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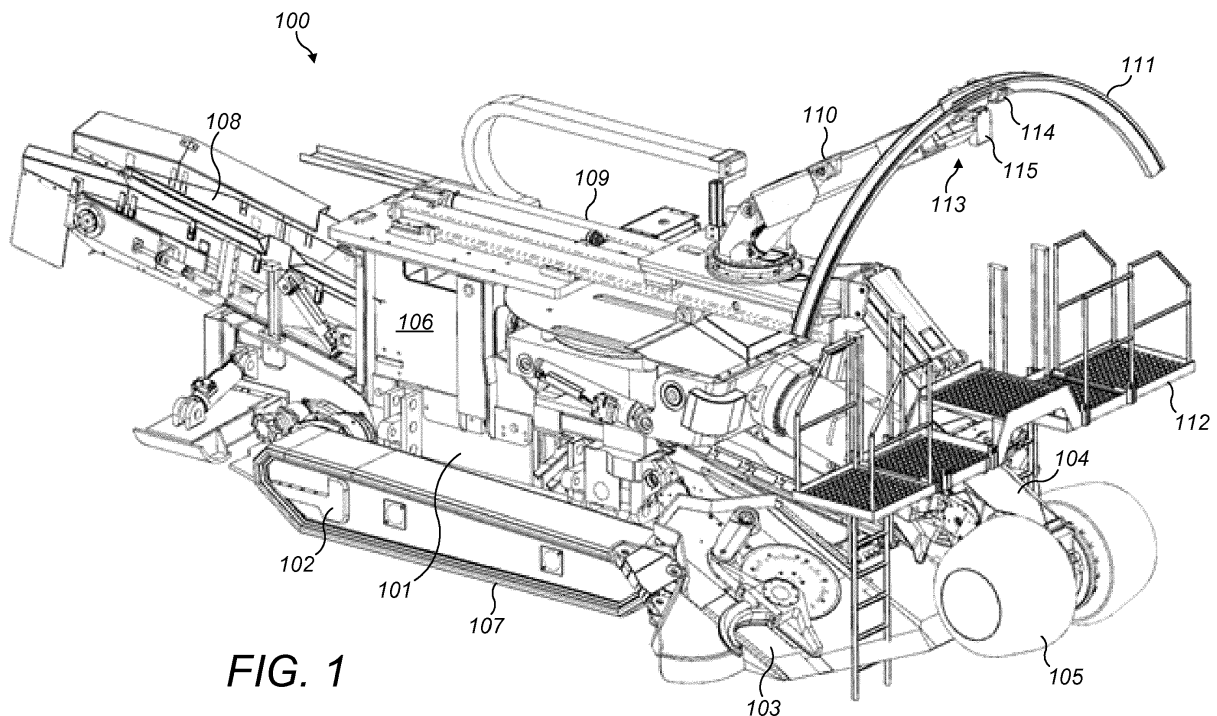
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(54) **Tunnel support installation apparatus**

(57) Apparatus to install structural supports in a mine tunnel. The apparatus is conveniently mountable on a mining machine having a cutting head (105) mounted at one end of a boom. An extendable and slewing manip-

ulator arm (110) is mounted on a support platform that is slidable in the axial forward and rearward direction and comprises a grasping device to hold the structural supports (111) in a plurality of different positions.



**FIG. 1**

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## Description

### Field of invention

**[0001]** The present invention relates to apparatus to install structural supports in a mine tunnel and in particular, although not exclusively, to a mining machine mounted assembly having an extendable arm to transport and hold the supports for attachment to the tunnel roof or walls.

### Background art

**[0002]** Mobile mining machines have been developed to provide both direct cutting at the rock face and rapid road and tunnel development within the mine. Typically, a mobile tunnel development machine comprises a rotatable cutting head having bits provided on rotating drums to break the rock face. The cutting head is mounted at a movable boom to create the tunnel with the desired width and height. As the cutting head is rotated and advanced into the face, extracted material is gathered by a gathering head and conveyed rearwardly via machine mounted conveying apparatus.

**[0003]** To secure the tunnel as the mining machine is advanced, it is common to support the roof and walls with a framework that may be formed from beams, arches or webbing. Rock or roof bolting is also widely used in which long bolts are embedded in the tunnel roof to support plates that extends transverse across the tunnel. Example 'bolter mines' are described in US 2003/0111892 and DE 3108877.

**[0004]** A variety of alternative machines have been developed for structurally supporting the mine tunnel by arch segments or sheet material with examples described in US 2012/0213598; EP 0383456; DE 19533904; CN 202668552 and RU 505799. In particular, WO 2013/110104 describes a tunnelling machine to provide simultaneous erection of a supporting archway structure and cutting of the rock face via a rotating cutting head. Each arch segment is manipulated and held in position by a movable telescopic arm that may be moved in the forward and rearward direction via a rail mounted assembly positioned at the upper region of the self-propelled mining machine.

**[0005]** However, conventional mining machine arrangements are disadvantageous for a number of reasons. In particular, it is typically required for personnel to stand at the forward end of the machine so as to manually manipulate the arch segments into correct position whilst being supported by the extendable arm. Due to the positional and movement limitations of such personnel working platforms, mounted at the machine, it is often difficult for the personnel to work safely and comfortably for sustained periods. Additionally, existing assemblies comprise multiple and separate components such as a lifting cranes that are configured to cooperate with an extendable arm to bring the arch supports into the raised

position. Existing structural support manipulators are therefore heavy and add considerable load and stress to the machine frame and motor. In particular, it is not uncommon for parts of the machine frame or components of the motor to crack due to stress concentrations when supporting the considerable mass of the manipulator assembly. Accordingly, what is required is apparatus to install structural supports in a mine tunnel that addresses the above problems.

