(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
22 December 2016 (22.12.2016)

WIPO | PCT

(10) International Publication Number
WO 2016/202456 A1

(51) International Patent Classification:
E21C 27/34 (2006.01) *E21C 27/32* (2006.01)
E21C 35/08 (2006.01)

(21) International Application Number:
PCT/EP2016/001000

(22) International Filing Date:
15 June 2016 (15.06.2016)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
15172961.3 19 June 2015 (19.06.2015) EP

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

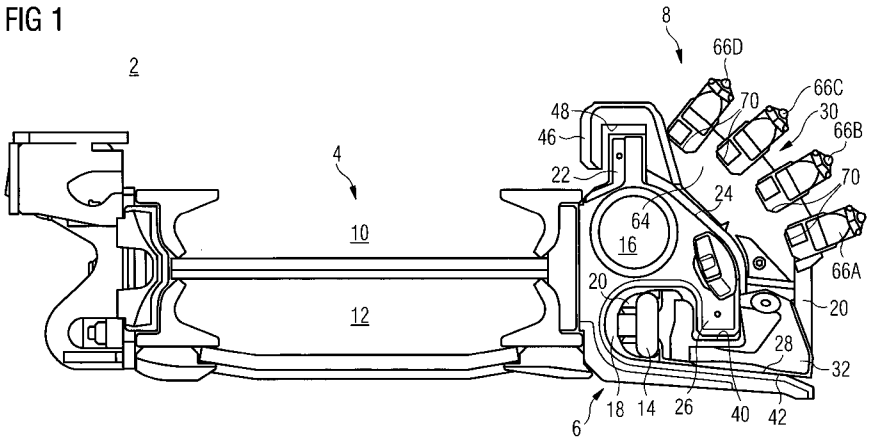
(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(54) Title: LONGWALL CLEARING PLOW

FIG 1



(57) Abstract: The present disclosure relates to a clearing plow (8) for loosening material of a material cluster, which blocks travel of a material winning plow (100) in a longwall mining installation (2). The clearing plow (8) may comprise a first bottom guide member (32) including a first guiding element (40) for guiding the clearing plow (8) along a plow guide assembly (6) of the longwall mining installation (2). The clearing plow (8) may further comprise a main body (30) supported by the first bottom guide member (32), and providing a loosening tool mounting face (64) extending across the first guiding element (40) in a lateral direction of the main body (30). In clearing operation, the clearing plow (8) may be moved against the material cluster to loosen material.

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Description

LONGWALL CLEARING PLOW

Technical Field

[01] The present disclosure relates to longwall mining applications. Particularly, the present disclosure relates to a clearing plow for loosening material of a material cluster, which may form because of a material break-in from a roof or a longwall face and which blocks travel of a material winning plow in a longwall mining installation. The present disclosure is further directed to a related method for loosening material of the material cluster.

Background

[02] In longwall underground mining, a longwall mining installation extends along a longwall face to extract material therefrom, and subsequently advances in a working direction perpendicular to the longwall face. For example, a material winning plow (longwall plow) is guided along a plow guiding assembly attached to a face conveyor such that the plow reciprocates along the longwall face to extract material.

[03] During mining operation, it may occur that material from the roof and/or the longwall face breaks-in and forms material clusters of considerable size consisting of bulky material. For example, material may loosen from the roof or the longwall face due to geological faults and dislocations. It may further happen that such a material cluster forms between the longwall face and the face conveyor. As a result, the material cluster may block the way of the material winning plow, and even the material winning plow itself. In those situations, the

material cluster cannot be loosened by repeatedly moving the material winning plow against the material cluster.

[04] The present disclosure is directed, at least in part, to improving or overcoming one or more aspects of prior systems.

Summary of the Disclosure

[05] In one aspect, a clearing plow for loosening material of a material cluster, which blocks travel of a material winning plow in a longwall mining installation with a plow guide assembly, is disclosed. The clearing plow may comprise a first bottom guide member including a first guiding element for guiding the clearing plow along the plow guide assembly. The clearing plow may further comprise a main body supported by the first bottom guide member, and providing a loosening tool mounting face extending across, and particularly above, the first guiding element in a lateral direction of the main body.

[06] In another aspect, a longwall mining installation is disclosed. The longwall mining installation comprises a plow guide assembly, and a material winning plow configured to be guided along the plow guide assembly for extracting material from a longwall face in mining operation. The longwall mining installation may further comprise a clearing plow as exemplary disclosed herein. The clearing plow may be configured to be guided along the plow guide assembly for loosening material of a material cluster, which blocks travel of the material winning plow, in clearing operation.

[07] In yet another aspect, a method for loosening material of a break-in material cluster, which blocks travel of a material winning plow in a longwall mining installation with a plow guide assembly for guiding the material winning plow, is disclosed. The method may comprise providing a clearing plow separate from the material winning plow. The method may further comprise moving the clearing plow, which may be guided along the plow guide assembly, against the material cluster to loosen material.

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

Brief Description of the Drawings

[09] The accompanying drawings, which are incorporated herein and constitute a part of the specification, illustrate exemplary embodiments of the disclosure and, together with the description, serve to explain the principles of the disclosure. In the drawings:

Fig. 1 shows a schematic drawing of an exemplary clearing plow in a side view, wherein the clearing plow is mounted to a plow guide assembly extending along a face conveyor in a longwall mining installation;

Fig. 2 shows a schematic drawing of the exemplary clearing plow in a perspective view;

Fig. 3 shows a schematic drawing of another embodiment of a clearing plow according to the present disclosure, in which the clearing plow is towed behind a conveyor chain of a face conveyor in a perspective view;

Figs. 4 and 5 show schematic drawings of the clearing plow in front and top views, respectively;

Fig. 6 shows a schematic drawing of the clearing plow relative to a material winning plow in a side view for discussing the dimensional and structural differences between both plows; and

Figs. 7A to 7E show method steps for installing the clearing plow on a longwall mining installation according to the present disclosure.

Detailed Description

[10] The following is a detailed description of exemplary embodiments of the present disclosure. The exemplary embodiments described therein and illustrated in the drawings are intended to teach the principles of the present disclosure, enabling those of ordinary skill in the art to implement and use the

present disclosure in many different environments and for many different applications. Therefore, the exemplary embodiments are not intended to be, and should not be considered as, a limiting description of the scope of patent protection. Rather, the scope of patent protection shall be defined by the appended claims.

[11] The present disclosure is based in part on the realization that manually clearing a material cluster of material, which broke-in from the roof or the longwall face, should be avoided, because it is a difficult, dangerous and time-consuming work.

[12] The present disclosure is further based in part on the realization that the material winning plow is not well suited to loosen material of certain material cluster. The cutting tools of the material winning plow are oriented to perform cutting work at the longwall face instead of loosening work at the material cluster. The risk of blockage of the material wining plow may be further increased as bulky material of the material cluster may be present in considerable amounts close to a face conveyor and a plow guide assembly. This is a region that is contacted in full by a lateral face of the material winning plow only, and which is not contacted by cutting tools of the material winning plow.

[13] Accordingly, herein a clearing plow is suggested, which is particularly suitable to loosen material of a material cluster that blocks travel of a material winning plow along the longwall face. Specifically, the clearing plow is configured to loosen material in a region of the material cluster, where no cutting work is performed by the material winning plow. Further, the clearing plow is configured to ensure that a contact between the clearing plow and the material cluster results in a loosening effect instead of a potential compaction effect that might be generated by the material winning plow as is described in detail herein.

[14] Referring now to the drawings, Fig. 1 shows components of a longwall mining installation 2. Specifically, in Fig. 1, a face conveyor segment of a face conveyor 4, a plow guide component of a plow guide assembly 6, and a

clearing plow 8 are shown in a side view, in other words, viewed in a direction parallel to the longwall face and a longitudinal axis of longwall mining installation 2.

[15] Although not depicted in further detail, longwall mining installation 2 may include more components required for operation, for example, a material winning plow (not shown in Fig. 1), which is guided by plow guide assembly 6, reciprocates along the longwall face to extract material and loads the material onto face conveyor 4. Further, for example, a plurality of shield supports (not shown) may be positioned side-by-side to extend along the longwall face behind face conveyor 4 for supporting the roof. Surrounding rock can only break in and form the so-called old workings after advancing of the shield supports, which are connected to face conveyor 4 in a manner that allows forward advancing in direction to the longwall face to follow the mineral seam. For instance, moving devices may be supported between shield supports and face conveyor segments of face conveyor 4. Those moving devices may consist of in each case one pushing or walking bar, which can be loaded hydraulically in both directions in order to push the respective face conveyor segment of face conveyor 4 optionally and section by section in a work direction or pull up an individual shield support in the work direction to follow the longwall face, which moves on and on in the work direction as the material winning plow continues to extract material.

[16] It should be noted that during normal mining operation, in which material is extracted from the longwall face, clearing plow 8 would not be installed in longwall mining installation 2 as clearing plow 8 is not required for extracting material, but to loosen material of a material cluster as is described in detail herein. Instead, the material winning plow (not shown in Fig. 1) may be the only plow installed in longwall mining installation 2 and guided by plow guide assembly 6.

[17] Face conveyor 4, for example a chain scraper conveyor, extends along the longwall face and is build-up of a plurality of face conveyor segments. Specifically, adjacent face conveyor segments are connected to one another, for example, so as to resist separation when a tensile force is applied and so as to restrict relative angular movement. Further, the face conveyor segments are arranged in a row between two stations at longitudinal ends of face conveyor 4. Those stations respectively accommodate sprockets and use the sprockets to redirect one or more endless conveyor chains of face conveyor 4. Specifically, the conveyor chain(s) is/are guided in a first direction (parallel to the longwall face) in an upper strand 10 of face conveyor 4 when transporting material to a roadway, and is/are guided in a second direction, which is oppositely directed to the first direction, in a lower strand 12 of face conveyor 4 during return travel. To facilitate a material transport by means of the conveyor chain(s), a plurality of flight bars (scrapers) are fastened at the conveyor chain(s) at preset distances.

