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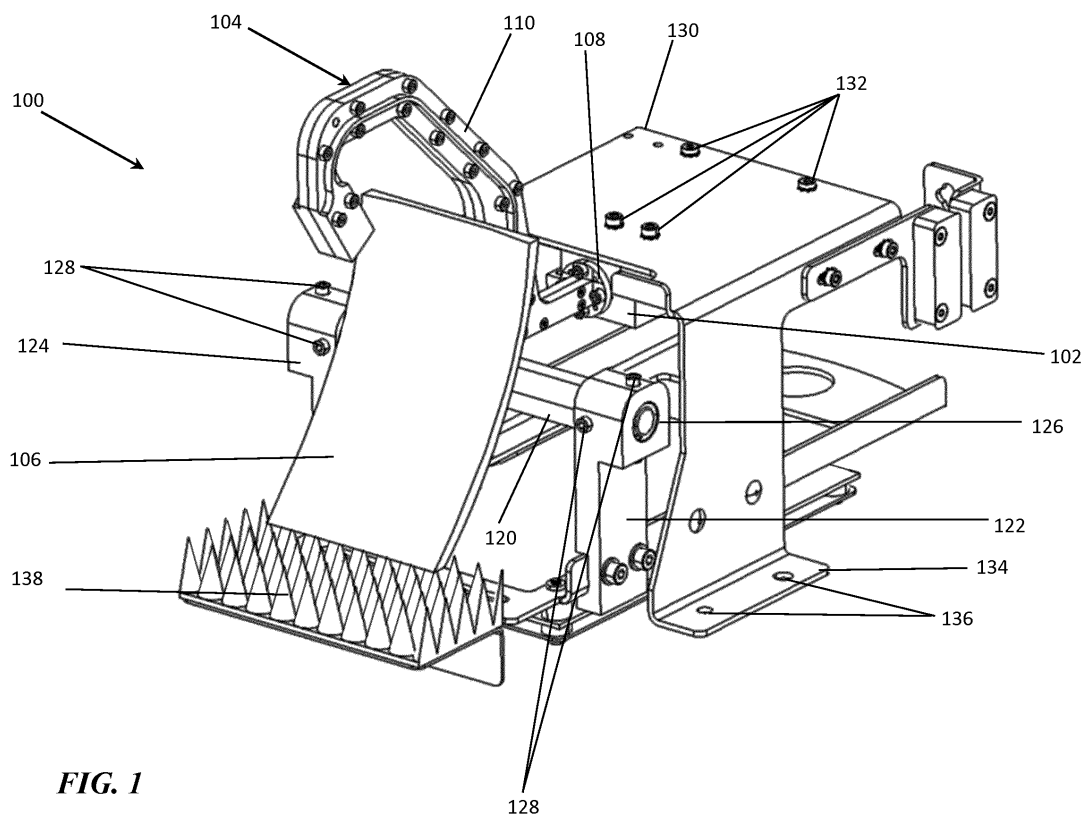
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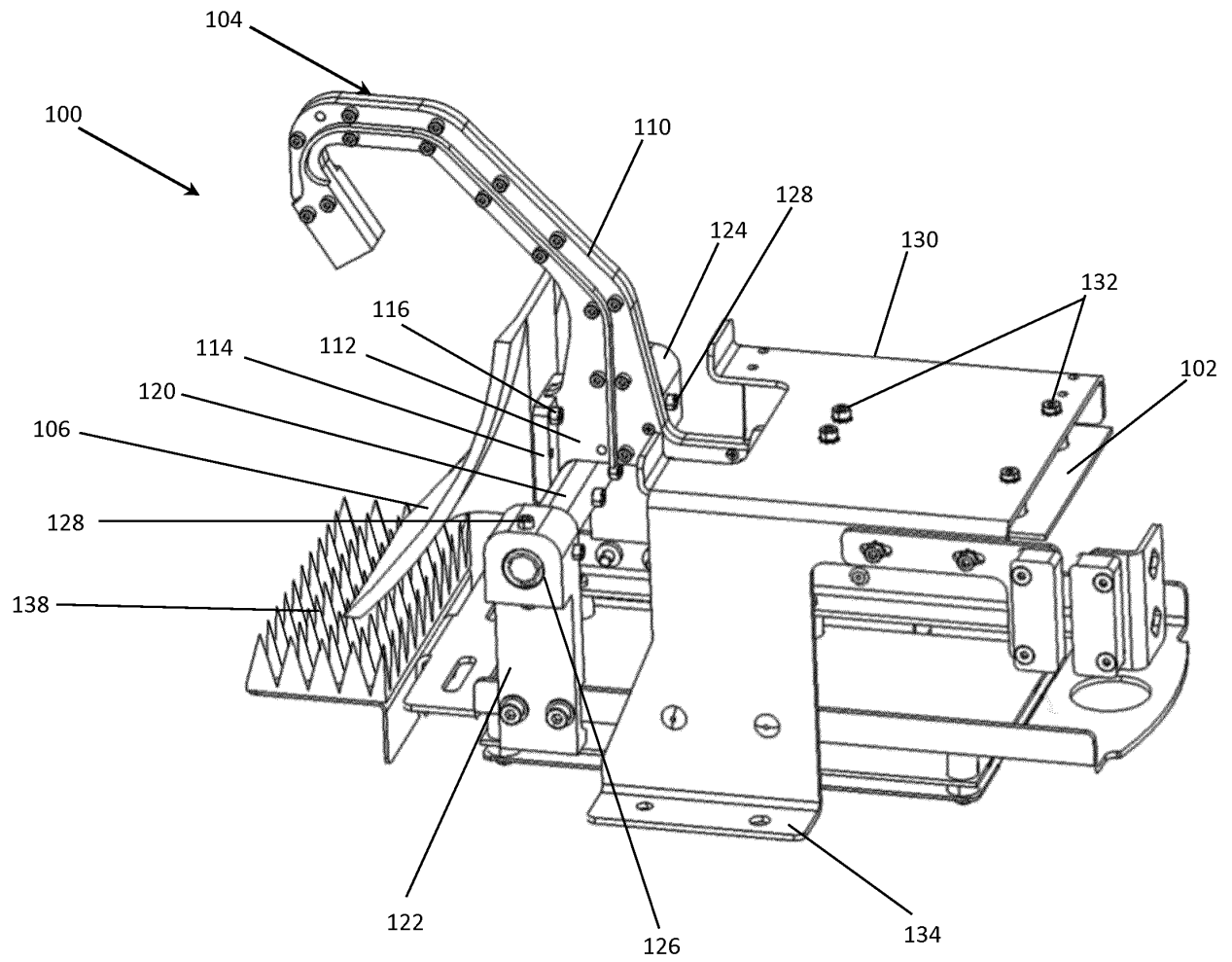
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(54) **MICROWAVE ANTENNA**

