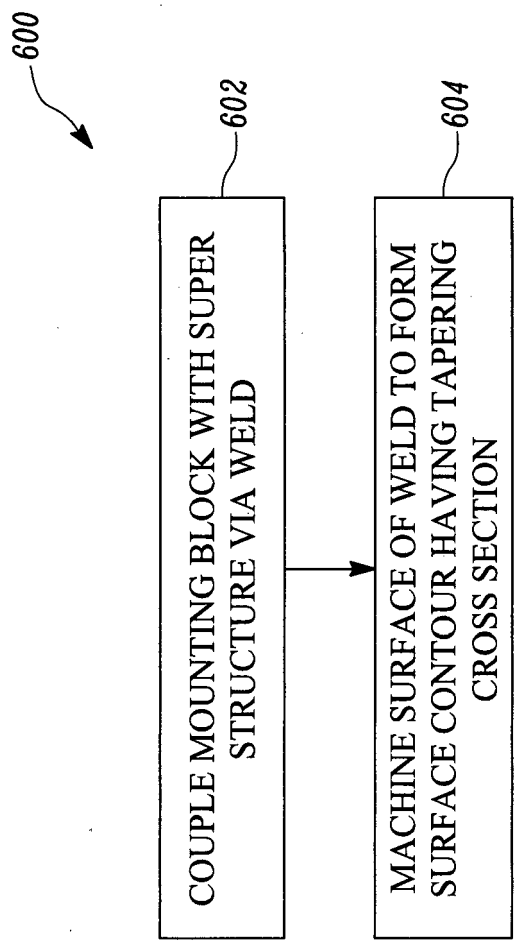
600
602
604
COUPLE MOUNTING BLOCK WITH SUPER STRUCTURE VIA WELD
MACHINE SURFACE OF WELD TO FORM SURFACE CONTOUR HAVING TAPERING CROSS SECTION

FIG. 6

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 16 00 2502

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 Y	US 3 785 696 A (MOORE J ET AL) 15 January 1974 (1974-01-15) * abstract; figures 1,5-6 *	1,11-14 2-5	INV. E02F9/08
X Y	JP H09 310375 A (KUBOTA KK) 2 December 1997 (1997-12-02) * paragraph [0038] - paragraph [0041]; figure 8 *	1-5 6,9-15	
Y	US 3 612 581 A (FRANKENBERG EDWARD V ET AL) 12 October 1971 (1971-10-12) * abstract; figures 1-4 *	2-5,9-15	
X	JP 2001 213589 A (HITACHI CONSTRUCTION MACHINERY) 7 August 2001 (2001-08-07) * abstract; figures 1-3 *	1,6-8	
Y	KR 2010 0020567 A (VOLVO CONSTR EQUIP HOLDING SE [SE]) 23 February 2010 (2010-02-23) * figures 2-4 *	6	
			TECHNICAL FIELDS SEARCHED (IPC) E02F B60R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 April 2017	Ferrien, Yann

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 16 00 2502

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.

11-04-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3785696 A	15-01-1974	AU 457949 B2	13-02-1975
		CA 984874 A	02-03-1976
		GB 1355896 A	05-06-1974
		JP S4863506 A	04-09-1973
		JP S5212481 B2	07-04-1977
		US 3785696 A	15-01-1974
		ZA 7207586 B	25-07-1973
JP H09310375 A	02-12-1997	JP 3148637 B2	19-03-2001
		JP H09310375 A	02-12-1997
US 3612581 A	12-10-1971	NONE	
JP 2001213589 A	07-08-2001	NONE	
KR 20100020567 A	23-02-2010	NONE	

EPO FORM P0459

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