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(54) A SPLITTING, A CUTTING OR A CUTTING-SPLITTING MACHINE WITH A SAFETY MECHANISM FOR RESTRAINING ACCESS TO SPLITTING MEANS

(57) The present invention belongs to the field of splitting and cutting-splitting machines, particularly to the field of safety devices for said machines, which prevent the user from accessing to parts, which split or cut wood. The invention relates to a splitting, a cutting or a cutting-splitting machine with a safety mechanism for restraining access to splitting means. The machine has a frame to which a movable and optionally left-right adjustable conveyor belt is mounted, said conveyor belt being rotatable around a fulcrum in the bottom part of the conveyor belt. On both sides of the conveyor belt, a movable protective plate is provided, so that the protective plate is arranged to cover at least part of the machine frame and part of the conveyor belt side. The protective plate is provided with at least one groove, cut-out, guide or a similar structure, along which a screw, or a similar element mounted on the side of the conveyor belt and/or on the machine frame is movable. The protective plate is through a connective lever or a handle connected to an axis of the protective plate, which is located in the bottom part of the conveyor belt frame, wherein the protective plate is mounted to the fulcrum of the conveyor belt, around which said conveyor belt is rotatable and thus enables installation of the conveyor belt in a transport position or in a working position at any angle relative to the ground.

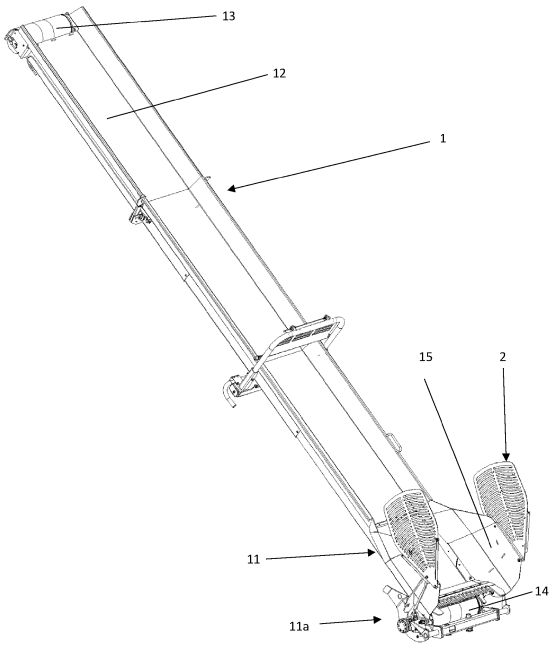

Figure 1

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Description

Field of the invention

[0001] The present invention belongs to the field of splitting and cutting-splitting machines, particularly to the field of safety devices for said machines, which prevent the user from accessing to parts, which split or cut wood. The invention relates to a splitting, a cutting, or a cutting-splitting machine with a safety mechanism for restraining access to splitting means.

Background of the invention and the technical problem

[0002] Wood is widely used for heating, but has to be suitably shaped and sized for use. During log processing wood trunks are cut into logs having a size and shape corresponding to fireplaces, furnaces, and stoves, so that no further cutting or splitting is necessary. Different wood processing devices are known, which cut and split trunks with minimal manual handling. Created logs are led with a conveyor belt to a trailer or any other suitable place for collection of logs. Said conveyor belt is usually movable and may be installed at different angles relative to the ground on which the machine stands. The transport position of the conveyor belt is approximately vertical, i.e., approximately perpendicular to the floor.

[0003] The splitting machine has a splitting knife arranged in the interior of the machine, which cannot be accessed by the user when the machine is in operation for protection. The cutting-splitting machine also has a similarly implemented protection. The problem occurs in machines provided with the conveyor belt as movement of the belt from the vertical transport position creates a space that allows the user access the splitting knife. Consequently, tampering with the machine can lead to injuries of the user. Such machines are described in patent applications EP1529611 and EP2839938.

[0004] According to currently valid laws and standards, such as DIN EN 609-1, the distance from the user to the splitting knife must be at least 85 cm, which is not achieved with machines with the movable conveyor belt.

[0005] Therefore, the technical problem, which is solved by the present invention, is design of a safety mechanism that will efficiently prevent interaction with the machine from the side of the transport belt regardless of its position. The solution has to be efficient, simple and reliable in any possible position of the transport belt.

Prior art

[0006] The technical problem is partly solved by the manufacturer of PALAX machines, wherein the cutting-splitting machine is provided with a movable and adjustable conveyor belt that is additionally provided with a flexible protective net, which works as swinging doors that prevent access to the splitting knife when the conveyor belt is not in the transport, i.e., vertical position. The doors are movable mounted in hinges on the frame of the machine and are connected to a sensor to a machine controller for controlling door status. In case the sensor senses the doors are shut, the machine can operate, while in case of sensed open doors, the machine cannot operate, as the drive is not turned on.

[0007] The company Posch solves this problem by moving the splitting knife further in the machine interior and the side plate of the machine housing is elongated to ensure the prescribed distance. However, these machines do not have an adjustable transport belt, therefore, side plates may be elongated. In case the transport belt wad adjustable, this solution would not be useful.

Description of the solution to the technical problem

[0008] The invention is designed based on a cutting, splitting or a cutting-splitting machine for preparation of wood logs, which is equipped with an adjustable conveyor belt that has a transport vertical position and several arbitrary positions at different angles relative to the machine frame or the ground, respectively. The technical problem of protecting the space created due to the movement of the conveyor belt from the transport position is solved as defined in the independent claim, whereas preferred embodiments of the invention are defined in dependent claims.