(57) A microwave antenna for detecting obstacles in a railway is disclosed which permits fine adjustment of the orientation of the antenna. The antenna comprises a waveguide attached to a radar transceiver, a reflector element, and a pivot bar. The pivot bar is fastened to the waveguide and the reflector element and is configured to stabilize and fasten together the waveguide and the reflector element. The pivot bar is mounted via a plurality of threaded fasteners that permit adjustment of the orientation of the pivot bar and the reflector element.



**FIG. 1**



**FIG. 2**

## Description

### Technical Field

**[0001]** The present disclosure relates to a microwave antenna, and in particular relates to a microwave antenna for detecting obstacles in a railway.

### Background

**[0002]** Modern railways use systems to detect obstacles in the railway, for instance at a railway crossing where the railway intersects a road. One such detection system involves a radar system oriented to detect objects in the railway.

**[0003]** The orientation of the radar system's antenna must be accurate to ensure the targeting zone of the radar covers the area of interest. It is not uncommon for the radar system to have a working range of 50 m to ensure adequate coverage of a railway crossing. A change in the antenna orientation of 1 degree will result in an approximately 1 m change in the targeting zone at 50 m, which can be sufficient for the radar to miss an obstacle. For instance, if the 1 degree change is in the inclination axis, the targeting zone may move above or below an obstacle.

**[0004]** When the antenna is replaced during servicing a loss of the desired targeting usually occurs. The origin of the loss is the combined effects of manufacturing and assembly tolerances of the antenna components and the assembly to which the antenna is mounted. As a result, it is often necessary to re-adjust the antenna after replacement to ensure the targeting zone of the radar covers the area of interest.