### Summary of the Invention

**[0006]** It is an objective of the present invention to provide apparatus mountable at a mining machine configured to manipulate and hold mine tunnel support members at a position of a mine tunnel roof and/or wall. It is a further specific objective to provide apparatus having a manipulator arm and working platform that are collectively and independently movable at the mining machine having a plurality of available movement types and movement directions. It is a further specific objective to provide apparatus to support a movable personnel working platform that may be extendable in a sideways direction across the machine, may be moved in a forward and rearward direction along the machine and may be raised and lowered relative to the machine.

**[0007]** The objectives are provided via the present apparatus in which an extendable roof support manipulator arm and optionally a personnel working platform are movably mounted relative to a fixed base. Accordingly an assembly is provided of reduced weight relative to existing manipulator assemblies that offers a greatly extended range of movement of the manipulator arm. Such an arrangement provides for the efficient and reliable carriage and support of roof and wall lining members. Additionally where the apparatus comprises a working platform personnel are enabled to access a greater range of locations at the raised and forward position of the mining machine in close proximity to the roof and wall where the support members are to be affixed.

**[0008]** Additionally, the objectives are achieved via the mounting of an extendable arm upon a slewing device to allow the extendable arm to conveniently and reliably engage a roof support at the region of the floor of the tunnel and then to carry the roof support in vertical, forward and lateral directions relative to the apparatus so as to bring support at a raised position in contact with the tunnel roof. The extendable arm is accordingly pivotally mounted at the slewing device via one or a plurality of pivot mountings.

**[0009]** Advantageously, the extendable arm comprises a gripping device having at least one holding pocket to at least partially receive a portion of the structural support and maintain secure contact with the support as it is transported from a lateral lower to a central raised position above the mining machine. The gripping device may comprise a plurality of holding pockets to grasp independently a plurality of roof supports that may be

moved collectively relative to the mining machine. A single extendable arm is beneficial to minimise the overall weight of the apparatus and the mining machine whilst providing a versatile mechanism for lifting and transporting the roof supports within the vicinity immediately surrounding the mining machine including in particular the lateral sides, region above and in front of the mining machine. Optionally, the extendable arm may also be configured to engage and transport the roof support in the region behind the mining machine.

**[0010]** In particular, the present apparatus may comprise a support platform that is movably mounted relative to a fixed base via at least one elongate guiderail such that the support platform is capable of moving in a forward and rearward direction along the guiderail. In addition, the guiderail via at least one rail mount is cantilevered and slidably mounted at the fixed base. This provides that the elongate guiderail is capable of sliding in a forward and rearward direction relative to the fixed base such that a majority of the length of the guiderail is configured to project forward of the support platform when moved to its axially forwardmost position. Such an arrangement is advantageous to greatly extend the possible range of linear movement of the support platform in the forward and rearward direction. The support platform advantageously provides a mount for the extendable arm and the working platform such that both components may be moved collectively via an efficient linear movement of i) the support platform relative to the guiderail and ii) the guiderail relative to the fixed base. According to the present configuration, the working platform may be positionable immediately above a forwardmost end of the mining machine corresponding to the rotating cutting head that mounts the cutting bits in a use position. Alternatively, the working platform and manipulator arm may be moved rearwardly so as to be positioned over the mainframe and drive components of the mining machine to protect the manipulator assembly by positioning sufficiently rearward of the cutting head when the machine is operating in cutting mode. The present apparatus therefore is advantageous to avoid damage to the manipulator assembly via its available range of movement. By enabling the working platform and manipulator arm to be positioned at the very forward end of the machine, the mine roof and walls may be supported at the position immediately behind the cutting face to significantly reduce the risk of collapse. Versatility of the available positioning of the working platform via the present mounting arrangement provides a safe working environment for personnel in very close proximity to the cut face when installing roof and wall structural supports.

**[0011]** According to a first aspect of the present invention there is provided apparatus to install a structural support in a mine tunnel comprising: a support platform mounted and configured to slide in a forward and backward direction on a mining machine; an extendable arm, at its one end connected to a gripping device for gripping at least one structural support, in particular a support

arch, the arm mounted at the support platform; a slewing device mounting the extendable arm at the support platform to allow the arm to slew outwardly in a sideways direction from the apparatus; the arm being pivotally mounted at the slewing device to enable the gripping device to be raised and lowered relative to the support platform; the gripping device comprises at least one holding pocket for the structural support, in particular the support arch.

**[0012]** Preferably, the arm is telescopic having a head section and an extendable tail section. The extendable tail section further extends the available reach of the arm so as to be positionable immediately behind the cutting face.

**[0013]** Preferably, the apparatus comprises a base to mount the apparatus at a mobile mining machine; the support platform mounted on at least one guiderail and configured to slide in a forward and backward direction along the guiderail relative to the base; and at least one rail mount to slidably mount and allow the guiderail to slide in the forward and backward direction along the base.

**[0014]** The arm is advantageously pivotally mounted at the slewing device to enable a grasping end of the arm to be raised and lowered relative to the slewing device. Such a configuration is beneficial to firstly enable the arm to be moved to a substantially horizontal storage position when the apparatus is moved rearwardly during cutting operations and secondly to be tilted or inclined upwardly to position the arm grasping end at a fully elevated position in close proximity to the roof.

**[0015]** Preferably, axis of the slewing device is aligned substantially perpendicular to a pivoting axis by which the arm is pivotally mounted at the slewing device. Such an arrangement is advantageous to optimise the possible movement of the extendable arm such that grasping end is configured to access the majority of the space immediately surrounding the mining machine to engage, transport and hold the support members at a plurality of different positions.

**[0016]** Preferably, the pocket may comprise an elongated form extending substantially transverse including perpendicular, to a main length of the arm. In particular, the pocket may be formed as a part cylindrical segment, a cup shaped portion, a body having a channel or trough corresponding in shape and dimensions to a part of the structural support. Optionally, the at least one holding pocket comprises a plurality of hooked portions that engage spaced apart regions of the structural support so as to stabilise the transport of the structural support. Preferably, the holding pocket is configured to engage onto an underside and optionally the sides of the structural support so as to not obscure the upward facing surface of the support to allow convenient positioning and securement opposed to the roof.