[18] As can be seen in Fig. 1, plow guide assembly 6 is attached to face conveyor 4 at a longitudinal side thereof, which faces the longwall face during operation. Similar to face conveyor segments of face conveyor 4, plow guide assembly 6 includes a plurality of plow guide segments connected to one another in a row to extend along face conveyor 4.

[19] Plow guide assembly 6 is configured to guide a plow chain 14 in respective plow chain channels 16 and 18 for moving a plow along the longwall face. In normal operation, the material mining plow (not shown in Fig. 1) is connected to plow chain 14 via a respective traction carriage (pulling sleigh). However, as depicted in Fig. 1, in some embodiments of clearing plow 8, the same may also be connected to plow chain 14 via a respective traction carriage 20.

[20] Additionally, for guiding the respective plow(s), for example the material winning plow (not shown in Fig. 1) or clearing plow 8, along plow guide assembly 6, the same includes a top guide beam 22, an intermediate guide face

24, a bottom guide beam 26, and a bottom guide face 28, each extending along the longwall face to allow guidance and movement of the respective plow.

[21] Referring now to Figs. 1 and 2 for describing clearing plow 8 in more detail, which is used and installed for clearing operation.

[22] In the shown embodiment, clearing plow 8 includes a main body 30 supported by a first bottom guide member 32 and a second bottom guide member 34 configured as guide skids, both including mounting recesses or pockets in which bottom mounting protrusions 36 and 38 of main body 30 are insertable. In other embodiments, for example in clearing plow configurations without traction carriage and/or with one or more loosening tools for one travel direction only, the clearing plow may be supported by one bottom guide member only.

[23] As can be best seen in Fig. 1, bottom guide members 32 and 34 (only one of which is visible in Fig. 1) includes a longitudinal channel or recess 40. Said recess 40 partially surrounds bottom guide beam 26 of plow guide assembly 6 such that the respective bottom guide member 32, 34, and thus clearing plow 8, is guidable along bottom guide beam 26.

[24] In the shown configuration, bottom guide members 32 and 34 include a U-profile cross-section defining recess 40 as a reception for bottom guide beam 26 having a matching rectangular cross-section. Alternatively, other matching configurations may be used for recess 40 and guide beam 26.

[25] Further, bottom guide member 32 and 34 include bottom guide faces 42 and 44 for supporting and guiding the respective guide member 32, 34 on bottom guide face 28 of plow guide assembly 6.

[26] For guiding clearing plow 8 along top guide beam 22 of plow guide assembly 6, a top guide member 46 with a longitudinal channel or recess 48 for partly surrounding top guide beam 22 is provided. Similar to bottom guide beam 26 and bottom guide members 32, 34, top guide member 46 may have a U-profile cross-section matching with a rectangular cross section of top guide beam

22. For example, top guide member 46 may be integrally formed with main body 30 as exemplary depicted, or may be provided as a separate unit to be connected to a clearing plow main body.

[27] In some embodiments, bottom guide members 32, 34 and/or top guide member 46 may include respective guiding elements that differ from recesses 40, 46 as described above. For example, first bottom guide member 32, second bottom guide member 34, and/or top guide member 46 may include a first guiding element, a second guiding element and a third guiding element, respectively, which may be configured as beam segments for guiding clearing plow 8 along guiding channels of plow guide assembly 6 (not shown). Those guiding channels may be provided at plow guide assembly 6 instead of upper and lower guide beams 22 and 26.

[28] In the shown embodiment, clearing plow 8 further includes traction carriage 20 connected to plow chain 14 for moving clearing plow 8 similar to a conventional material winning plow. Said traction carriage 20 is inserted into a recess 50 situated in a bottom region of main body 30.

[29] Additionally or alternatively, as exemplary shown in Fig. 3, clearing plow 8 may be equipped with an attachment unit or point 52, which may be fastened to or integrally formed with main body 30. Attachment unit 52 allows to connect clearing plow 8 to one or more conveyor chains 54, 56, or flight bars 60 via a connecting member 58, for example a chain, for moving clearing plow 8 along plow guide assembly 6. As considerable forces and loads may act onto connecting member 58 if moving clearing plow 8 into a material cluster for loosening material, a safety coupling 62 may be included in connecting member 58.

[30] Referring back to Figs. 1 and 2, main body 30 provides a loosening tool mounting face 64 at a longitudinal side thereof, which faces the longwall face during operation. Loosening tool mounting face 64 is configured

for mounting one or more loosening tools 66 and 68 to main body 30 of clearing plow 8.

[31] As can be best seen in Fig. 1, loosening tool mounting face 64 extends obliquely across recess 40 in a lateral direction of clearing plow 8 and main body 30. Alternatively, loosening tool mounting face 64 may extend at any other angle across recess 40 in a lateral direction of clearing plow 8.

[32] In other words, loosening tool mounting face 64 is positioned in a region above recess 40 in a vertical direction without any offset in a lateral direction of clearing plow 8. However, depending on the specific configuration of a main body of the clearing plow relative to a respective bottom guide member of the clearing plow, there might be an offset in a longitudinal direction of the clearing plow.

[33] In the shown embodiment of Figs. 1 and 2, clearing plow 8 is provided with a plurality of loosening tools 66, 68 for both travel directions along plow guide assembly 6. Specifically, loosening tools 66 are provided for a first travel direction, whereas loosening tools 68 are provided for a second travel direction oppositely directed to the first travel direction. For example, in some embodiments, clearing plow 8 (and its loosening tools 66 and 68) may be configured mirror-symmetrically with respect to a plane defined by a vertical axis of clearing plow 8 and a lateral axis of clearing plow 8. Alternatively, a clearing plow may be provided with loosening tools for one travel direction along longwall mining installation 2 only.

[34] Examples of loosening tools include, but are not limited to, plow bits such as roof cutting bits and notch cutting bits. It is contemplated that the loosening tools may be any kind of tools that are suitable to loosen material of the material cluster.

[35] Further, loosening tool to 66, 68 are accommodated in loosening tool receptions 70, 72 provided on loosening tool mounting face 64. For example,

loosening tools 66, 68 may include plow bits and bit holders for releasably securing a respective plow bit therein, for example as shown in Figs. 1 and 2.

[36] As clearing plow 8 is intended to loosen material of a material cluster, loosening tools 66, 68 may be oriented in an upward direction (to the roof) in a mounted state. For example, loosening tool mounting face 64 and loosening tool receptions 70, 72 may be configured for mounting loosening tools 66, 68 at an angle with respect to a (horizontal) lateral axis of clearing plow 8 within a range between 5° and 90°.

[37] Further, loosening tools 66, 68 may differ with respect to their respective orientation as exemplary shown in the embodiment of Fig. 1. There, inclination angles of neighboring loosening tools 66 gradually increase from a lowest loosening tool 66A to a highest loosening tool 66D with respect to a vertical axis of clearing plow 8. In some embodiments, the same may apply to loosening tools 68A to 68D (see Fig. 2).

[38] As a result of arranging loosening tools 66, 68 at an angle in an upward direction, a work direction of those loosening tools 66, 68 also has an upward directed component. If contacting the material cluster, an upward directed force may be applied by clearing plow 8. This may improve a loosening effect as bulky material is pushed upward in a direction to hollow spaces below the roof instead of being pushed downwards against a ground floor, which may even compact the material cluster. Generally speaking, clearing plow 8 is configured to push material of a material cluster substantially in an upward direction to the roof for loosening the same.

[39] As can be further in seen in Figs. 4 and 5, loosening tools 66, 68 may be arranged displaced to one another in a longitudinal direction of clearing plow 8 to provide a stepped contact area for contacting the material cluster. Specifically, loosening tools 66 for the first travel direction (and loosening tool 68 for the second travel direction) successively get in contact with the material cluster one after another.

[40] In the shown embodiment, lowest loosening tool 66A has the outermost position of loosening tools 66A to 66D with respect to the longitudinal axis of clearing plow 8. As a result, loosening tool 66A is the first loosening tool that gets in contact with the material cluster and pushes material in an upward direction. Further, the initial contact area is provided by outermost loosening tool 66A only, which is relatively small and results in a strong impact on the material cluster in a single point only, which may further improve the loosening effect provided by clearing plow 8.

[41] Further, loosening tools 66 (and 68) are arranged displaced from one another in lateral and vertical directions of clearing plow 8 such that contact areas with the material clusters provided by different loosening tools 66 are spaced apart from one another. Therefore, loosening tools 66A to 66D contact the material cluster one after another and at spaced apart regions.

[42] Specifically, in the shown embodiment, loosening tools 66, 68 are arranged to gradually approach to a center of clearing plow 8 in the longitudinal direction and the lateral direction.

[43] For example, as can be seen in Fig. 4, an imaginary line A defined by tool tip regions of loosening tools 66 may confine an angle a with vertical axis Z of clearing plow 8 within a range between 30° and 50°, for example 40°.

[44] Similarly, as shown in Fig. 5, an imaginary line B defined by tool tip regions of loosening tools 66 may confine an angle b with lateral axis Y of clearing plow 8 within a range between 25°and 45°, for example 35° .

[45] As one skilled in the art will appreciate, all features described herein with reference to loosening tools 66 may likewise apply to loosening tools 68 in some embodiments.