### Summary of the Disclosure

**[0005]** In an aspect of the present disclosure, a microwave antenna for detecting obstacles in a railway is provided. The microwave antenna comprises a radar transceiver, a waveguide attached to the radar transceiver, and a reflector element. A pivot bar is fastened to the waveguide and the reflector element, the pivot bar being configured to stabilize and fasten together the waveguide and the reflector element in accordance with predetermined relative positions and angles thereof. The pivot bar is mounted via a plurality of threaded fasteners that adjust the orientation of the pivot bar and the reflector element.

**[0006]** Other features and aspects of this disclosure will be apparent from the following description and the accompanying drawings.

### Brief Description of the Drawings

**[0007]**

FIG. 1 illustrates a front perspective view of a micro-

wave antenna according to one embodiment of the present disclosure;

FIG. 2 illustrates a rear perspective view of the microwave antenna of FIG. 1; and

FIG. 3 illustrates a side view of the microwave antenna of FIG. 1.

### Detailed Description

**[0008]** 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.

**[0009]** FIG. 1 illustrates a microwave antenna 100 for detecting obstacles in a railway according to an embodiment of the disclosure. The microwave antenna 100 comprises a radar transceiver 102, a waveguide 104 and a reflector element 106. One end 108 of the waveguide 104 is fastened to the radar transceiver 102. The waveguide 104 has a neck 110, at a base 112 of which there may be provided a flange 114, as seen in FIG. 2. The reflector element 106 may be fastened to the flange 114 using fasteners 116.

**[0010]** The microwave antenna 100 further comprises a pivot bar 120 that is fastened to the waveguide 104 and the reflector element 106. The pivot bar 120 may be fastened to the flange 114 of the waveguide 104.

**[0011]** First and second arms 122, 124 may be provided spaced apart from each other and configured to receive opposite ends of the pivot bar 120 in an opening 126 formed in each arm 122, 124. The pivot bar 120 may be mounted to the arms 122, 124 via a plurality of threaded fasteners 128. In other embodiment, the pivot bar 120 may be mounted via the threaded fasteners 128 in other arrangements. For instance, the pivot bar 120 may be mounted to only one of the arms 122, 124 via the threaded fasteners 128.

**[0012]** The pivot bar 120 acts to stabilize and fasten together the waveguide 104 and the reflector element 106 in accordance with predetermined relative positions and angles thereof. In the embodiment shown in FIG. 2, the base 112 of the waveguide 104 rests on the pivot bar, providing further stability.

**[0013]** Referring now to FIG. 3, the arrangement of the threaded fasteners can be seen in more detail. The pivot bar 120 is mounted to each arm 122, 124 via four threaded fasteners 128 arranged in two pairs, one of which extends generally horizontally and the other of which ex-

tends generally vertically as shown in FIG. 3. Each pair of threaded fasteners 128 is provided in an opposed configuration, one to each side of the opening 126, and engage threaded holes (not shown) formed in each arm 122, 124 such that the threaded fasteners 128 extend into the opening 126. The pivot bar 120 is held between the threaded fasteners 128. As best seen in FIG. 1, the pairs of threaded fasteners 128 may be spaced slightly apart from each other along the pivot bar 120.

**[0014]** The threaded fasteners 128 permit adjustment of the orientation of the pivot bar 120 and the reflector element 106 fastened thereto, which in turn adjusts a targeting zone of a radar system incorporating the microwave antenna 100. The pairs of threaded fasteners 128 may be arranged in two axes such that orientation of the pivot bar 120 and the reflector element 106 may be adjusted in two axes. In a preferred arrangement, the threaded fasteners 128 are configured to adjust the azimuthal and inclination orientations of the pivot bar 120 and reflector element 106.

**[0015]** The threaded fasteners 128 may comprise fine adjustment screws having at least 100 threads-per-inch to allow fine adjustment of the orientation of the pivot bar 120 and the reflector element 106. In addition to providing fine adjustment of the pivot bar 120's orientation, the opposed configuration of the threaded fasteners 128 also provides a secure mounting for the pivot bar 120.