**[0017]** Preferably, the gripping device is fastened to the arm in a pivotable manner via a hinge. The hinge may comprise a universal hinge such as a ball joint or a plu-

ality of hinges having pivoting axes aligned transverse and/or perpendicular to one another such that the gripping device may be pivoted relative to the arm in a plurality of pivoting axes and directions.

**[0018]** Preferably, the apparatus further comprises an adjustable bracket mounting the working platform at the support platform to allow the working platform to be raised and lowered relative to the support platform. Advantageously the working platform is mounted to be independently adjustable at the support platform relative to the arm. Such an arrangement is configured to provide a safe, convenient and comfortable working environment for personnel to cooperate with the extendable arm when manipulating the support members into position and holding the members as they are fixed to the roof or wall. Preferably, the bracket is pivotally mounted between the support platform and the working platform to allow the working platform to be raised and lowered above and below a height of the support platform. Pivot joints and couplings provide a reliable means of adjusting the position of the working platform and are suitably robust to withstand the dust and debris laden environment surrounding the mining machine.

**[0019]** Preferably, a distance in the forward and rearward direction over which the support platform is configured to slide on the guiderail is substantially equal to a distance in the forward and rearward direction over which the guiderail is configured to slide on the base. Accordingly, the arm and the platform are configured to move over an extended axial range between the very forwardmost end of the mining machine (above the cutting head) and a region towards the centre of the mining machine for safe storage rearwardly of the cutting head when the manipulator apparatus is not in use. Such an arrangement is also advantageous to install roof supports in close proximity and immediately behind the cutting face to avoid undesirable roof collapse.

**[0020]** Preferably, the apparatus further comprises at least one power operated actuator coupled to the support platform to move the support platform along the guiderail in the forward and rearward direction. Preferably, the apparatus further comprises at least one power operated actuator coupled to the guiderail to move the guiderail along the base in a forward and rearward direction. Preferably, the apparatus comprises a power operated actuator associated with the adjustable bracket that mounts the working platform to actuate pivoting of the bracket in the upward and downward direction. The actuators may comprise linear actuators such as hydraulic cylinders. Alternative actuators configured to provide the linear sliding movement of the support platform and guiderail and the pivoting action of the bracket may be provided including for example rack and pinion, chain, turnbuckle and pulley or wheel drive arrangements known to those skilled in the art.

**[0021]** Preferably, the working platform is elongate in a widthwise direction across the apparatus such that ends of the working platform extend outwardly beyond

respective sides of the support platform. Accordingly, where the apparatus is used to install elongate beams (for example curved arches) the platform comprises a length sufficient to be positioned under substantially the full length of the beam to provide unhindered access by personnel to manipulate all parts of the beam. Preferably, the working platform comprises folding or extendable regions such that the platform may be truncated in a storage mode and extended when in use so as to protect the platform when not in use and not to restrict manoeuvrability of the mining machine in the confined mine environment. Optionally, the working platform comprises a central region being raised above a pair of end regions in the height direction, the central region configured to sit and slide over the guiderail. Such an arrangement allows the working platform to be transported rearwardly over the guiderail such that the side portions are positioned immediately above the roof or canopy of the mining machine to reduce as far as possible the overall height of the machine in certain configurations.

**[0022]** According to a second aspect of the present invention there is provided a mobile mining machine comprising the apparatus as claimed herein configured to install structural supports within a mine tunnel.

**[0023]** According to a third aspect of the present invention there is provided apparatus to install structural supports in a mine tunnel comprising: an extendable arm to raise and hold supports at a position at or close to a mine tunnel roof; a working platform to allow personnel to stand on the apparatus at a location close to the arm; a base to mount the apparatus at a mobile mining machine; a support platform mounted on at least one guiderail and configured to slide in a forward and backward direction along the guiderail relative to the base, the arm and the working platform mounted at the support platform; characterised by: at least one rail mount to slidably mount and allow the guiderail to slide in the forward and backward direction along the base.

**[0024]** Preferably, the mining machine further comprises a cutting boom pivotally mounted at a mainframe and configured to support and allow a raising and lowering of a rotatable cutting head provided at a forward end of the machine. Preferably, the base is mounted on the mainframe such that the working platform is positionable substantially vertically above the cutting boom and/or the cutting head. The sliding guiderail is advantageous to greatly extend the range of travel of the extendable arm and working platform in the forward and rearward direction by providing a telescopic sliding support arrangement for the arm and working platform. In the fully extended position the guiderail is cantilever mounted at the base via a plurality of guiderail support mounts. Preferably, the apparatus comprises at least two and preferably at least four support mounts positioned approximately at each corner of the base so as to provide an effective cantilever mounting of the guiderail. Accordingly, the weight of the support platform, the extendable arm and working platform may be transferred reliably by a guide-

rail to the underlying base when moved to it fully forward-most position.

#### Brief description of drawings

**[0025]** A specific implementation of the present invention will now be described, by way of example only, and with reference to the accompanying drawings in which:

Figure 1 is a perspective view of a mobile mining machine comprising manipulator apparatus to install structural supports at the roof and walls of a mine tunnel according to a specific implementation of the present invention;

Figure 2 is a further perspective view of the mining machine of figure 1;

Figure 3 is a right side perspective view of the manipulator apparatus of figure 2;

Figure 4 is a left side perspective view of the manipulator apparatus of figure 2;

Figure 5 is a further right side perspective view of the manipulator apparatus of figure 3 showing safety railings and access ladders according to a specific implementation of the present invention;

Figure 6 is a perspective view of the mining machine of figure 2 with the manipulator assembly moved to a rearward position on a mining machine according to a specific implementation of the present invention;

Figure 7 is a further perspective view of the mining machine of figure 6 with a manipulator arm slewed in a sideways direction to extend outwardly from the mining machine of figure 6;

Figure 8 is further perspective view of the mining machine of figure 6 with the manipulator apparatus moved to a fully forward position such that a working platform is positioned vertically above a cutting head at a forward end of the machine;

Figure 9 is a further perspective view of the mining machine of figure 8 with the working platform fitted with the safety railings and ladders of figure 5.