[46] Turning to Fig. 6 for describing similarities and differences between clearing plow 8 and a (conventional) material winning plow 100.

[47] In Fig. 6, clearing plow 8 is shown in a side view next to material winning plow 100 that is also shown in a side view. To ease comparison, both plows 8 and 100 are shown as being mounted to plow guide assembly 6.

[48] As one skilled in the art will appreciate, material winning plow 100 includes a plurality of cutting tools 102, which may be mounted to pivotable cutting bit carriers at each longitudinal end of material winning plow 100, a main body 104 of material winning plow 100, and/or a (movable) roof cutting bit carrier.

[49] As can be seen in Fig. 6, main body 30 of clearing plow 8 has a smaller cross-sectional area than material winning plow 100. For example, a width of main body 30 of clearing plow 8 may be about 40% of a width of main body 104 of material winning plow 100 as shown in Fig. 6, or even less.

[50] Generally, the overall dimensions of clearing plow 8 may be relatively small. For example, a length measured along the longitudinal axis of clearing plow 8 may be within a range between 1000 mm and 2000 mm.

[51] A width of clearing plow 8 may be chosen to ensure that clearing plow 8, particularly bottom guide members 32 and 34, substantially flush with bottom guide face 28 of plow guide assembly 6 as shown in Fig. 1. In other words, in the shown embodiments, clearing plow 8 does not extend beyond bottom guide face 28 in a lateral direction of clearing plow 8, because clearing plow 8 is not intended to contact a longwall face to cut material therefrom. For instance, main body 30 of clearing plow 8 may have a width within a range between 400 mm and 550 mm, for example about 470 mm.

[52] Furthermore, a height of main body 30 may be chosen to ensure that loosening work is particularly performed in a region directly in front of plow guide assembly 6. For example, main body 30 of clearing plow 8 may extend beyond plow guide assembly 6 in a vertical direction within a range between 5 % and 20 % with respect to an overall height of plow guide assembly 6. In some embodiments, a height of clearing plow 8 measured between top guide member

46 and bottom guide member 32 may be within a range between 400 mm and 550 mm, for example about 460 mm.

[53] As can be further seen in Fig. 6, arrangement and orientation of tools differ between loosening tools 66 (and 68) of clearing plow 8 and cutting tools 102 of material winning plow 100.

[54] Specifically, loosening tools 66 are arranged relatively close to plow guide assembly 6 in a region L extending substantially above plow guide assembly 6 without substantial lateral offset. In contrast, cutting tools 102 are arranged in a region C extending substantially vertical and being situated relatively far from plow guide assembly 6 as cutting tools 102 are intended for extracting material from the longwall face.

[55] Thus, viewed in direction of longitudinal axes of plows 8 and 100, an impact region L defined by loosening tools 66 differs from an impact region C defined by cutting tools 102. Particularly, impact region L is substantially situated between plow guide assembly 6 and impact region L viewed in a direction parallel to the longwall face, in other words, in a longitudinal direction of the longwall mining installation.

[56] Furthermore, cutting tools 102 of material winning plow 100 are oriented to maximize a cutting area defined by cutting tools 102. Therefore, uppermost cutting tools of a respective cutting bit carrier are directed in an upward direction to the roof, whereas lowermost cutting tools of a respective cutting bit carrier are directed to the ground floor. In contrast, loosening tools 66 of clearing plow 8 are all directed in an upward direction to improve a loosening effect if contacting the material cluster as described herein.

[57] Additionally, neighboring loosening tools, for example tools 66A and 66B, of loosening tools 66, 68 are arranged with a gap therebetween to allow material from the material cluster to be pushed through the gap, which further increase the loosening effect. For example, such a gap may be within a range between 20 mm and 80 mm. In contrast, as can be noted in Fig. 6, neighboring

tools of the plurality of cutting tools 102 of material winning plow 100 are provided in a gapless manner.

[58] Hereinafter, an installation method for clearing plow 8 is described with reference to Figs. 7A to 7E, which allows installing the clearing plow in a quick and easy manner without requiring to disassemble components of longwall mining installation 2.

[59] Initially, as shown in Fig. 7A, a service panel at plow guide assembly 6 may be removed for providing access to a service opening 76 to uncover inner structures of plow guide assembly 6 such as plow chain channels 16 and 18. To ease installation of clearing plow 8 and access to the installation spot, the service panel may be positioned in plow guide assembly 6 close to a main or tail gate 5 of longwall mining installation 2.

[60] An example of configuring the service panel is disclosed in European patent application No. 14 186 374.6 (not yet laid-open to public) of Caterpillar Global Mining Europe GmbH, which is herewith incorporated herein with respect to the configuration, arrangement and functionality of the service panel in the plow guide assembly.

[61] As service opening 76 is accessible, first bottom guide member 32 can be inserted in service opening 76 and moved in a sideward direction such that recess 40 (see. Fig. 1) encompasses lower guide beam 26 and bottom guide face 42 of first bottom guide member 32 is supported onto guide face 28 of plow guide assembly 6 as exemplary shown in Fig. 7A.

[62] Further, as shown in Fig. 7B, traction carriage 20 is inserted in service opening 76 and connected to plow chain 14 (see Fig. 1). As one skilled in the art will appreciate, in case clearing plow 8 is configured to be moved by conveyor chains 54, 56 only, as shown in Fig. 3, installation of a traction carriage would not be required.

[63] In a next step, main body 30 is lowered from above (not shown in further detail) into first bottom guide member 32 as shown in Fig. 7C. To

improve alignment during lowering of main body 30, top guide member 46 (see Fig. 1) of clearing plow 8 may encompass upper guide beam 22 of plow guide assembly 6 in part.

[64] Thereafter, second bottom guide member 34 is attached to main body 30, which is then pivoted downwards such that bottom guide member 34 is inserted in service opening 76, and main body 30 may be connected to traction carriage 20 if required as shown in Fig. 7D.

[65] Lastly, as shown in Fig. 7E, service opening 76 is closed by inserting service panel 78 again, and clearing plow 8 can be used to loosen material of a material cluster as described herein. It should be noted that removing clearing plow 8 after finishing the clearing work may be performed as discussed above in a reversed order.

Industrial Applicability

[66] In the following, operation of clearing plow 8 is described in connection with Figs. 1 to 6.

[67] During normal mining operation with material winning plow 100, it may occur that material breaks-in from the longwall face and/or the roof. In certain situations, a considerable material cluster may form between the longwall face and face conveyor 4.

[68] It may further happen that travel of material winning plow 100 is blocked by said material cluster. The reason might be that the material cluster is compacted in a manner which cannot be loosened by cutting tools 102 of material winning plow 100 and/or the material cluster may be situated at least in part in a region close to face conveyor 4 and plow guide assembly 6. That is a region, which is substantially contacted by a lateral face of material winning plow 100 only, which is far from cutting area C defined by cutting tools 102 (see Fig. 6).

[69] In case blockage of material winning plow 100 is detected, clearing plow 8 may be used to loosen material of the material cluster. Hence, the

method for loosening material of a material cluster that blocks travel of material winning plow 100 includes providing a further plow, i.e. clearing plow 8, which is configured to loosen material of the material cluster.

[70] Clearing plow 8 may be installed in longwall mining installation 2 after detection of blockage of material winning plow 100. Specifically, clearing plow 8 may be mounted to plow guide assembly 6 for guiding clearing plow 8 along longwall mining installation 2 to reach the material cluster, and connected to plow chain 14 of plow guide assembly 6 (see Figs. 1 and 2) or conveyor chains 54, 56 of face conveyor 4 (see Fig. 3) for moving clearing plow 8 against the material cluster to loosen the material.

[71] Clearing plow 8 may be moved again and again against the material cluster and, thereby, loosens material, and pushes material in part onto face conveyor 4 and in direction to the longwall face. The loosening effect provided by clearing plow 8 may be considerably stronger relative to material winning plow 100 due to, for example, impact region L of clearing plow 8 differing from impact region C of material winning plow 100, upward directed loosening tools 66 and 68, and the stepped contact face provided by displaced loosening tools 66 and 68 along the longitudinal axis of clearing plow 8 as described in more detail hereinbefore.

[72] As soon as the material cluster is sufficiently loosened, material winning plow 100 may be moved against the same to fully load it onto face conveyor 4. Before or afterwards, clearing plow 8 may be removed as the same is not required for normal mining operations.

[73] As used herein, longitudinal axis and longitudinal direction of the clearing plow, the clearing plow main body, the longwall mining installation, etc. refers to an axis (and corresponding direction) parallel to the longwall face, in other words, in a moving direction of the clearing plow along the plow guide assembly. Furthermore, lateral axis and lateral direction of the clearing plow, the clearing plow main body, etc. refers to an axis (and corresponding direction)

perpendicular to the longitudinal axis and towards (in direction to) the longwall face, in other words, perpendicular to the longwall face. Hence, vertical axis and vertical direction of the clearing plow, the clearing plow main body, etc. refers to an axis (and corresponding direction) perpendicular to the longitudinal axis and the lateral axis.

[74] Although the preferred embodiments of this invention have been described herein, improvements and modifications may be incorporated without departing from the scope of the following claims.

Claims

1. A clearing plow (8) for loosening material of a material cluster, which blocks travel of a material winning plow (100) in a longwall mining installation (2) including a plow guide assembly (6), the clearing plow (8) comprising:

a first bottom guide member (32) including a first guiding element (40) for guiding the clearing plow (8) along the plow guide assembly (6); and

a main body (30) supported by the first bottom guide member (32), and providing a loosening tool mounting face (64) extending across the first guiding element (40) in a lateral direction of the main body (30).