**[0016]** The microwave antenna 100 may further comprising a frame 130 to which the first and second arms 122, 124 are fastened. The radar transceiver 102 may also be fastened to the frame 130 using fasteners 132. The fasteners 132 may be loosened prior to adjusting the orientation of the pivot bar 120 and the reflector element 106 using the threaded fasteners 128. Since the waveguide 104 is fastened to the pivot bar 120 and the radar transceiver 102 is fastened to the waveguide 104, adjusting the orientation of the pivot bar 120 also results in movement of the radar transceiver 102 relative to the frame 130. Loosening the fasteners 132 permits movement of the radar transceiver 102 relative to the frame 130 without inducing stress on the components. One adjustment of the pivot bar 120 is completed, the fasteners 132 may be refastened to secure the radar transceiver 102 to the frame and help hold the adjusted orientation of the pivot bar 120 and reflector element 106.

**[0017]** The frame 130 has mounting flanges 134 provided on each side of the frame 130. Each mounting flange 134 has holes 136 formed therein that may be used to mount the microwave antenna 100 in use. The threaded fasteners 128 permit adjustment of the orientation of the pivot bar 120 and reflector element 106 relative to the frame 130.

**[0018]** The frame 130 may have a portion of microwave absorber 138 attached thereto. The microwave absorber 138 is provided adjacent to the reflector element 106.

**[0019]** 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 Application

**[0020]** Embodiments of the disclosure provide a microwave antenna 100 for detecting obstacles in a railway, in which orientation of the microwave antenna 100 may be adjusted with fine precision and in a simple and convenient manner. Such a microwave antenna 100 may reduce installation time during replacement or servicing of microwave antennas.

**[0021]** 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 embodiments without departing from the spirit and scope of the disclosure. Such embodiments should be understood to fall within the scope of the present disclosure as set forth in the claims.

#### Claims

1. A microwave antenna (100) for detecting obstacles in a railway, comprising:
  - a radar transceiver (102);
  - a waveguide (104) attached to the radar transceiver (102);
  - a reflector element (106);
  - a pivot bar (120) fastened to the waveguide (104) and the reflector element (106), the pivot bar configured to stabilize and fasten together the waveguide and the reflector element in accordance with predetermined relative positions and angles thereof; and
  - the pivot bar being mounted via a plurality of threaded fasteners (128) that adjust the orientation of the pivot bar and the reflector element.
2. The microwave antenna of claim 1, further comprising first and second arms (122, 124) spaced apart and configured to receive opposite ends of the pivot bar (120), wherein the pivot bar is mounted to at least one of the arms via the plurality of threaded fasteners.
3. The microwave antenna of claim 2, wherein the pivot bar (120) is mounted to both of the arms (122, 124) via the plurality of threaded fasteners (128).
4. The microwave antenna of claim 2 or 3, wherein the pivot bar (120) is mounted to the or each arm (122, 124) via two pairs of threaded fasteners (128), each pair of threaded fasteners arranged in an opposed configuration with the pivot bar provided therebetween.

5. The microwave antenna of any of claims 2 to 4, further comprising a frame (130) to which the first and second arms (122, 124) and radar transceiver (102) are fastened, wherein the threaded fasteners (128) are configured to adjust the orientation of the pivot bar (120) and reflector element (106) relative to the frame. 5
6. The microwave antenna of any preceding claim, wherein the threaded fasteners (128) are configured to adjust the orientation of the pivot bar (120) and reflector element (106) in two axes. 10
7. The microwave antenna of any preceding claim, wherein the threaded fasteners (128) are configured to adjust the azimuthal orientation of the pivot bar (120) and reflector element (106). 15
8. The microwave antenna of any preceding claim, wherein the threaded fasteners (128) are configured to adjust the inclination orientation of the pivot bar (120) and reflector element (106). 20
9. The microwave antenna of any preceding claim, wherein the threaded fasteners (128) comprise screws having at least 100 threads-per-inch. 25
10. The microwave antenna of any preceding claim, wherein the waveguide (104) further comprises a flange (114), the reflector element (106) being fastened to the flange and the pivot bar (120) being fastened to the flange and the reflector element. 30