#### Detailed description of preferred embodiment of the invention

**[0026]** Referring to figures 1 and 2, a mobile mining machine 100 comprises a mainframe 101 mounting a pair of endless tracks 107 via an undercarriage 102. A motor 106 is also carried by mainframe 101 and is positioned substantially centrally of the main body of machine 100. A rotatable cutting head indicated generally by ref-

erence 105 is positioned at a forward end of machine 100 and comprises a plurality of rotating drums that mount a plurality of cutting bits (not shown). Head 105 is mounted at mainframe 101 via an elongate boom 104 that is in turn pivotally mounted at its rearward end to mainframe 101. A gathering head 103 is also mounted at the machine forward end and is positioned below boom 104 so as to receive and gather material dislodged from the cutting face. Machine 100 further comprises a discharge conveyor 108 that extends rearwardly from gathering head 103 and projects rearwardly from the machine 100 behind motor 106.

**[0027]** Machine 100, typically referred to as a 'Road-header' is also configured for installation of mine tunnel structural support beams 111 at the tunnel roof and side-walls as created by the action of cutting head 105. This configuration is provided by a manipulator assembly indicated generally by reference 109 that is mounted generally at the upper region of machine 100. In particular, assembly 109 comprises an extendable manipulator arm 110 having a grasping end 113 configured to hold a beam 111 as it is raised from a tunnel floor level to a mounting position at the tunnel roof. Assembly 109 further comprises a personnel working platform 112 to support a number of working personnel 200 at the region of arm grasping end 113 such that personnel 200 may manipulate and affix beam 111 at the desired elevated position.

**[0028]** Grasping end 113 is formed as a specifically configured grasping or engaging device to hold beam 111 from below so as to allow the beam 111 to be presented to an underside surface of the roof. In particular, the grasping device comprises an elongate holding pocket 114 in the form of semi cylindrical cupped sections that are shaped and dimensioned to correspond approximately to an underside surface of beam 111. The main body that supports or defines holding pockets 114 is hingeably mounted at arm 110 via a pivot mount 115. According to the specific implementation, mount 115 comprises a ball joint to allow the holding pockets 114 to be orientated at an almost unlimited range of orientations relative to arm 110. Such an arrangement is advantageous to grasp beam 111 at any position at the lateral sides of machine 100 and then to raise the beam 111 to the positions of figures 1 and 2.

**[0029]** Figures 3 to 5 illustrate the assembly 109 removed from the machine 100 with various components removed for illustrative purposes. Assembly 109 comprises in particular a plate like base 300 capable of being mounted rigidly to machine mainframe 101 via a console 601 (illustrated in figure 6). Four rail mounts 304 project upwardly from an upward facing surface 317 of base 300. Rail mounts 304 are divided into pairs with each pair spaced apart in a widthwise direction across base 300. Two mounts are provided towards a forward end of base 300 with the remaining two mounts 304 provided towards a rearward end of base 300. The collective pairs of rail mounts 304 are configured to mount a guide rail indicated generally by reference 301 at the base 300 in a slidable

manner. Elongate guiderail 301 comprises a forward end 303 and rearward end 302 and a pair of elongate channels 318 recessed or indented in the guiderail sides, the channels 318 extending the length of guiderail 301 between the forward and rearward ends 303, 302. A guide shoe 319 is supported by each mount 304 and positioned to sit at least partially within each respective channel 318 so as to allow guiderail 301 to slide linearly in a forward and rearward direction over base 300. According to the specific implementation, an axial length of guiderail 301 is greater than a corresponding axial length of base 300. In particular, guiderail 301 is at least twice the length of base 300.

**[0030]** A plate like support platform 305 is slidably mounted on guiderail 301 via four platform mounts 306 that project from an underside surface of platform 305. At least a part of each mount 306 is engaged within each side channel 318 so as to allow platform 305 to slide in the forward and rearward direction along guiderail 301 independently of the axial movement of guiderail 301 relative to base 300. Assembly 109 further comprises at least one power operated linear actuator 800 (referring to figure 8) coupled to support platform 305 to move platform 305 along guiderail 301. Additionally, assembly 109 further comprises at least one power operated linear actuator (not shown) coupled to guiderail 301 to move guiderail 301 along the base 300. As will be appreciated, the sliding axial movement of the guiderail 301 at base 300 and the corresponding axial sliding movement of support platform 305 at guiderail 301 may be supported by appropriate wheels, rollers, bushings, bearings and other movement stabilising components such that guiderail 301 and platform 305 are suspended in a substantially 'floating' slidable configuration relative to base 300 that is rigidly mounted at mainframe 101.

**[0031]** Support platform 305 comprises a rearward end 410, a forward end 408 and respective sides 407. Assembly 109 further comprises a slewing device 307 comprising a conventional slew ring. A lower bracket of the slewing device 307 is rigidly mounted at an upward facing surface 320 of platform 305 whilst an upper slewing bracket provides a mount for extendable arm 110 via an upstanding arm bracket 409. Extendable arm 110 comprises a head portion 309 having a first end 312 coupled to arm bracket 409 via a pivot pin 311 and a free second end 313. An arm tail portion indicated generally by reference 310 is retractably mounted so as to be extendable from the second end 313 of head portion 309 via a telescopic mounting arrangement. Extension of tail portion 310 is actuated by at least one power operated actuator such as a hydraulic cylinder or the like. Accordingly, arm 110 is capable of being raised and lowered in the vertical direction via pivoting about pivot axis 406. Additionally, arm 110 is capable of slewing in a widthwise sideways direction about slewing axis 308 via slewing device 307. Accordingly, the arm grasping end 113 is capable of being moved to a position outwardly and downwardly relative to platform 305 so as to receive beam 111. Via the

slewing and pivoting action, arm 110 is configured to bring the beam 111 into the raised upper position of figures 1 and 2 for affixing to the tunnel roof and wall.