2. The clearing plow (8) of claim 1, wherein the loosening tool mounting face (64) extends obliquely across the first guiding element (40) of the first bottom guide member (32) in the lateral direction of the main body (30).

3. The clearing plow (8) of claim 1 or 2, further comprising:

a second bottom guide member (34) including a second guiding element (40) for guiding the clearing plow (8) along the plow guide assembly (6); and/or

a top guide member (46) including a third guiding element (48) for guiding the clearing plow (8) along the plow guide assembly (6), and wherein preferably the loosening tool mounting face (64) extends from the top guide member (46) across the first guiding element (40) of the first bottom guide member (32) in the lateral direction of the main body (30).

4. The clearing plow (8) of any one of the preceding claims, wherein the clearing plow (8) is configured to push material substantially in an upward direction with respect to the bottom guide member (32).

5. The clearing plow (8) of any one of the preceding claims, further comprising:

at least one loosening tool reception (70, 72) provided on the loosening tool mounting face (64) for receiving a loosening tool (66, 68); and/or

at least one loosening tool (66, 68) mounted at the loosening tool mounting face (64).

6. The clearing plow (8) of claim 5, wherein the at least one loosening tool reception (70, 72) and/or the at least one loosening tool (66, 68) is oriented in an upward direction with respect to the bottom guide member (32).

7. The clearing plow (8) of claim 5 or 6, wherein neighboring loosening tools (66) are arranged spaced apart from one another to provide a gap therebetween.

8. The clearing plow (8) of any one of claims 5 to 7, wherein the loosening tools (66, 68) are arranged displaced to one another in a longitudinal direction and/or a lateral direction of the clearing plow (8), for example the loosening tools (66, 68) being arranged to gradually approach to a center of the clearing plow (8) in the longitudinal direction and/or the lateral direction of the clearing plow (8).

9. The clearing plow (8) of any one of the preceding claims, wherein:

loosening tools (66, 68) for both travel directions of the clearing plow (8) along the plow guide assembly (6) are provided; and/or

the clearing plow (8) is configured mirror-symmetrically with respect to a plane defined by a vertical axis and the lateral axis of the clearing plow (8).

10. The clearing plow (8) of any one of the preceding claims, further comprising:

an attachment unit (62) for connecting the clearing plow (8) to a conveyor chain (54, 56) of a chain conveyor (4) for moving the clearing plow (8) in operation; and/or

a traction carriage (20) mounted to the main body (30) for connecting the clearing plow (8) to a plow chain (14) guided in the plow guide assembly (6) for moving the clearing plow (8) in operation.

11. The clearing plow (8) of any one of the preceding claims, wherein:

the first guiding element (40) of the first bottom guide member (32) is configured as a recess for guiding the clearing plow (8) along a first guide beam (26) of the plow guide assembly (6); or

the first guiding element (40) of the first bottom guide member (32) is configured as a guide beam segment for guiding the clearing plow (8) along a guiding channel of the plow guide assembly (6).

12. A longwall mining installation (2) comprising:

a plow guide assembly (6);

a material winning plow (100) configured to be guided along the plow guide assembly (6) for extracting material from a longwall face in mining operation; and

a clearing plow (8) according to any one of the preceding claims, the clearing plow (8) being configured to be guided along the plow guide assembly (6) for loosening material of a material cluster, which blocks travel of the material winning plow (100), in clearing operation.

13. A method for loosening material of a break-in material cluster, which blocks travel of a material winning plow (100) in a longwall mining installation (2) including a plow guide assembly (6) for guiding the material wining plow (100), the method comprising:

providing a clearing plow (8) separate from the material winning plow (100); and

moving the clearing plow (8), which is guided along the plow guide assembly (6), against the material cluster to loosen material.

14. The method of claim 13, wherein the material winning plow (100) is configured to provide a first impact region (C) against the material cluster, and the clearing plow (8) is configured to provide a second impact region (L) against the material cluster, the second impact region (L) being different from the first impact region (C), for example the second impact region (L) being situated substantially between the first impact region (L) and a plow guide assembly (6) of the longwall mining installation (2) viewed in a longitudinal direction of the longwall mining installation (2).

15. The method of claim 13 or claim 14, wherein the method step of moving the clearing plow (8) against the material cluster further comprises applying a substantially upward directed force to the material cluster by the clearing plow (8).