[0009] The cutting or the cutting-splitting machine with the safety mechanism for limiting access to the splitting means has a frame to which a movable and optionally left-right adjustable conveyor belt is mounted, said conveyor belt being rotatable around a fulcrum in the bottom part of the conveyor belt. At least on one side (where the user is usually standing), preferably on both sides of the conveyor belt, a movable protective plate is provided, so that the protective plate is arranged to cover at least part of the machine frame and part of the conveyor belt side. The protective plate is provided with at least one groove, cut-out, guide or a similar structure, along which a screw, a bolt, a welded or screwed plug (insert) optionally protected with a cotter-pin, a cylinder or a similar element mounted on the side of the conveyor belt and/or on the machine frame, so that this also prevents the protective plate from moving too far from the conveyor belt side. The protective plate is through a connective lever or a handle connected to an axis of the protective plate, which is located in the bottom part of the conveyor belt frame, wherein the protective plate is mounted to the fulcrum of the conveyor belt, around which said conveyor belt is rotatable and thus enables installation of the conveyor belt in a transport position or in a working position at any angle relative to the ground. The connective lever is on both ends provided with a suitable machine element that enables rotation in the mounting to the protective plate or on the holder or the axis of the protective plate, respectively. A suitable machine element is for example a screw with a nut, optionally provided with washers, or a pivot joint, a bolt or a similar element. The connective

lever may be uniformly designed or it may have several pieces, wherein in the latter case transmission of movement is ensured with suitable connections, mountings, movable joints or similar elements.

[0010] The axis of the protective plate is mounted in any suitable manner that enables movement of the protective plate via the connective lever together with movement of the conveyor belt. Preferably, the connective lever is installed on a holder, in which the axle of the protective plate is mounted. The holder is located in the bottom part of the frame of the conveyor belt or on the machine frame, namely, between the axle for rotation of the conveyor belt and the machine frame. The position of the holder may be adapted relative to the size of the machine, protective plate, and conveyor belt, which is obvious to the skilled person. The position is selected so that in all positions the protective plate optimally covers the space created by movement of the conveyor belt into the working position. The holder is not an essential element, as suitable mountings allow installation on the bottom part of the conveyor belt frame. During movement of the conveyor belt the position of the protective plate is changed due to movement of the connective lever and rotation in mountings to the protective plate and its axis, wherein from approximately horizontal position in the transport position the lever is moved into an approximately vertical position in the extreme working position. The position of the screw or any other suitable element in the transport position is on the side of the cut-out, groove, or guide near the machine frame, while in the working position the screw is moved towards the other end of the cut-out, groove or guide.

[0011] Additionally or alternatively, the protective plate may be connected to the frame of the machine, namely in the same manner with a screw, a bolt, a plug, a cylinder or any other element arranged to move along the groove, the cut-out, the guide or any other structure on the protective plate. The screw or any other element is mounted on a suitable space on the machine frame, which enables movement and an optimal position relative to the open space between the machine and the conveyor belt. This position may be adjusted with regards to the machine size, conveyor belt dimensions, as well as size and shape of the protective plate, which is obvious to the person skilled in the art.

[0012] Inactive or transport position of the conveyor belt is approximately vertical, wherein the conveyor belt is installed at the machine frame and the access to the splitting means in the interior of the machine is prevented. During movement of the conveyor belt from the vertical transport position into a working position at any angle, optimally at 45°, relative to the machine frame or the ground where the machine is installed, the protective plate automatically moves due to movement of the connective lever and the screw along the groove of the protective plate.

[0013] The protective plate may be shaped in any suitable manner. Preferably, the protective plate on both sides of the conveyor belt has the same shape, however, the shapes may also differ if the frame is asymmetric or if any part of the machine has to be avoided. The optimal shape of the protective plate is approximately triangular or hand fan shaped, wherein it is beneficial if the corners are cut to prevent collision with machine frame. The plate may be a one-piece plate or a multiple-piece plate arranged to open and close as a handheld fan, wherein individual parts are suitably interconnected. The groove, cut-out, guide or the similar structure along which the screw, the bolt, the plug, the cylinder or any other element mounted on the conveyor belt or its side, respectively, is preferably provided along the middle of the plate from one side to the opposite side of the plate. The protective plate itself may have a full surface, a net-like surface, or any other surface with an arbitrary number of arbitrary shaped cut-outs. The material for the plate is any suitable, preferably the protective plate is made from sheet metal.

[0014] Function of the invention is reliable and thus does not require sensors or similar components, thus meaning that the solution is simpler and more cost efficient than the known solution with doors and sensors.

[0015] The cutting, the splitting, or the cutting-splitting machine with the safety mechanism for limiting access to the splitting knife according to the invention will be further described based on exemplary embodiments and figures, which show:

Figure 1 The transport belt with the protective plate

Figure 2 Elevation view of the conveyor belt in one of possible working positions from two sides (a, b) and a detail of the mounting of the protective plate (c)

Figure 3 Elevation view of the cutting-splitting machine with the conveyor belt in the transport position from two sides

Figure 4 Elevation view of the cutting-splitting machine with the conveyor belt in one of the possible working positions from two sides

[0016] Figure 1 shows the conveyor belt 1, which is installed on the splitting or cutting-splitting machine, wherein the conveyor belt 1 is equipped with a protective plate 2. The conveyor belt 1 comprises a belt frame 11, on which a belt 12 is installed, said belt 12 being movable by a motor and wherein the belt 12 is at its top provided with rollers 13, which enable transport of wood logs form the belt to a suitable container, trailer or similar. The bottom part 11a of the belt frame 11 is provided with a fulcrum 14 around which the conveyor belt can rotate from the transport position to the working position and vice versa. The conveyor belt 1 has on each side a lateral side 15, to which the protective plate 2 is connected with a screw or a similar element 16.