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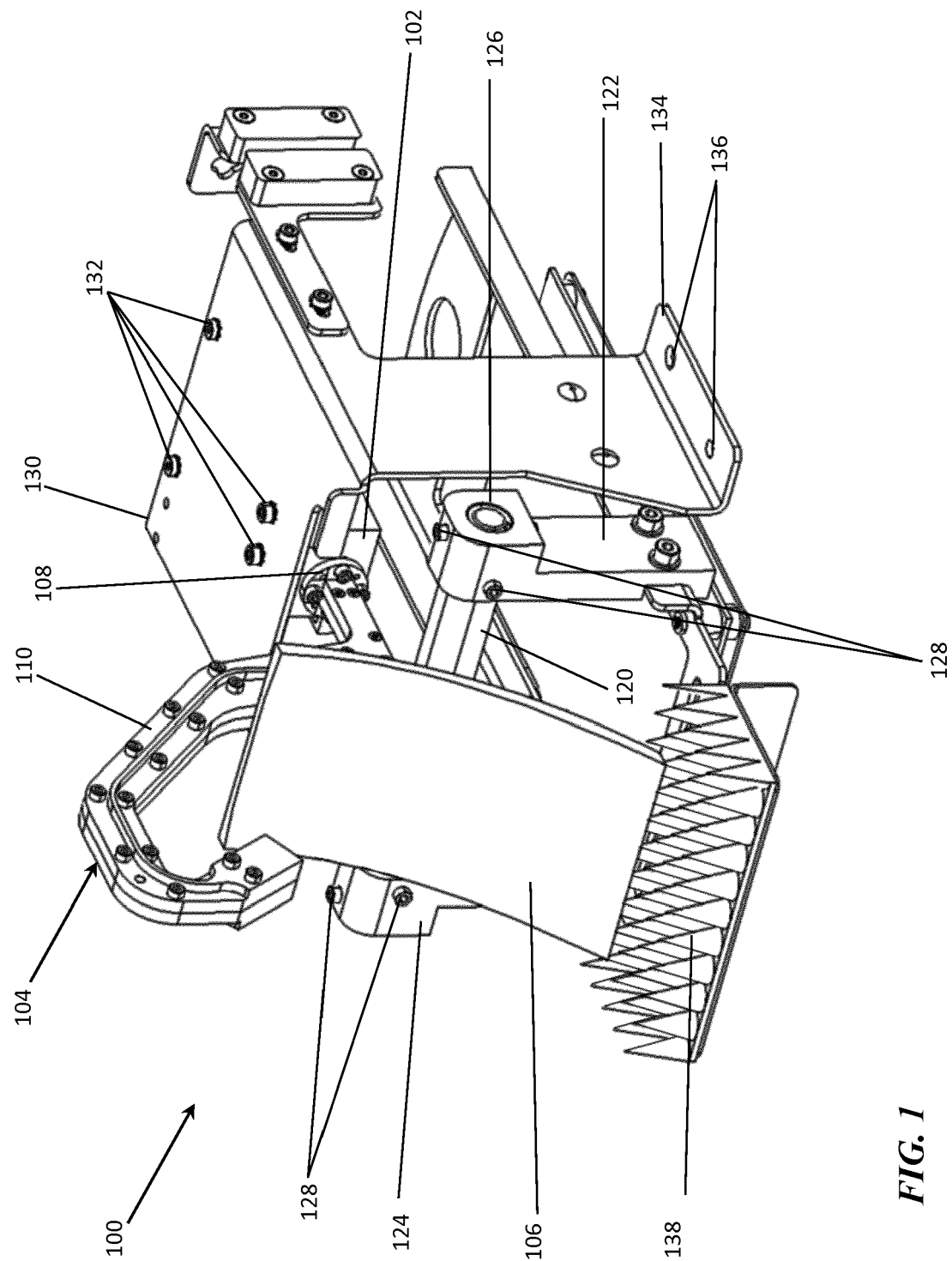