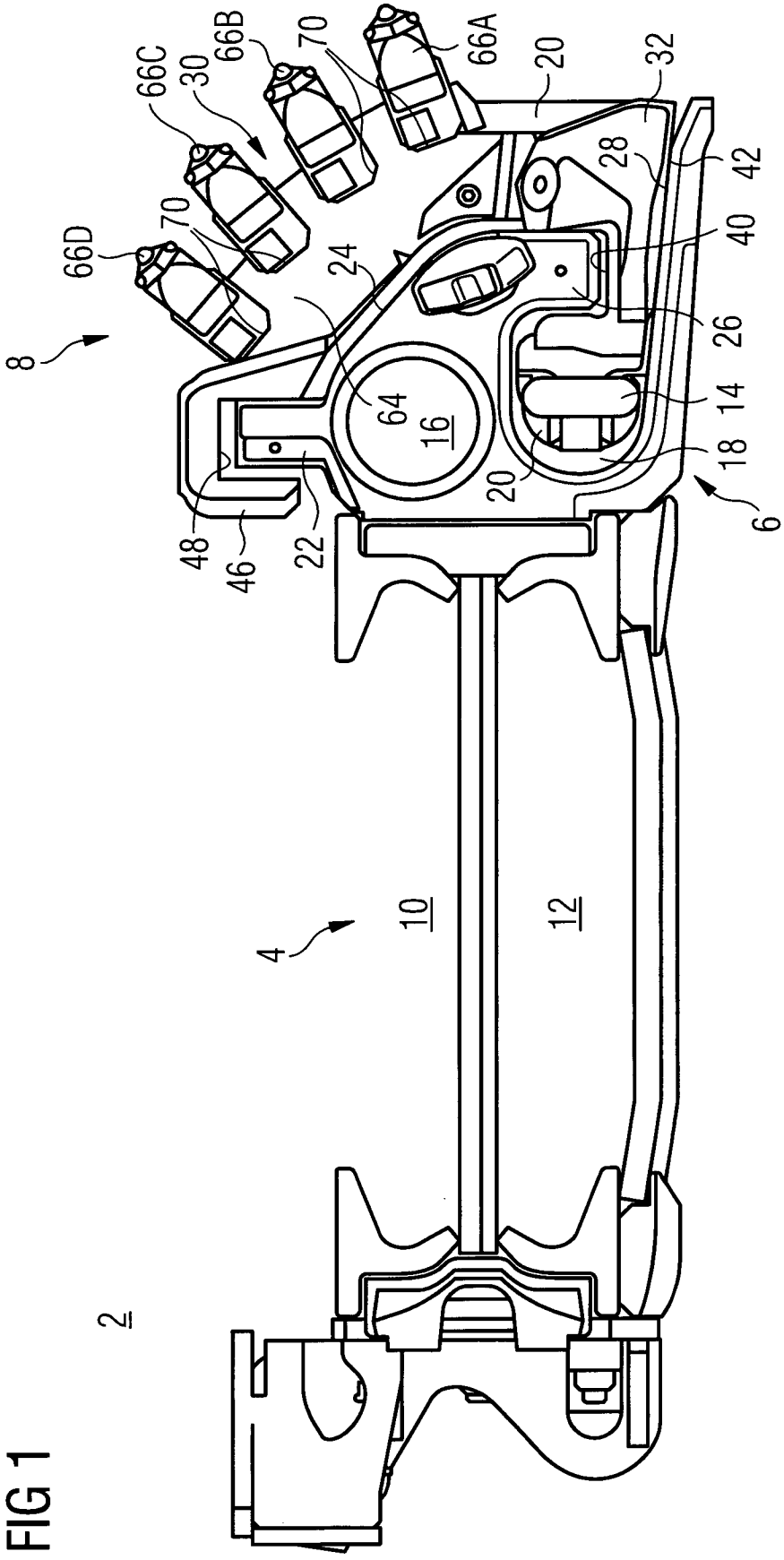

66C
30
66B
70
66A
20
32
28
42
70
66D
24
40
8
26
64
16
14
18
20
6
48
46
22
4
10
12
2

FIG 1

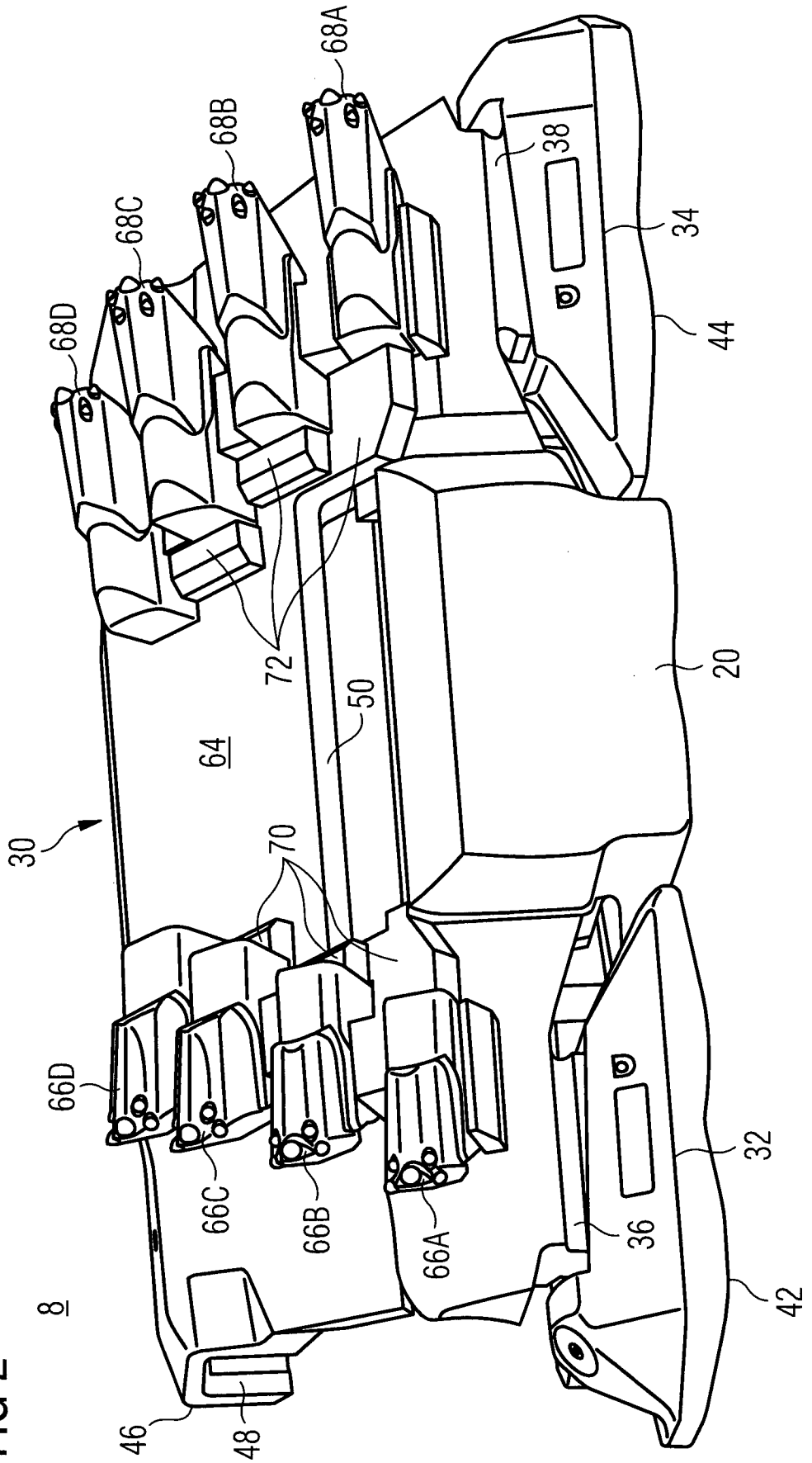

8
30
64
72
50
20
38
34
44
68A
68B
68C
68D
70