[0017] On the both sides of the transport belt 1 is provided with a movable protective plate 2, which is provided with at least one cut-out 21, along which the screw 16 mounted on the side 15 of the conveyor belt 1 can move.

Thus, the protective plate 2 is prevented from excessive movement from the side of the conveyor belt. The protective plate 2 is through the connective lever 22 connected to the axle 23 of the protective plate 2, which is installed on the bottom part 11a of the frame 11 of the conveyor belt 1, where the axle 14 of the belt is also installed, said axle 14 enabling rotation of the conveyor belt form the transport position to the working position at an arbitrary angle relative to the ground or vice versa. The connective lever 22 is on both ends provided with a suitable element arranged to enable rotation in the mounting 22a on the protective plate 2 or the holder 24 or the axle 23 of the protective plate, respectively, wherein in a preferred embodiment this is a screw with a nut, optionally provided with washers.

[0018] The axle 23 of the protective plate is mounted in any suitable manner that allows movement of the protective plate together with movement of the conveyor belt due to the connective lever. The connective lever 22 is mounted on the holder 24, in which said axle 23 of the protective plate is mounted. The holder 24 is located in the bottom part 11a of the frame 11 of the conveyor belt 1, namely, between the fulcrum 14 of the conveyor belt and the frame 3a of the machine 3.

[0019] An elevation view of the transport belt in one of the possible working positions from both sides is shown in figures 2a and 2b, while a detail of the mounting of the protective plate is shown in figure 2c. The protective plate 2 has an approximately triangular shape with cut-off corners, which forms sides 2a, wherein in the bottom part 2b the connective lever 22 is movably or rotatably mounted with a screw, said connective lever 22 is via an intermediate accessory 22a rotatably connected to the axle 23 in the holder 24. The position and the distance of the connective layer 22 ensures optimal movement of the protective plate 2 relative to the movement of the conveyor belt 1. The cut-out for the screw is in the bottom part of the plate and runs from one to the opposite side, so that movement is not hampered and all intermediate working positions are possible.

[0020] Figures 3 and 4 show an elevation view of the cutting-splitting machine 3 with the transport belt 1 in the transport and in working position, wherein the circle depicted in figures 4a and 4b indicates a space that is opened by movement of the transport belt 1 into the working position. This space, as evident from the said figures, is efficiently covered by the protective plate 2, which means that the user cannot reach into the interior of the machine, as the required length to the cutting means of the machine of at least 85 cm is ensured. Consequently, safety of the machine according to the invention is significantly improved.

Claims

1. A splitting, a cutting or a cutting-splitting machine with a safety mechanism for limiting access to a splitting knife, wherein the machine has a frame, to which a movable and optionally left-right adjustable conveyor belt is mounted, said conveyor belt being rotatable around a fulcrum in a bottom part of the conveyor belt and has an approximately vertical transport position and a working position at an angle relative to the ground where the machine is located, **characterized in that** the machine has:

- a movable protective plate provided at least on one side of the conveyor belt, the protective plate arranged to cover at least part of the machine frame and part of the conveyor belt side, wherein the protective plate is provided with at least one groove, cut-out, guide or a similar structure, along which a screw, a bolt, a welded or screwed plug with a cotter-pin, a cylinder or a similar element mounted on the side of the conveyor belt and/or on the machine frame,
- a connective lever or a handle connected to the protective plate and an axle of the protective plate, which is located in the bottom part of the conveyor belt frame, where said fulcrum is located, wherein the connective lever is on both ends provided with a suitable element arranged to enable rotation in the mounting on the protective plate or a holder or an axle of the protective plate,
- the axle of the protective plate mounted in a manner that enables movement of the protective plate together with movement of the conveyor belt due to the connective lever, wherein the connective lever is arranged to move preferably from an approximately horizontal position in a transport position to an approximately vertical position in a working position, wherein the screw, nut, plug or a similar element is arranged to move along the cut-out, groove, guide or any other suitable structure on the protective plate from one extreme position near the machine frame towards the second extreme position at the opposite end of the cut-out, groove, guide or any other structure.

2. The splitting, the cutting, or the cutting-splitting machine with the safety mechanism for limiting access to a splitting knife according to claim 1, wherein the protective plate is installed on both sides of the transport belt.

3. The splitting, the cutting, or the cutting-splitting machine with the safety mechanism for limiting access to a splitting knife according to claim 1 or claim 2, wherein the suitable machine element for the connective lever is a screw with a nut, optionally provided with washers, or a pivot joint, a bolt or similar element.

4. The splitting, the cutting, or the cutting-splitting machine with the safety mechanism for limiting access to a splitting knife according to any of the preceding claims, wherein the connective lever is mounted on a holder, in which said axis of the protective plate is mounted, wherein the holder is located in the bottom part of the frame of the conveyor belt or on the frame of the machine, namely between the rotation axis for rotation of the conveyor belt and the machine frame.

5. The splitting, the cutting, or the cutting-splitting machine with the safety mechanism for limiting access to a splitting knife according to any of the preceding claims, wherein the connective lever is a one-piece or a multiple-piece lever, wherein for the latter transmission of movement is ensured with suitable connections, mountings, movable joints and similar machine elements.

6. The splitting, the cutting, or the cutting-splitting machine with the safety mechanism for limiting access to a splitting knife according to any of the preceding claims, wherein the protective plate is connected to the machine frame, namely in the same manner with a screw, a bolt, an insert, a cylinder or any other element arranged to move along the groove, cut-out or guide on the protective plate.

7. The splitting, the cutting, or the cutting-splitting machine with the safety mechanism for limiting access to a splitting knife according to any of the preceding claims, wherein the protective plate has any suitable shape, preferably a triangular shape or a hand fan-like shape.