**[0032]** Working platform 112 is movably mounted at support platform 305 via a pivoting mechanical linkage 314 having a rearward end 400 (mounted at support platform 305) and a forward end 401 (mounted at working platform 112). Linkage 314 comprises a rearward set of pivot pins 315 and a forward set of pivot pins 316 at each respective rearward and forward end 400, 401. Accordingly, linkage 314 is capable of actuated pivoting so as to raise and lower working platform 112 in the upward and downward direction relative to support platform 305. In particular, linkage 314 may be substantially co-aligned at the same height as support platform 305 according to the configuration of figures 3 to 5 or may be lowered below the height level of platform 305 to the position of figures 1 and 9 when the assembly 109 is actuated so as to be displaced in its forwardmost position.

**[0033]** According to the specific implementation, working platform 112 is substantially elongate in a widthwise direction of machine 100 and comprises a central portion 402 mounted directly to the linkage forward end 401. A pair of end portions 403 project laterally outward from central portion 402 and mount a corresponding pair of platform wings 405 via respective hinges 404 to allow wings 405 to fold laterally outward from side portions 403. Accordingly, working platform 112 is extendable and retractable in the widthwise direction of machine 100. Central portion 402 is mounted at a raised position above side portions 403 such that central portion 402 is configured to sit above elongate guiderail 301 when the assembly 109 is configured in its rearwardmost position as shown in figures 3 to 7. That is, in this configuration working platform 112 is positioned rearwardly behind the rail forward end 303 with the platform end portions 403 projecting laterally outward to the side of each respective rail channel 318. Referring to figure 5, working platform 112 is configured to releasably mount a safety rail structure 501 so as to provide railings that at least partially surround platform 112 when laterally fully extended. Additionally, platform 112 provides a support structure for a plurality of ladders 500 having lowermost ends that are mountable on the mine floor to further stabilise and working platform 112 when used by personnel. According to further implementations, platform 112 may comprise suitable telescopic or pivot mounted struts or ladders to provide downwardly projecting ground engaging support legs.

**[0034]** Referring to figures 6 to 9 machine 100 is advantageously configured with a manipulator assembly 109 having working components 110, 112 that may be moved in the axial forward and rearward direction along machine 100 towards and away from cutting head 105. Figures 6 and 7 illustrate the assembly 109 in the rearward position with figures 8 and 9 illustrating the assembly 109 moved to its forwardmost position (with platform 112 positioned substantially vertically above cutting head

105). Machine 100 further comprises a canopy 600 positioned at a height above boom 104 and immediately below guiderail 301. Canopy 600 is positioned at a generally forward region of machine 100 immediately above a rearward end of gathering head 103. With manipulator assembly 109 located at its rearward position of figures 6 and 7, canopy 600 is accordingly exposed with arm 110 positioned substantially above the rearwardly projecting discharge conveyor 108 axially rearward of motor 106. Accordingly, in this position, manipulator assembly 109 does not restrict the pivoting movement of boom 104 to allow cutting head 105 to be raised and lowered during cutting operations. Additionally, platform 112 and arm 110 are maintained rearward of any material dislodged from the cutting face. The distribution of the weight of assembly 109 is also fully adjustable via the present arrangement so as to minimise fatigue of the machine 100 generally and those components 601 that support the assembly 109 via mainframe 101. In use, the support platform 305 and in particular arm 110 and working platform 112 may be displaced in the linear forward direction involving sliding movement of the guiderail 301 on base 300 and the corresponding sliding movement of support platform 305 on guiderail 301. Arm 110 may then be slewed in the lateral outward direction such that grasping end 113 is extended laterally outward in the widthwise direction beyond tracks 107 to take hold of support beam 111. Arm 110 may then be raised vertically via pivoting about axis 406 to allow support beam 111 to clear the working components of machine 100. The present assembly 109 therefore provides a linear telescopic arrangement to maximise the axial displacement of arm 110 and platform 112. With the support platform 305 displaced to its forwardmost position of figures 8 and 9, linkage 314 may then be pivoted so as to project generally downward from support platform 305 to lower working platform 112 downward towards boom 104 and cutting head 105. In this configuration, the rail forward end 303 and support platform 305 extend axially forward beyond canopy 600.

## Claims

1. Apparatus (109) to install a structural support (111) in a mine tunnel comprising:

a support platform (305) mounted and configured to slide in a forward and backward direction on a mining machine (100);  
 an extendable arm (110), at its one end connected to a gripping device for gripping at least one structural support (111), in particular a support arch, the arm (110) mounted at the support platform (305);  
 a slewing device (307) mounting the extendable arm (110) at the support platform (305) to allow the arm (110) to slew outwardly in a sideways

direction from the apparatus (109);  
 the arm (110) being pivotally mounted at the slewing device (307) to enable the gripping device to be raised and lowered relative to the support platform (305);  
 the gripping device comprises at least one holding pocket (114) for the structural support (111), in particular the support arch.