66D
66C
66B
66A
36
32
42
46
48

FIG 2

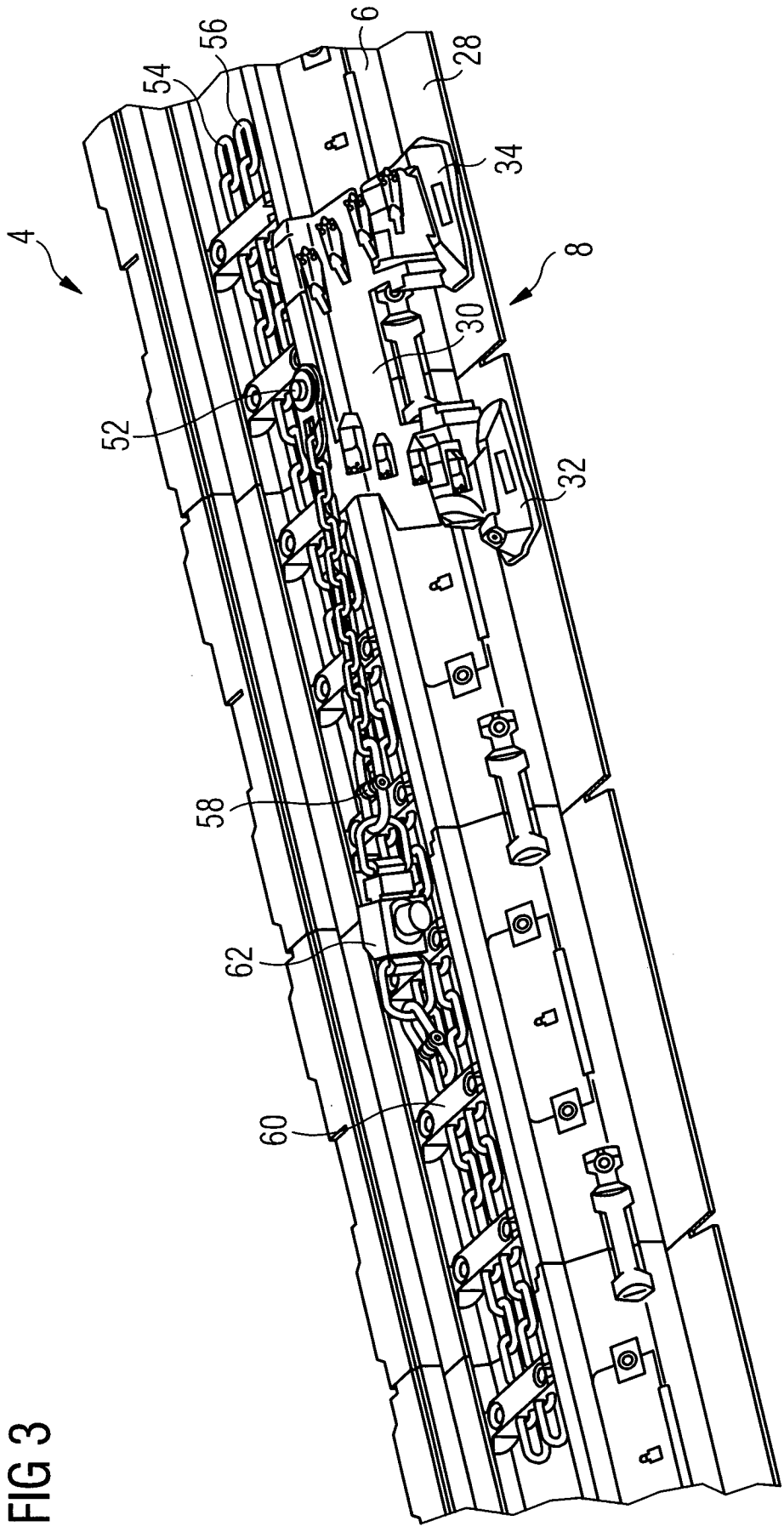


FIG 3

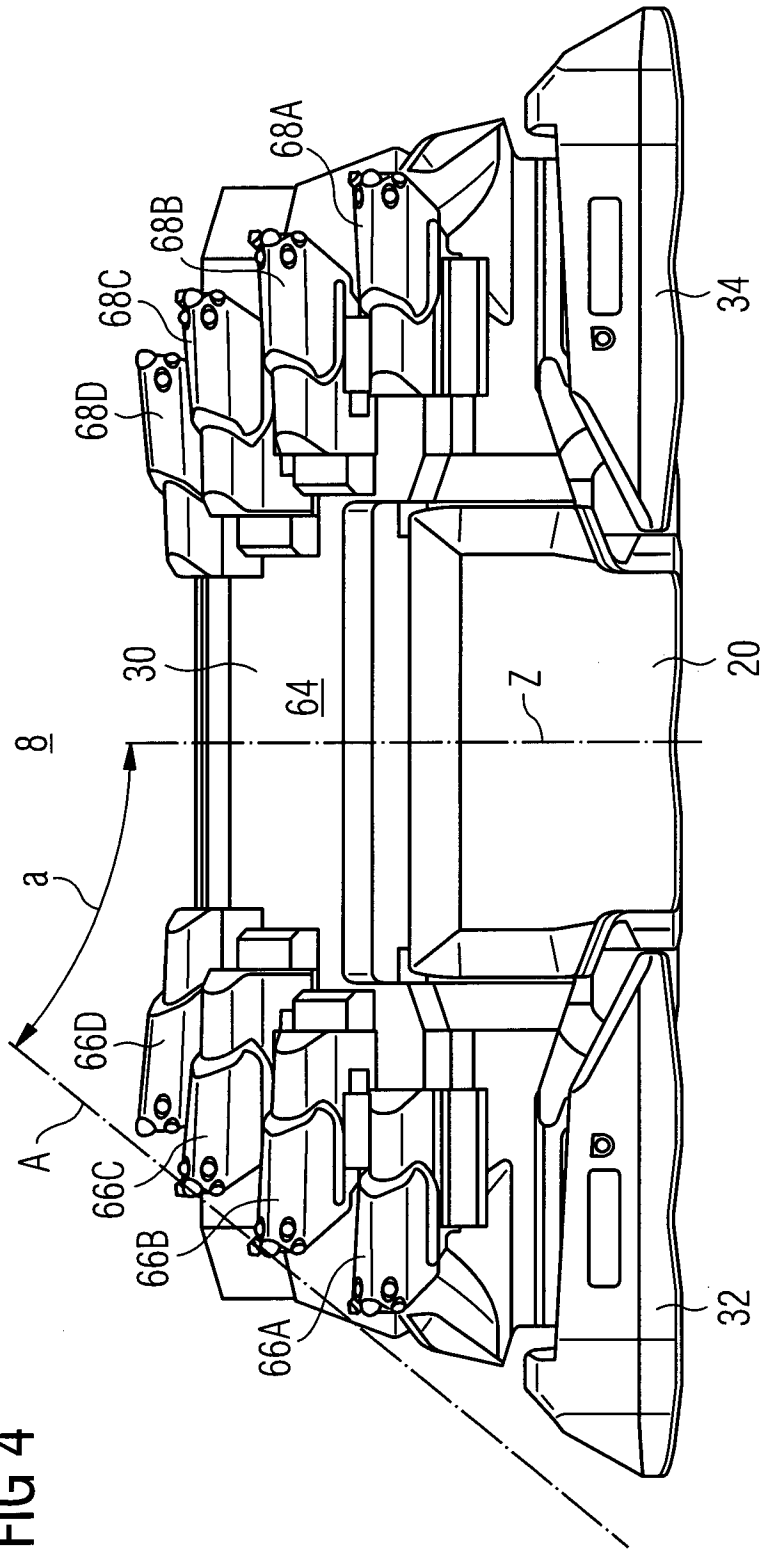


FIG 4

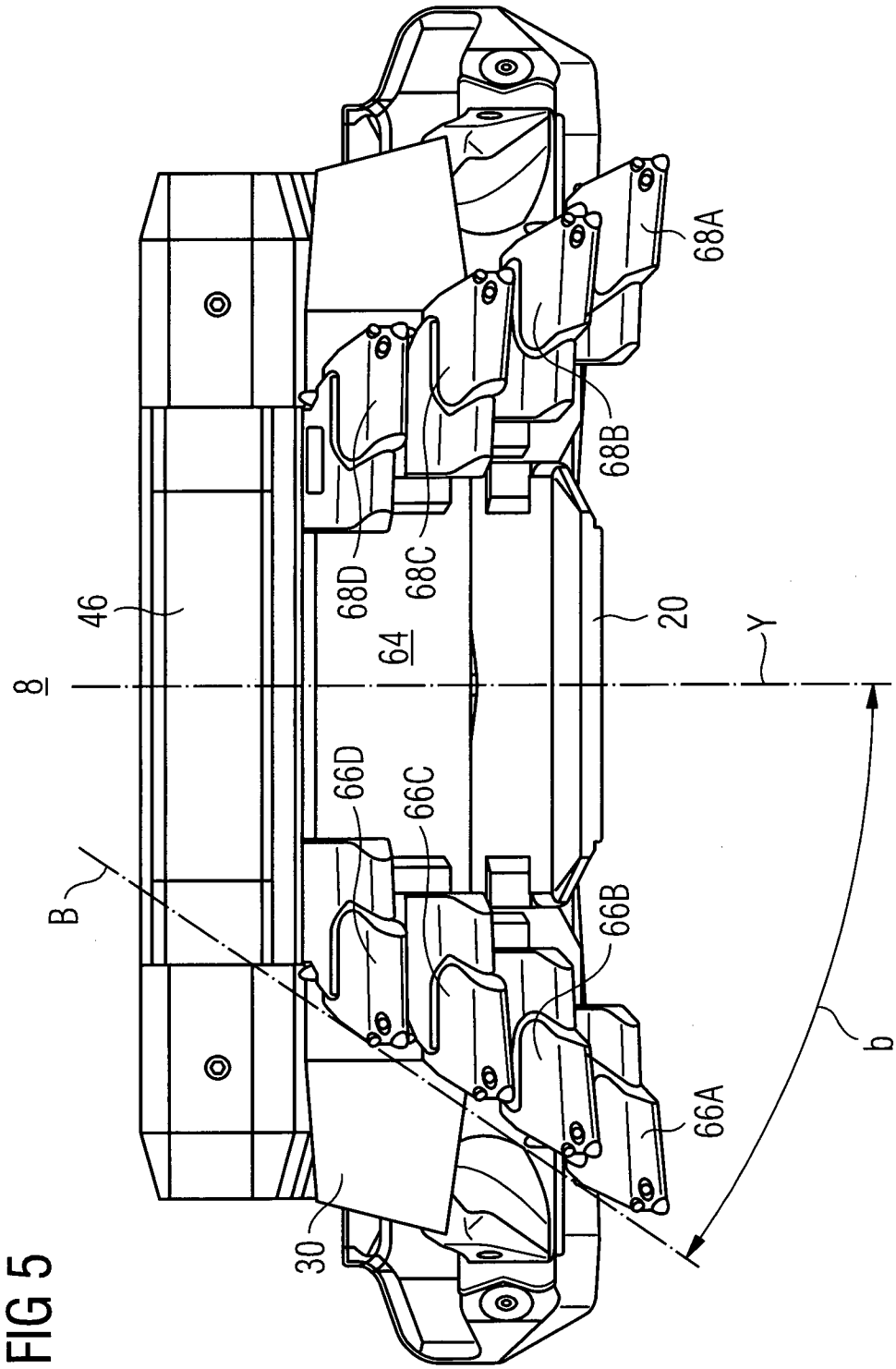
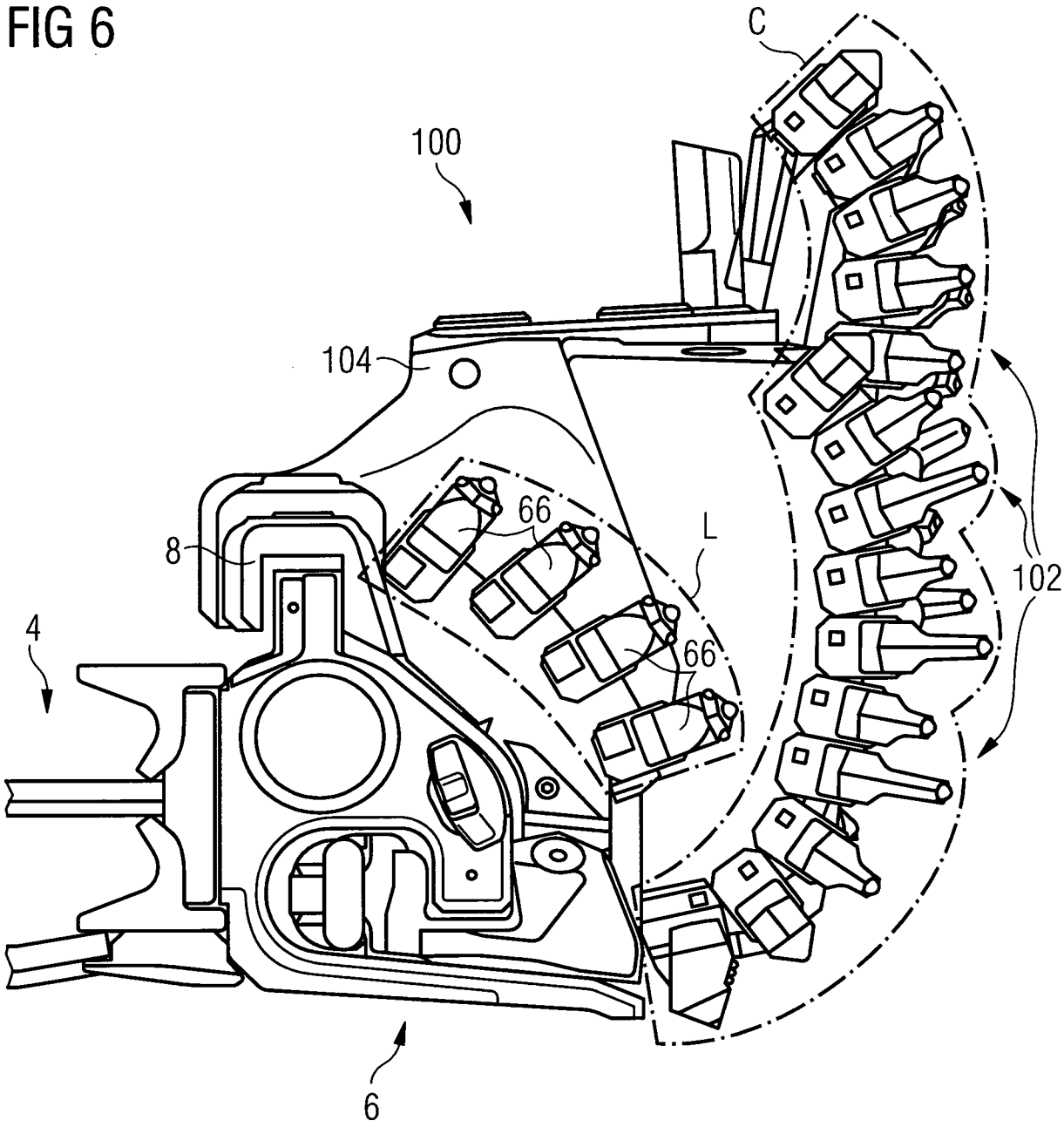