8. The splitting, the cutting, or the cutting-splitting machine with the safety mechanism for limiting access to a splitting knife according to any of the preceding claims, wherein the protective plate is uniformly designed or has several pieces arranged to open and close as a handheld fan, wherein pieces of the protective plate are suitably interconnected.

9. The splitting, the cutting, or the cutting-splitting machine with the safety mechanism for limiting access to a splitting knife according to any of the preceding claims, wherein the groove, cut-out, guide or a similar structure along which the screw, bolt, insert, cylinder or any other suitable element moves mounted on the conveyor belt or its side, respectively, is provided along the middle of the plate from one side to the opposite side of the plate.

10. The splitting, the cutting, or the cutting-splitting machine with the safety mechanism for limiting access to a splitting knife according to any of the preceding claims, wherein the protective plate has a full surface, a net-like surface or any other surface with an arbitrary number of arbitrary shaped cut-outs.

11. The splitting, the cutting, or the cutting-splitting machine with the safety mechanism for limiting access to a splitting knife according to any of the preceding claims, wherein the protective plate is made from any suitable material, preferably from sheet metal.

12. The splitting, the cutting, or the cutting-splitting machine with the safety mechanism for limiting access to a splitting knife according to any of the preceding claims, wherein the connecting lever is uniformly designed or is made from several interconnected parts.