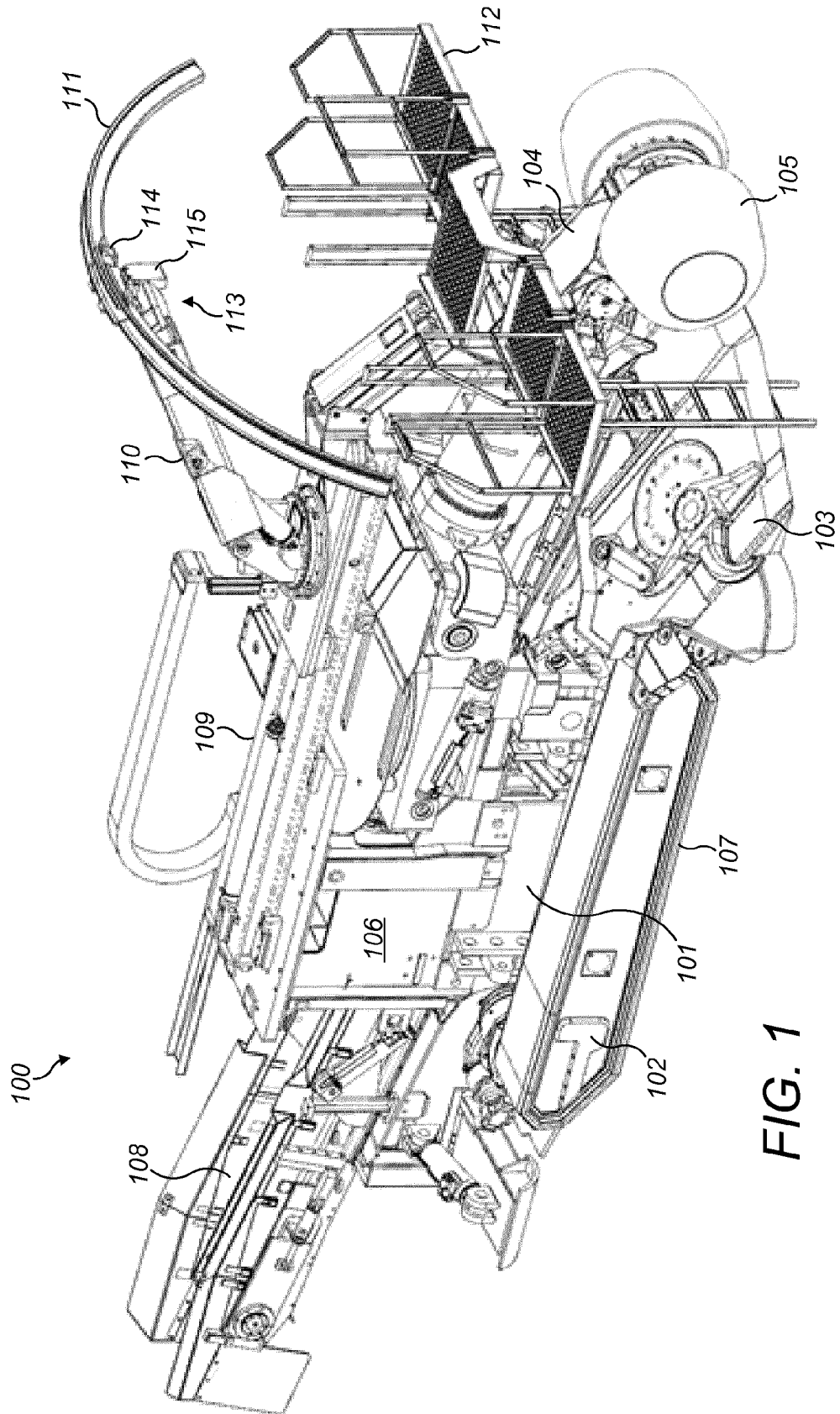
2. The apparatus as claimed in claim 1 further comprising a base (300) to mount the apparatus at a mobile mining machine (100);  
 the support platform (305) mounted on at least one guiderail (301) and configured to slide in a forward and backward direction along the guiderail (301) relative to the base (300); and  
 at least one rail mount (304) to slidably mount and allow the guiderail (301) to slide in the forward and backward direction along the base (300).
3. The apparatus as claimed in claims 1 and 2 wherein the arm (110) is telescopic having a head section (309) and an extendable tail section (310).
4. The apparatus as claimed in claims 1 or 2, wherein the pocket (114) has an elongated form extending substantially transverse including perpendicular to a main length of the arm (110).
5. The apparatus as claimed in claims 1 or 2, wherein the gripping device is fastened to the arm (110) in a pivotable manner via a hinge (115).
6. The apparatus as claimed in any preceding claim wherein a slewing axis (308) of the slewing device (307) is aligned substantially perpendicular to a pivoting axis (406) by which the arm (110) is pivotally mounted at the slewing device (307).
7. The apparatus as claimed in any preceding claim comprising a working platform (112) mounted at the support platform (305) to allow personnel (200) to stand on the apparatus at a location close to the arm (110);
8. The apparatus as claimed in claim 7 further comprising an adjustable bracket (314) mounting the working platform (112) at the support platform (305) to allow the working platform (112) to be raised and lowered relative to the support platform (305).
9. The apparatus as claimed in claim 8 wherein the bracket (314) is pivotally mounted between the support platform (305) and the working platform (112) to allow the working platform (112) to be raised and lowered above and below a height of the support platform (305).

10. The apparatus as claimed in claim 9 wherein the working platform (112) is elongate in a widthwise direction across the apparatus such that ends of the working platform (112) extend outwardly beyond respective sides (407) of the support platform (305). 5
11. The apparatus as claimed in claim 10 wherein the working platform (112) comprises a central region (402) being raised above a pair of end regions (403) in the height direction, the central region (402) configured to sit and slide over the guiderail (301). 10
12. The apparatus as claimed in any preceding claim further comprising: 15
- at least one power operated actuator (800) coupled to the support platform (305) to move the support platform (305) along the guiderail (301) in the forward and rearward direction; and
- at least one power operated actuator coupled to the guiderail (301) to move the guiderail (301) along the base (300) in a forward and rearward direction. 20
13. The apparatus as claimed in claims 2 and 7 wherein a distance in the forward and rearward direction over which the support platform (305) is configured to slide on the guiderail (301) is substantially equal to a distance in the forward and rearward direction over which the guiderail (301) is configured to slide on the base (300). 25 30
14. A mobile mining machine (100) comprising the apparatus as claimed in any preceding claim configured to install structural supports (111) within a mine tunnel. 35
15. The machine as claimed in claim 13 further comprising a cutting boom (104) pivotally mounted at a main-frame (101) and configured to support and allow a raising and lowering of a rotatable cutting head (105) provided at a forward end of the machine. 40