FIG 5

FIG 6



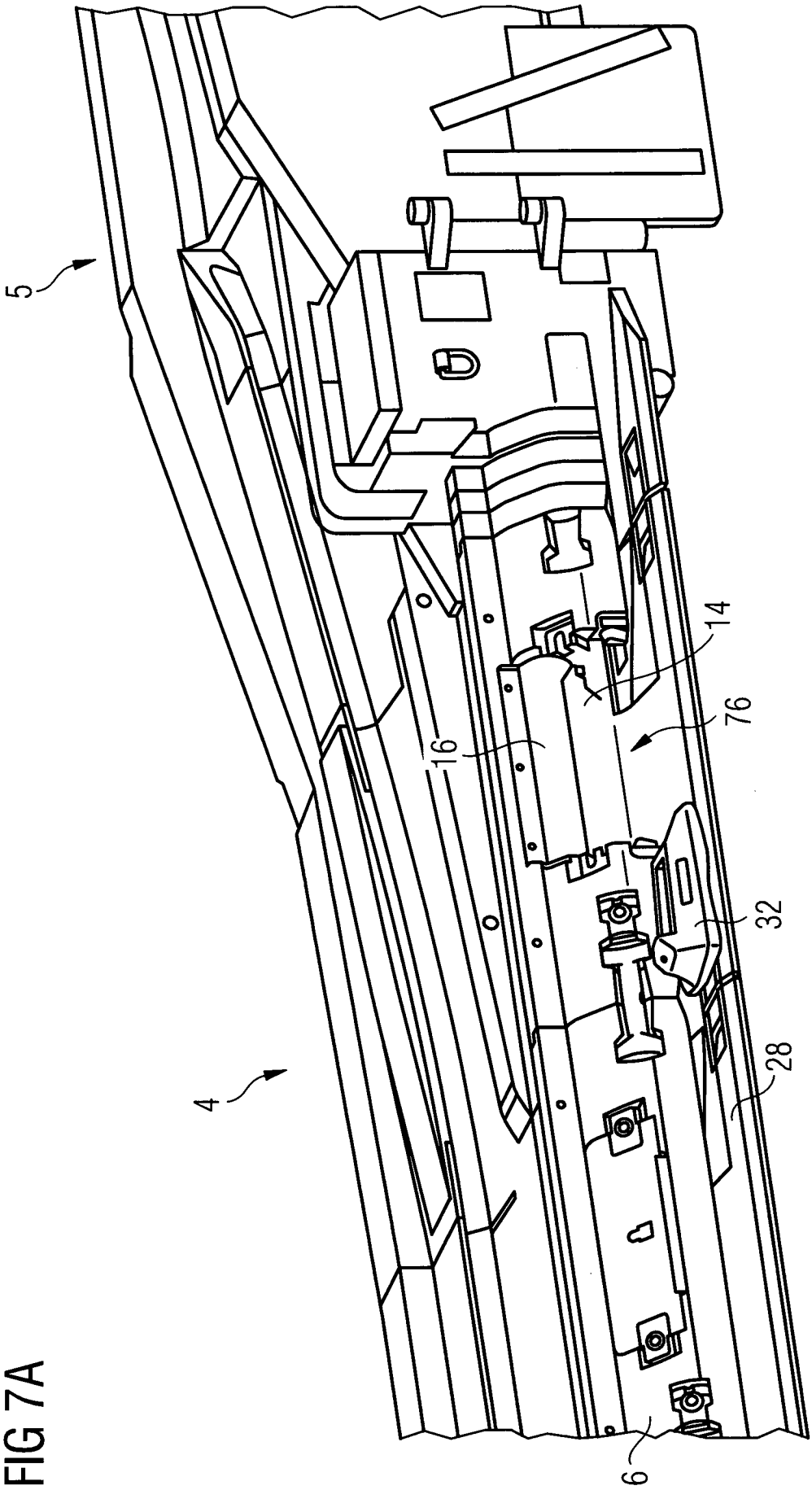


FIG 7A

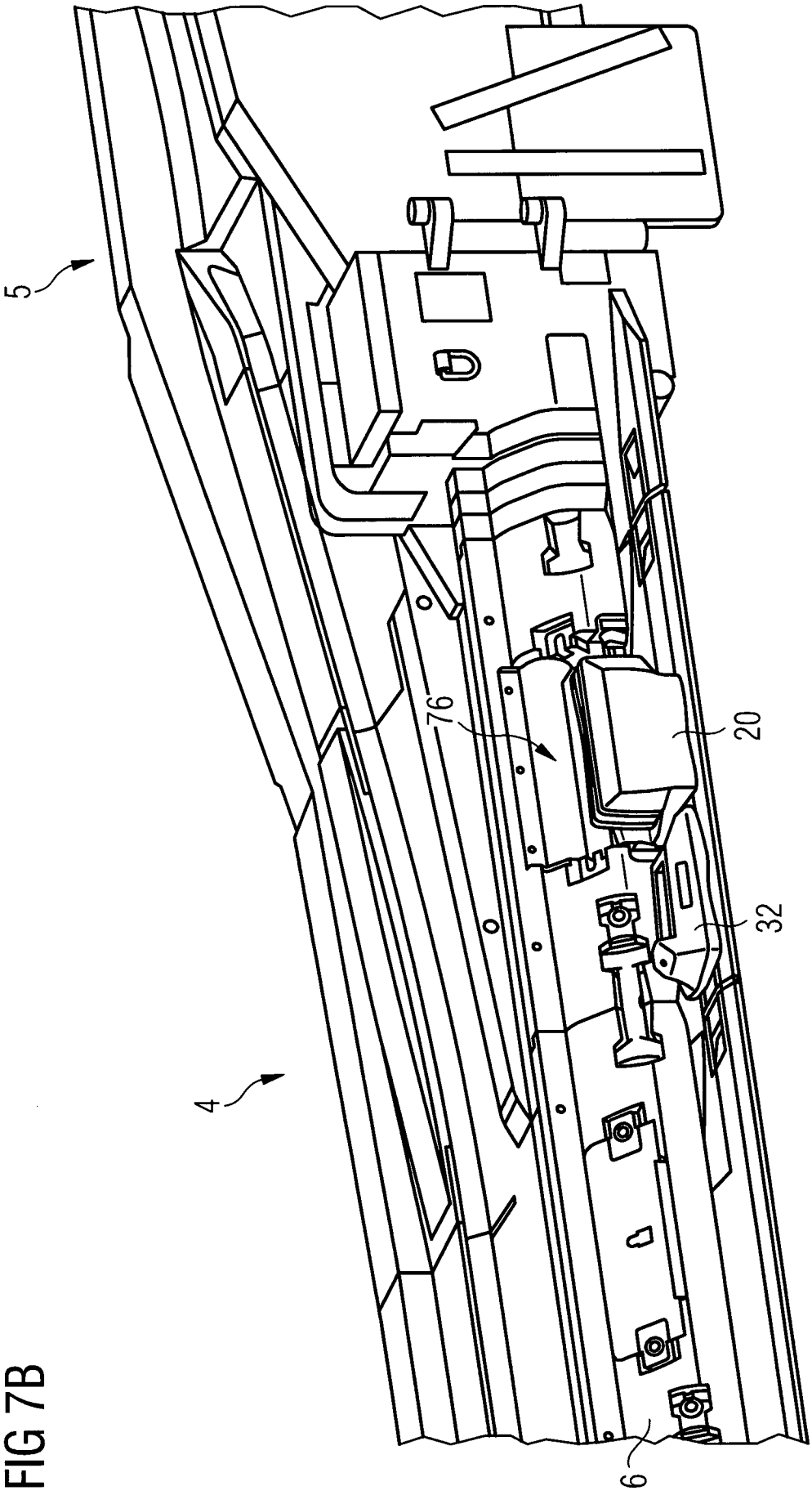


FIG 7B

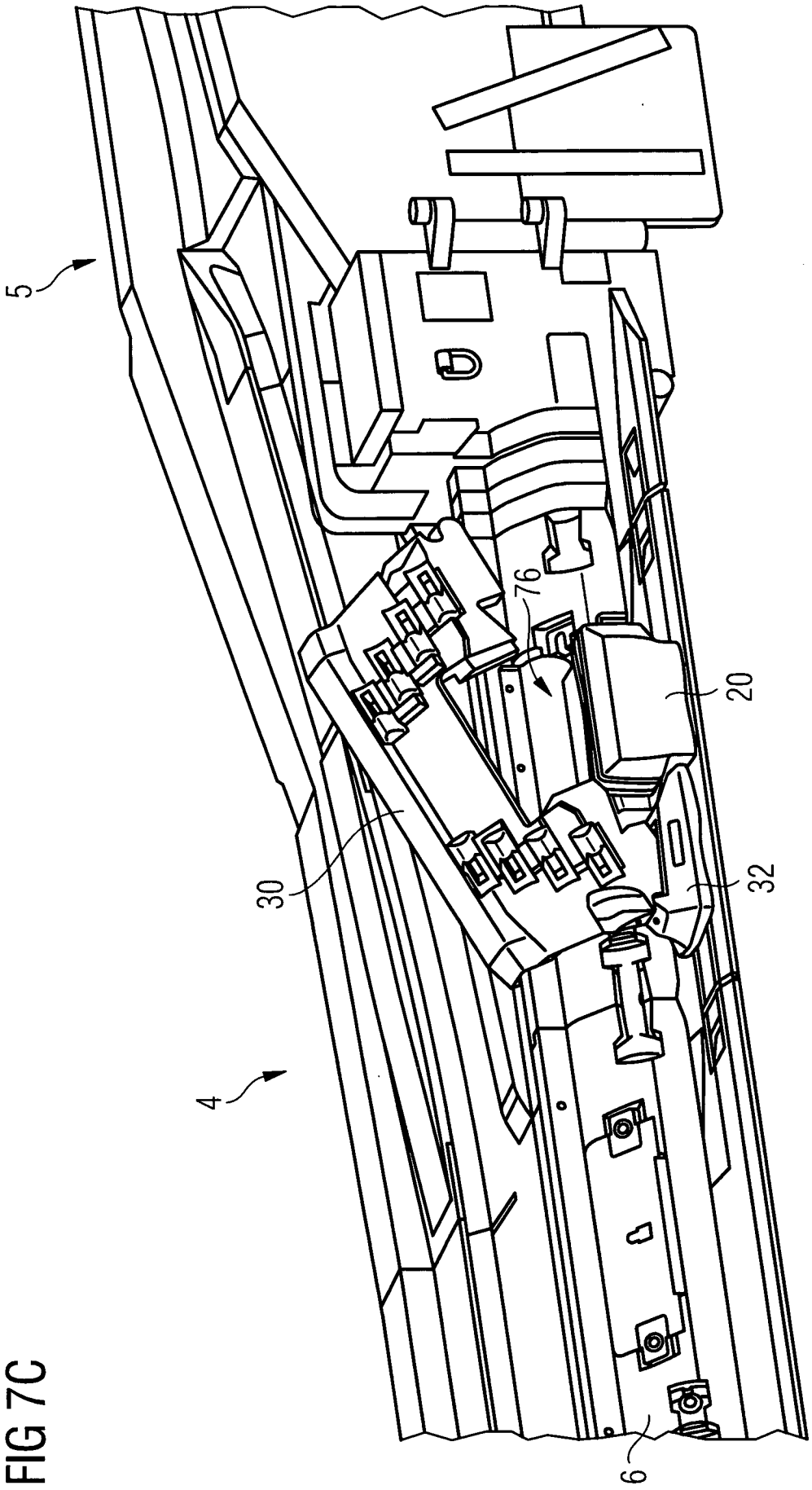


FIG 7C

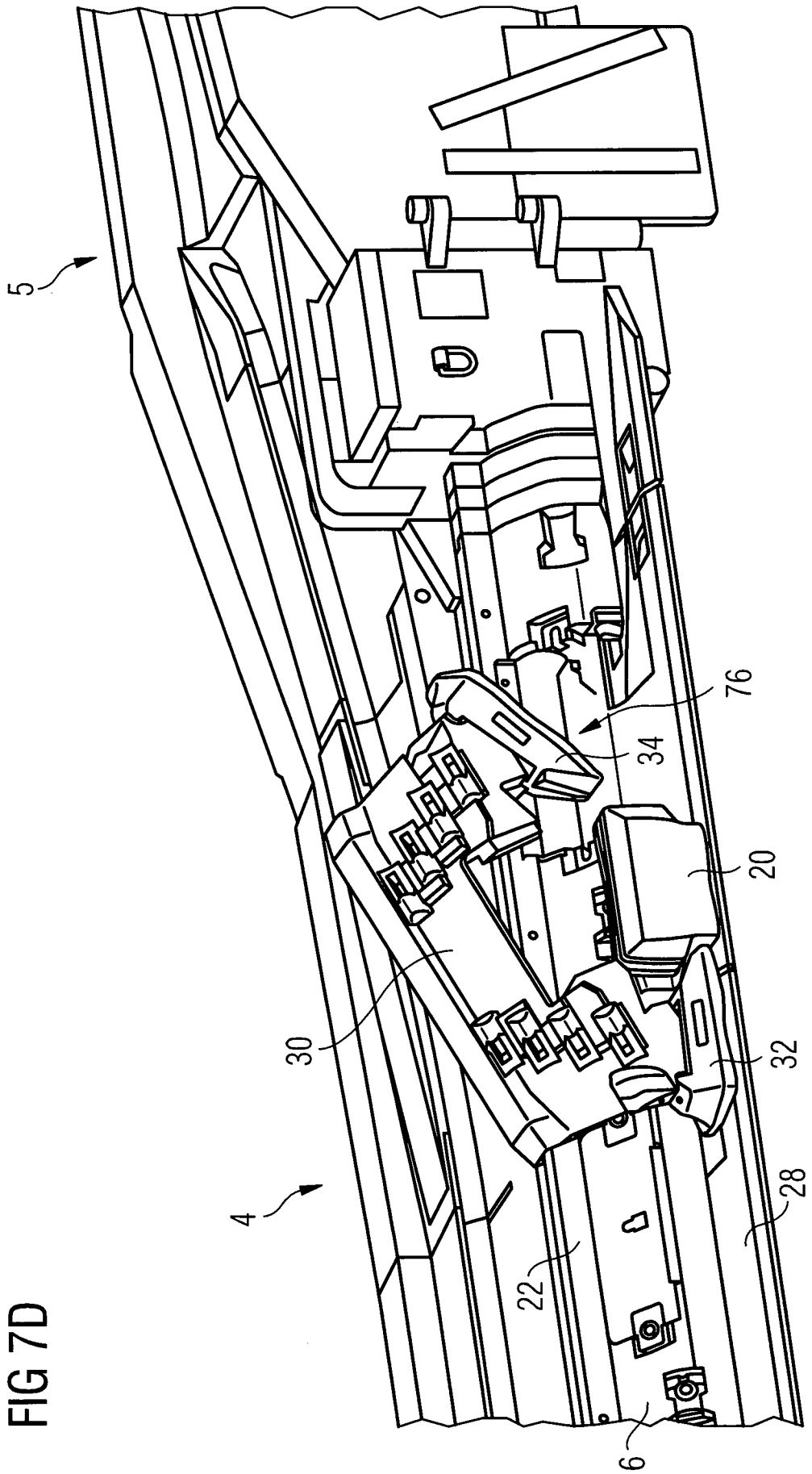


FIG 7D

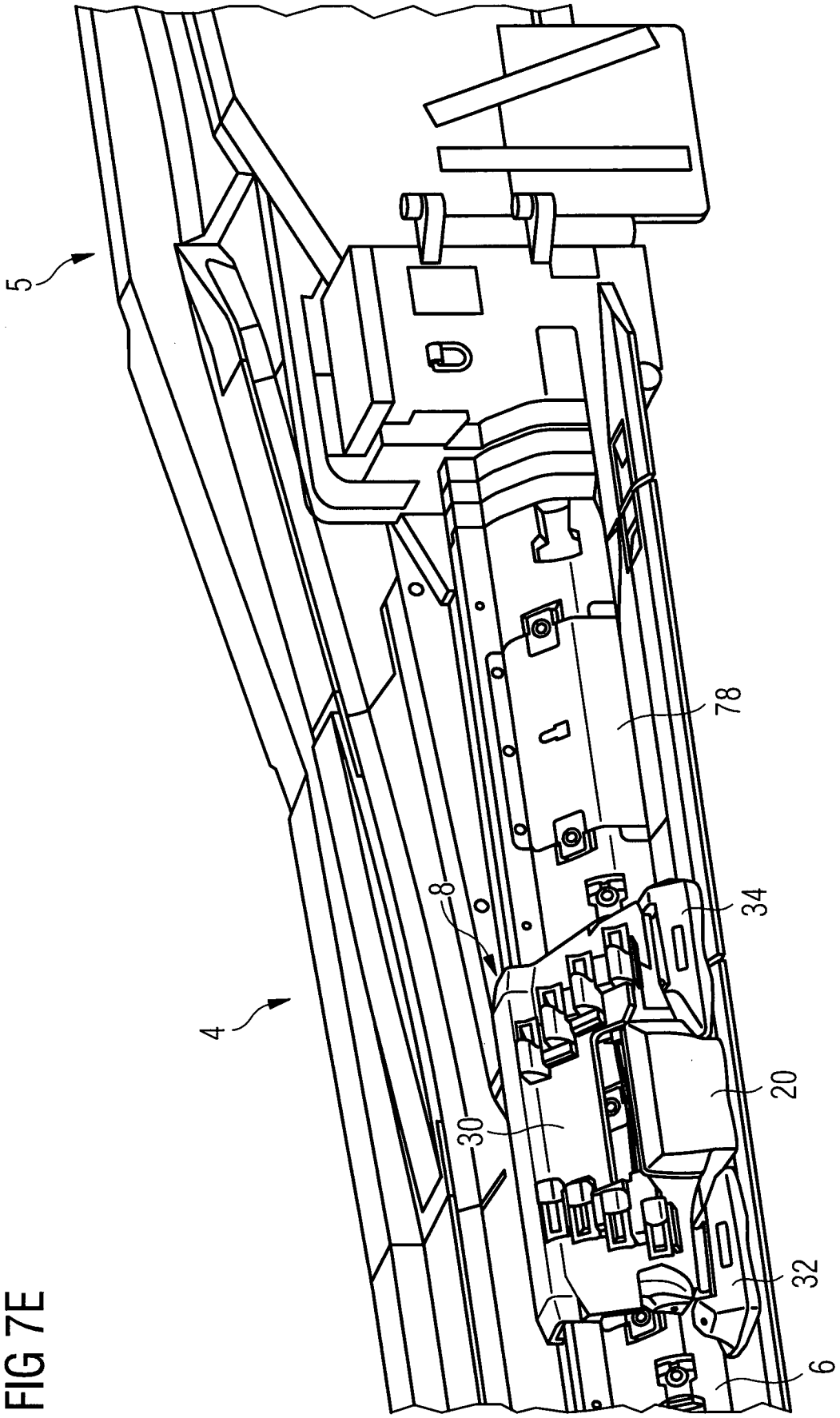


FIG 7E

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/001000

A. CLASSIFICATION OF SUBJECT MATTER
INV. E21C27/34 E21C35/08 E21C27/32
ADD.

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)
E21C

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)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2012/038204 A1 (KLABISCH ADAM [DE] ET AL) 16 February 2012 (2012-02-16) page 2, paragraph 23 - page 3, paragraph 26; figures 1,2	1-15
X	US 4 583 785 A (BREUER OSWALD [DE] ET AL) 22 April 1986 (1986-04-22) column 4 - column 5; figures 1,2	1-3,12, 13
A	US 2015/084396 A1 (HESSE NORBERT [DE] ET AL) 26 March 2015 (2015-03-26) figure 3	1-15
A	US 4 407 546 A (BRAUEN ERNST [DE] ET AL) 4 October 1983 (1983-10-04) figure 3	1-15

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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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 such 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
16 August 2016	26/08/2016

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Morrish, Susan

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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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1

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Information on patent family members

International application No
PCT/EP2016/001000

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