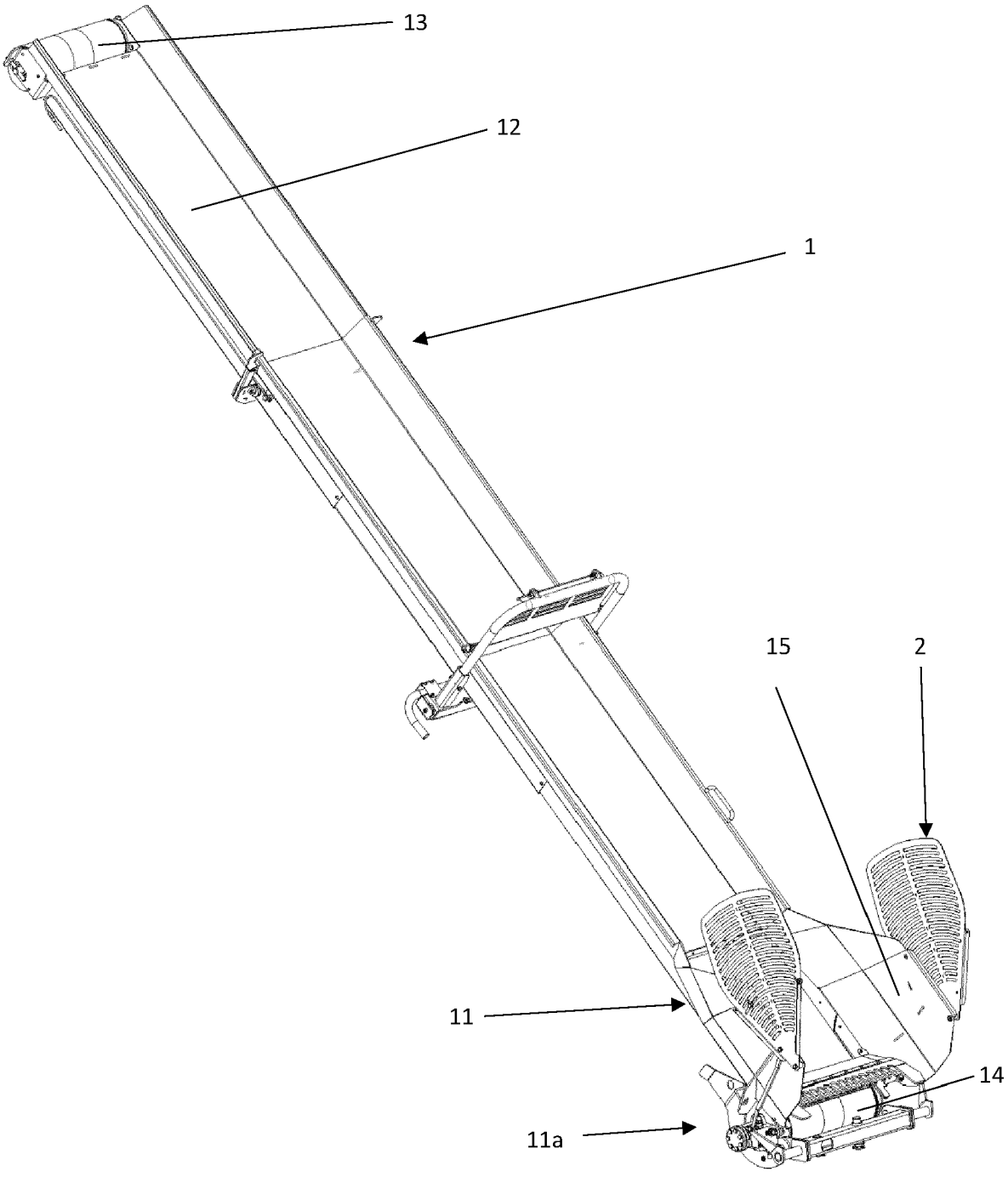

Figure 1

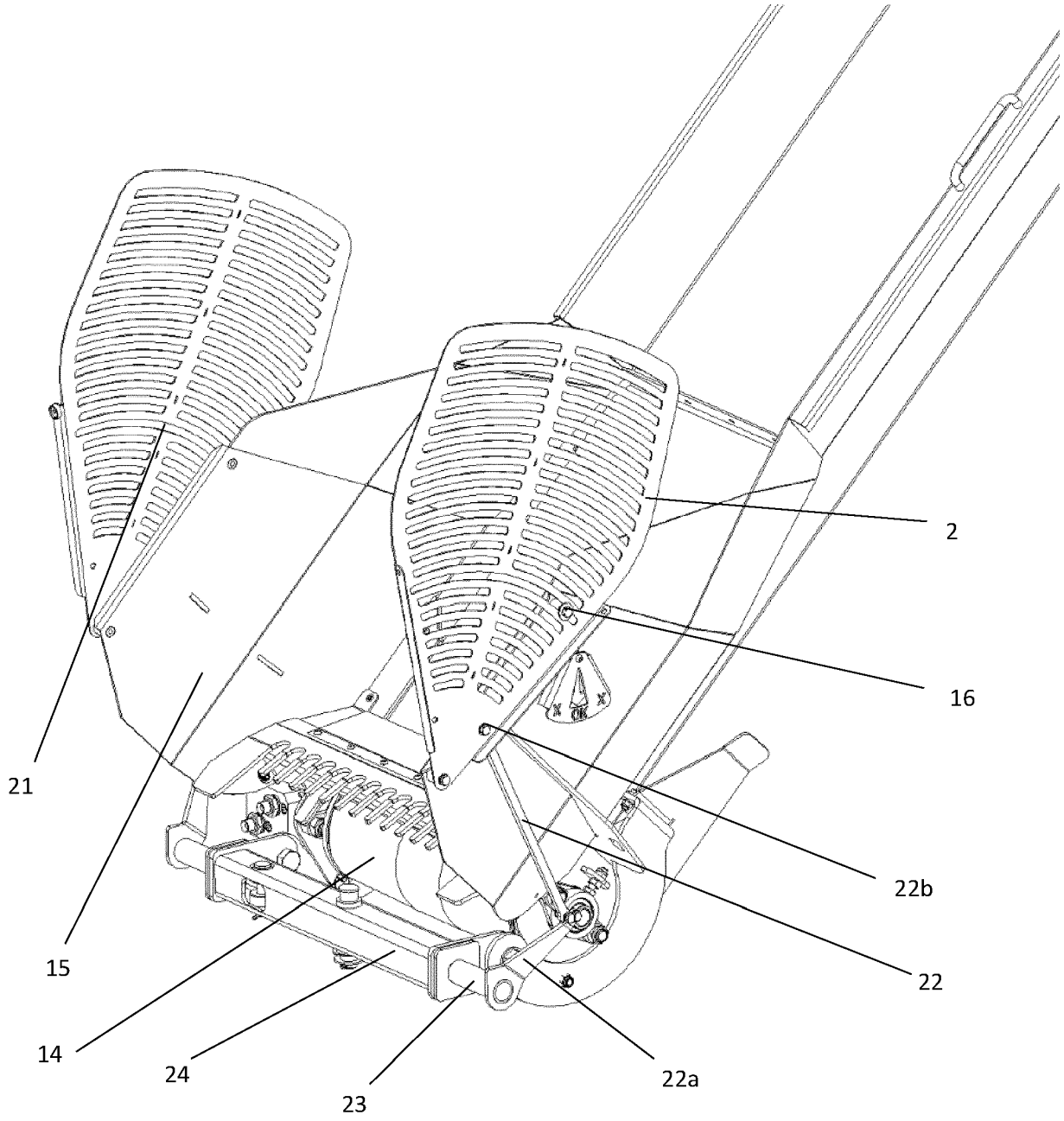

Figure 2a

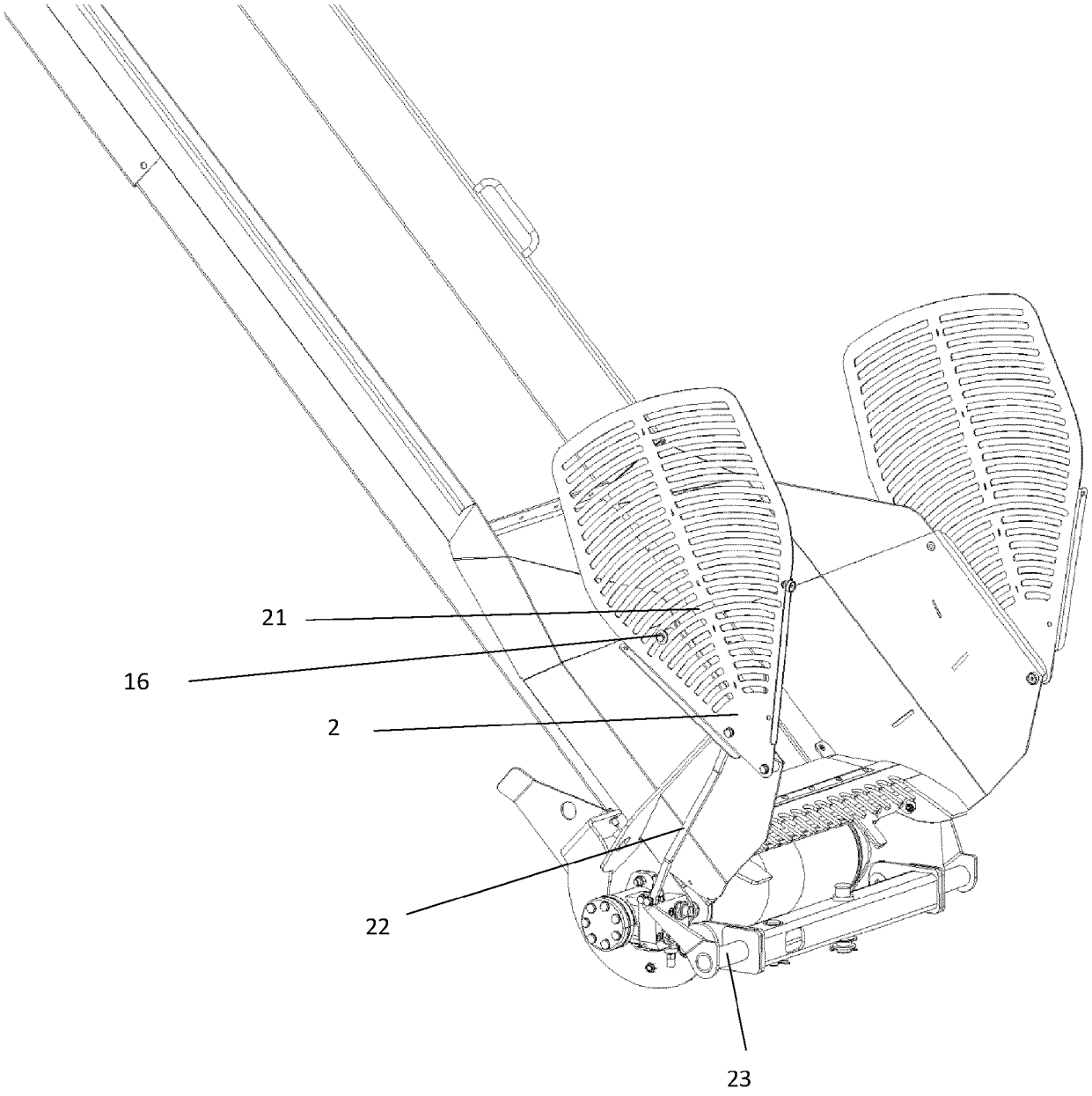

Figure 2b

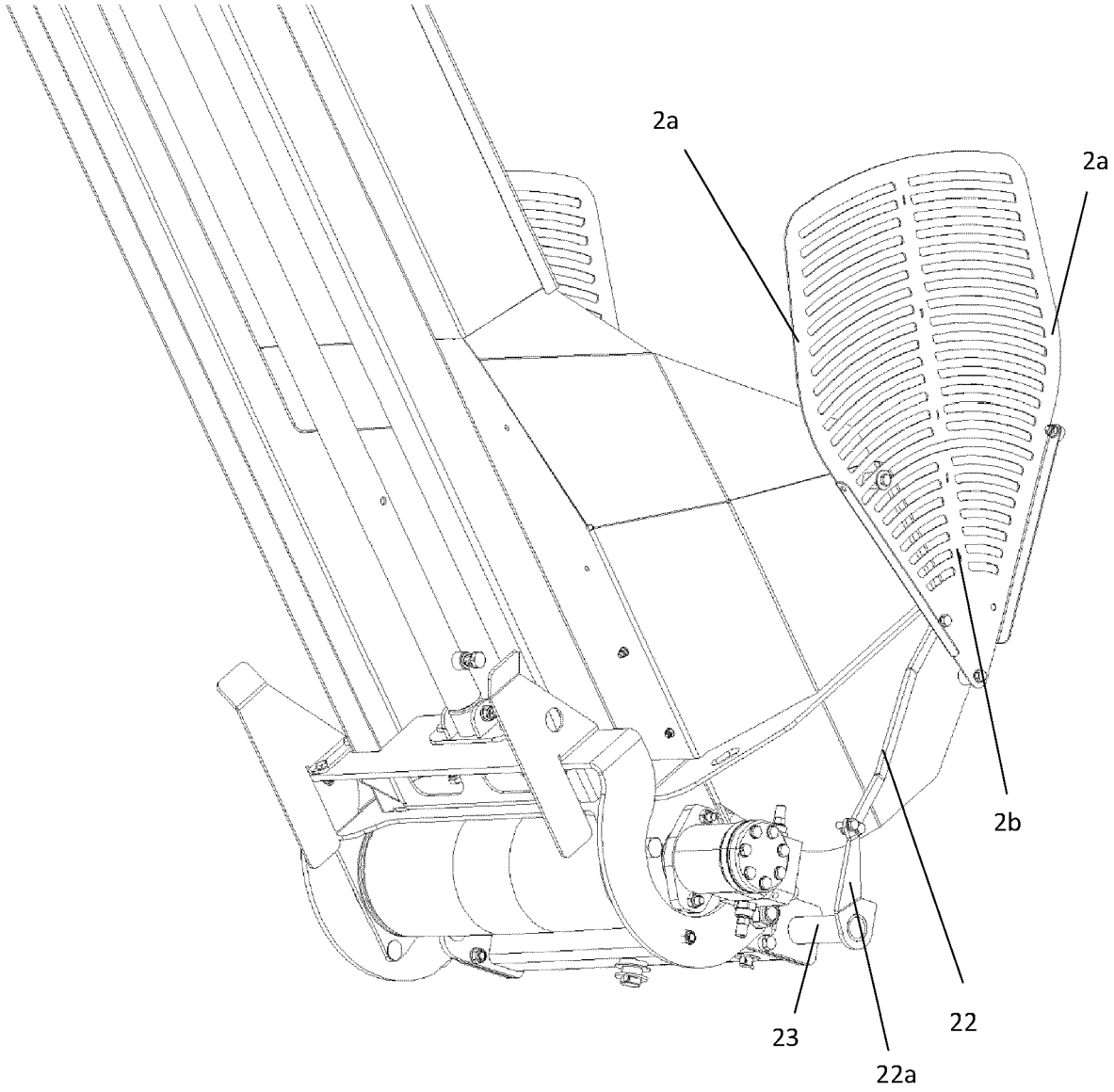

Figure 2c

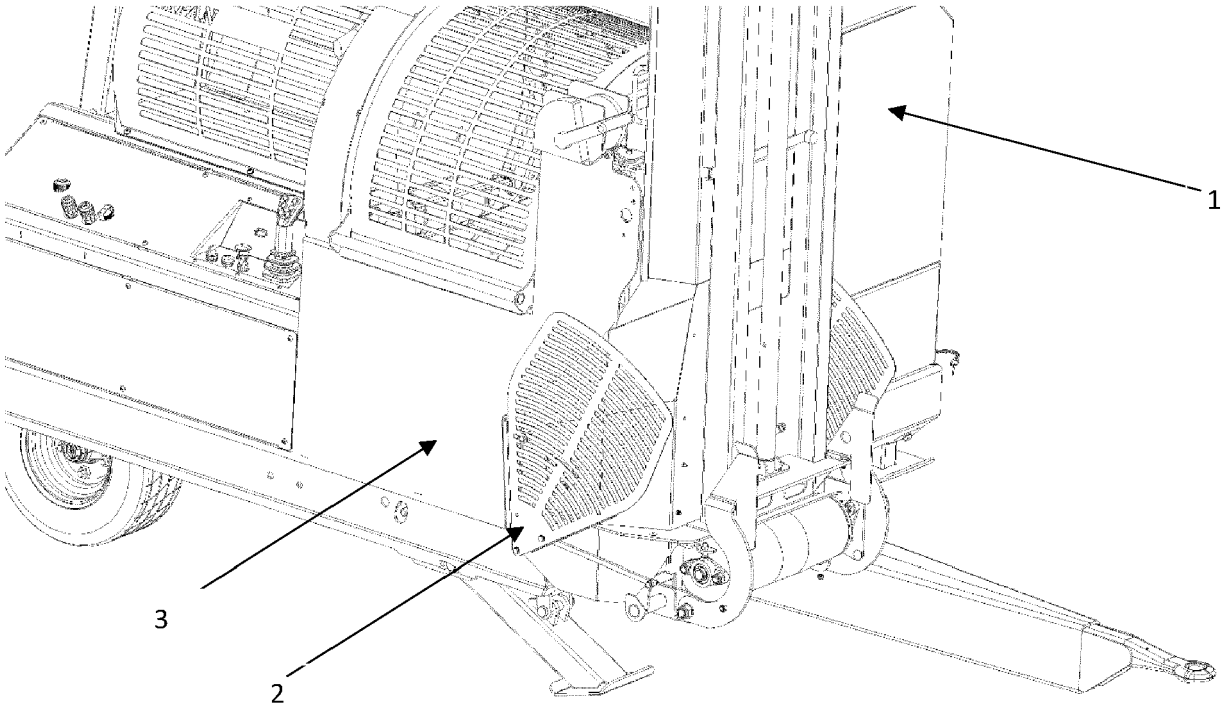

Figure 3a

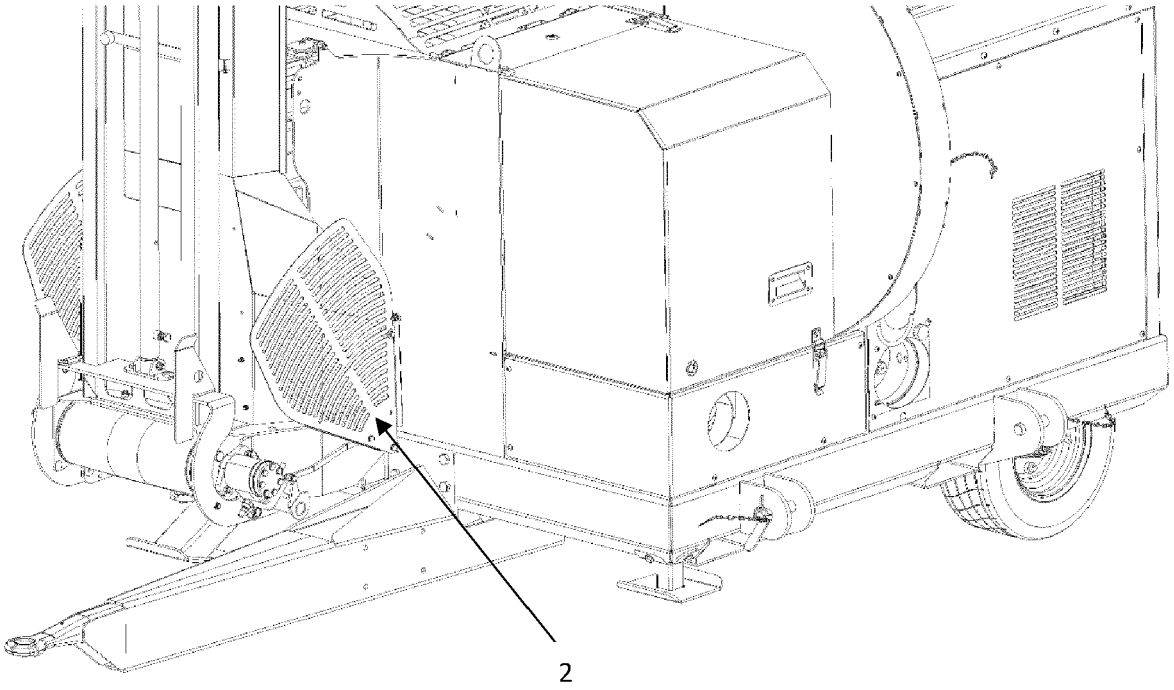

Figure 3b

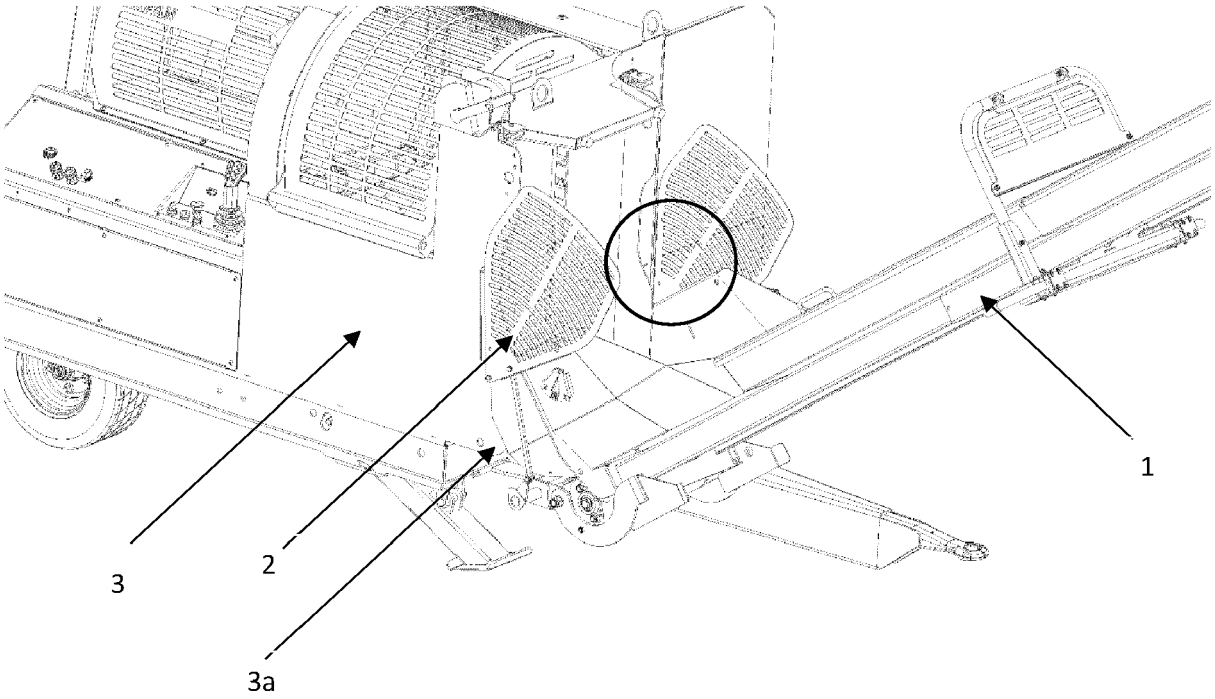