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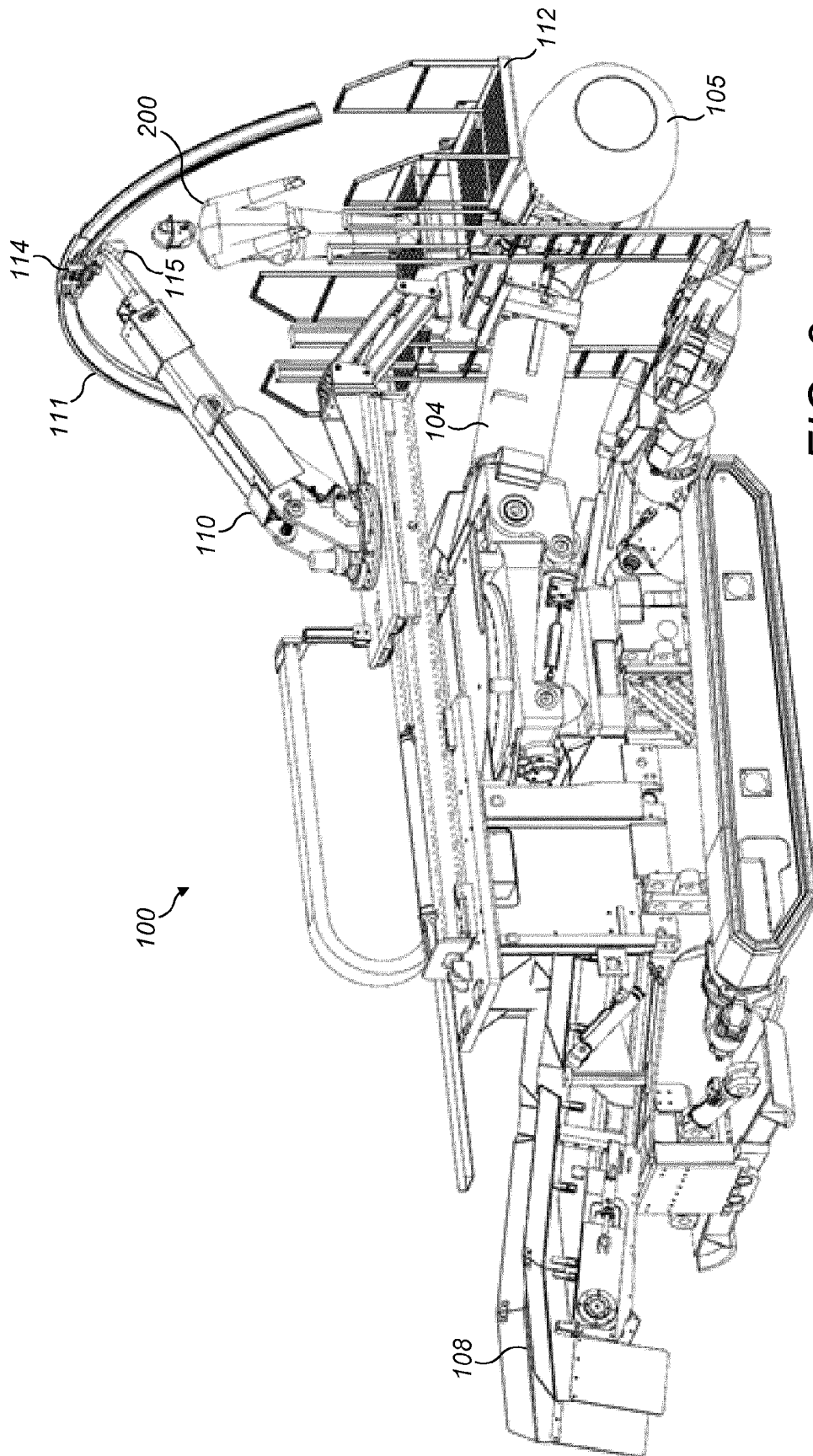