FIG. 1

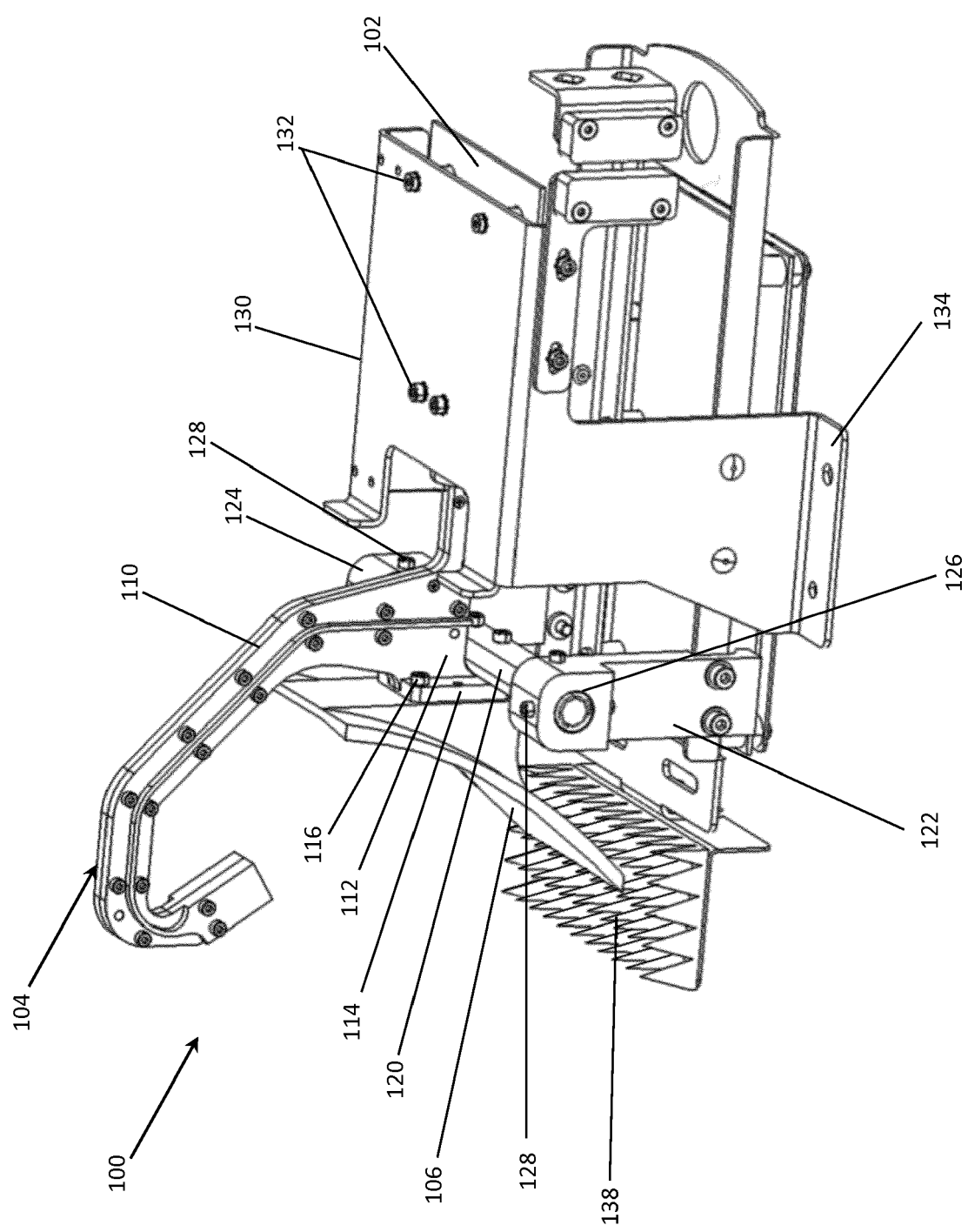
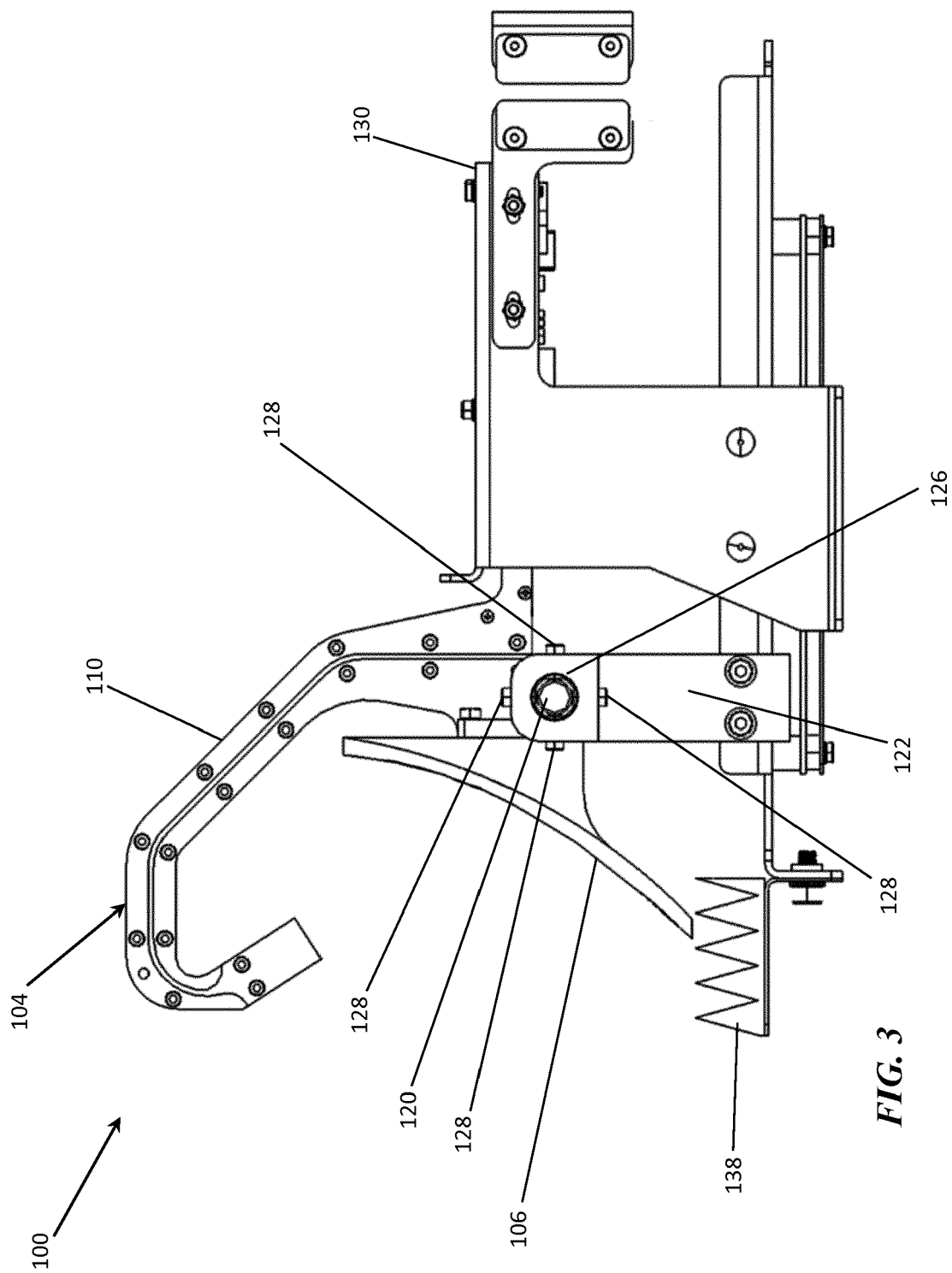