Figure 4a

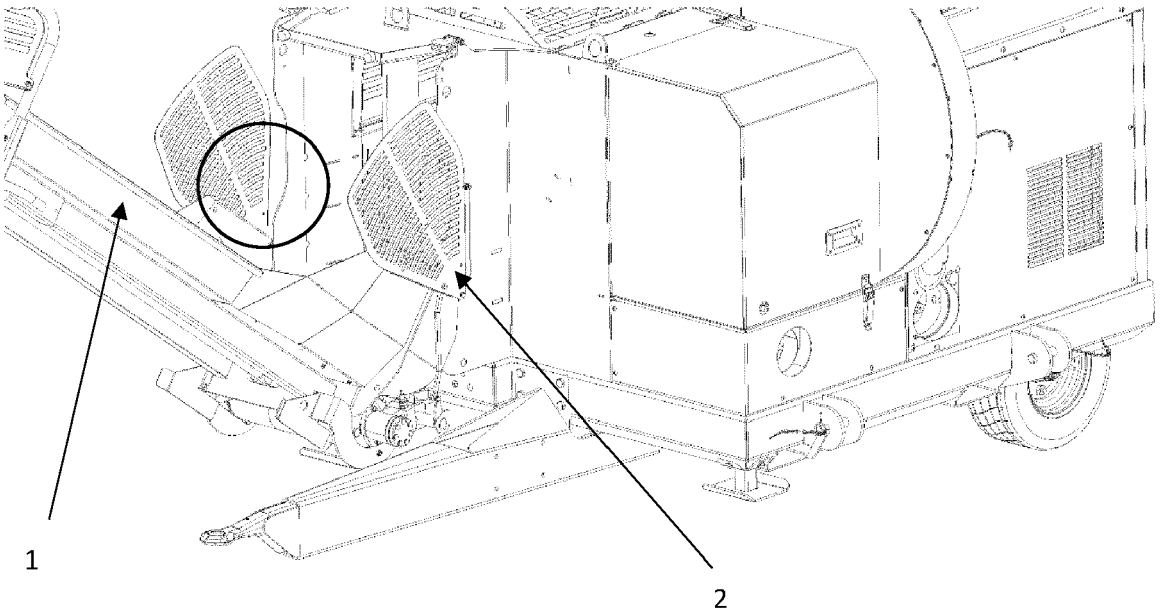

Figure 4b

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EUROPEAN SEARCH REPORT

Application Number
EP 22 21 2376

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 A	US 7 669 618 B1 (HALVERSON GLEN [US]) 2 March 2010 (2010-03-02) * column 1, lines 20-50 * * column 5, lines 28-51 * * column 7, line 52 - column 8, line 26 * * figures *	1,3-7, 9-11 2,8,12	INV. B27L7/00
X A	DE 299 18 673 U1 (RATERING GEORG [DE]; TENOTH ERNST [DE]; WESSELER GUIDO [DE]) 2 March 2000 (2000-03-02) * paragraphs [0012], [0015] * * claim 1 * * figures *	1,2,7,8, 10-12 3-6,9	
X A	US 4 068 549 A (HUFFMAN JAMES EARLE) 17 January 1978 (1978-01-17) * column 2, line 54 - column 3, line 13 * * figures *	1-7,9-11 8,12	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	11 May 2023	Hamel, Pascal

CATEGORY OF CITED DOCUMENTS

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11-05-2023

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

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- EP 2839938 A **[0003]**