FIG. 2



**FIG. 3**



## EUROPEAN SEARCH REPORT

Application Number  
EP 17 16 3987

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| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                    |                                                              |                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|-----------------------------------------|
| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                                                                      | Relevant to claim                                            | CLASSIFICATION OF THE APPLICATION (IPC) |
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| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | * paragraph [0022] - paragraph [0024];<br>figures 1-4 *<br>* paragraph [0044] *<br>* paragraph [0052] - paragraph [0059] *<br>* paragraph [0067] * | 10                                                           |                                         |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | -----<br>US 5 870 062 A (COX GARY A [AU])<br>9 February 1999 (1999-02-09)<br>* column 2, line 42 - column 3, line 51;<br>figure 1 *                | 10                                                           |                                         |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | -----<br>US 2011/156948 A1 (BEREJIK ZACHARIA [IL])<br>30 June 2011 (2011-06-30)<br>* paragraph [0062] - paragraph [0068];<br>figure 1 *            | 1-10                                                         |                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | -----                                                                                                                                              |                                                              |                                         |
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| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                    |                                                              |                                         |
| Place of search<br><b>The Hague</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                    | Date of completion of the search<br><b>29 September 2017</b> | Examiner<br><b>La Casta Muñoa, S</b>    |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                                                                                                                                    |                                                              |                                         |

**ANNEX TO THE EUROPEAN SEARCH REPORT  
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
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