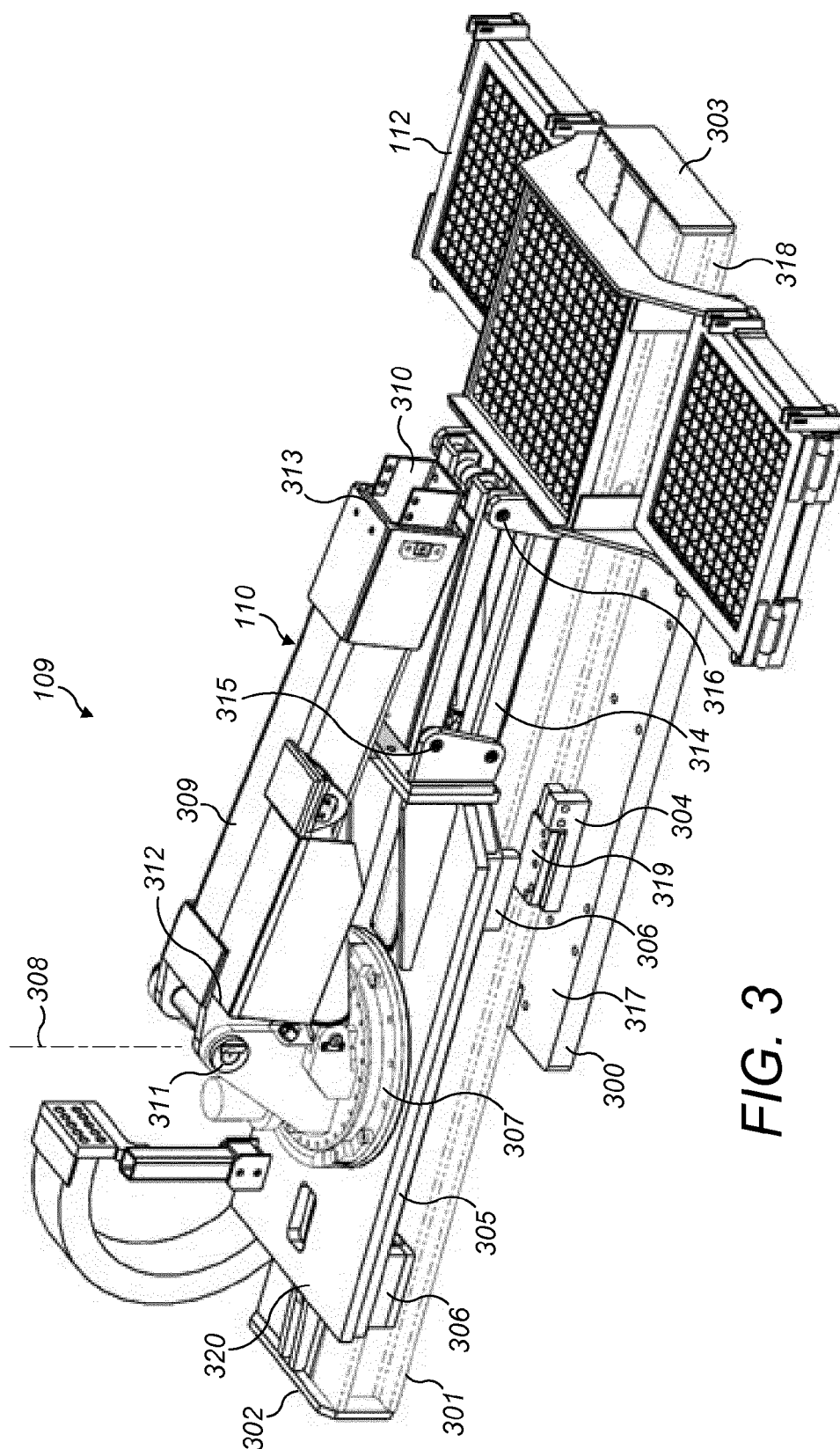
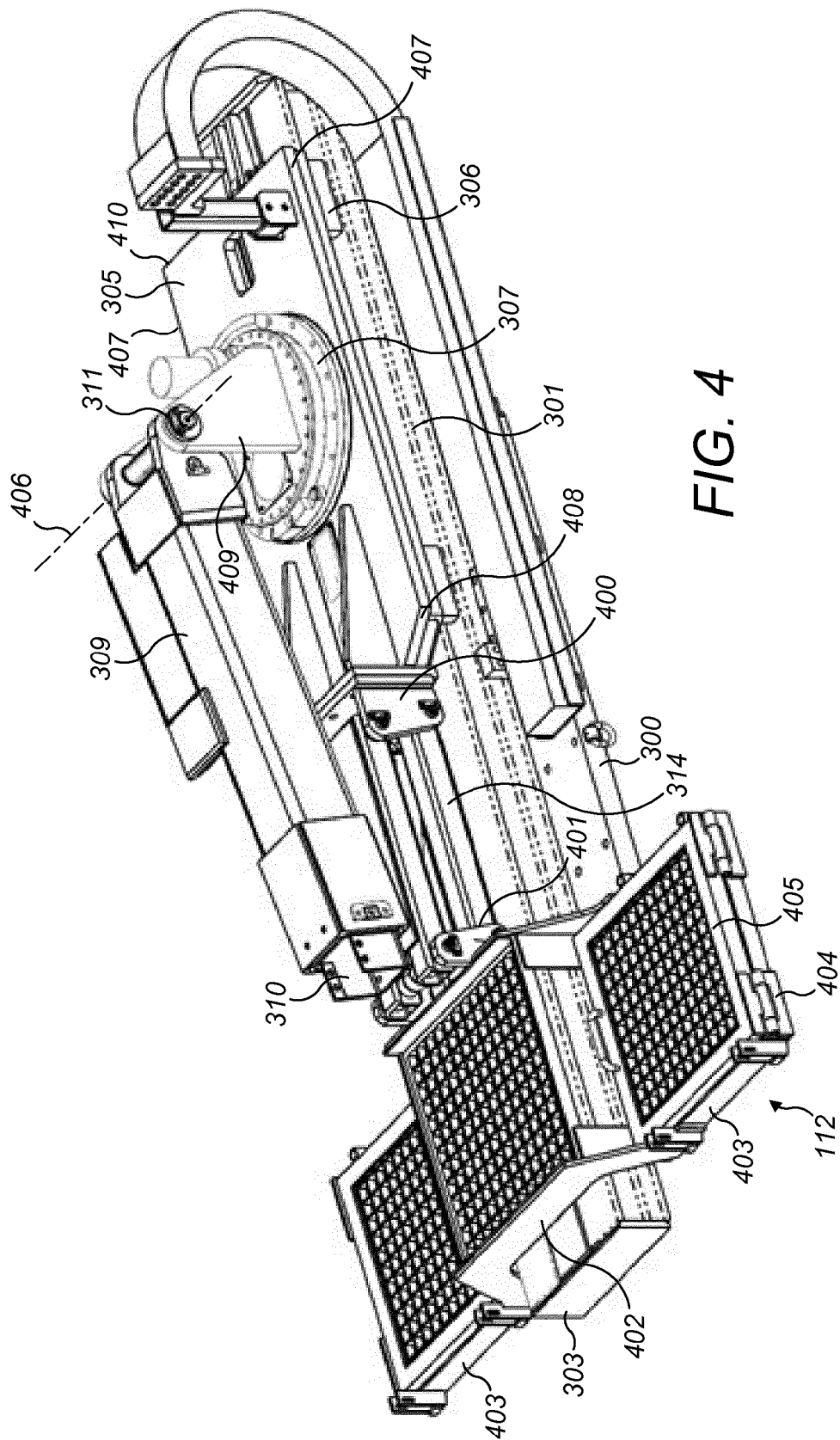


FIG. 2



**FIG. 3**



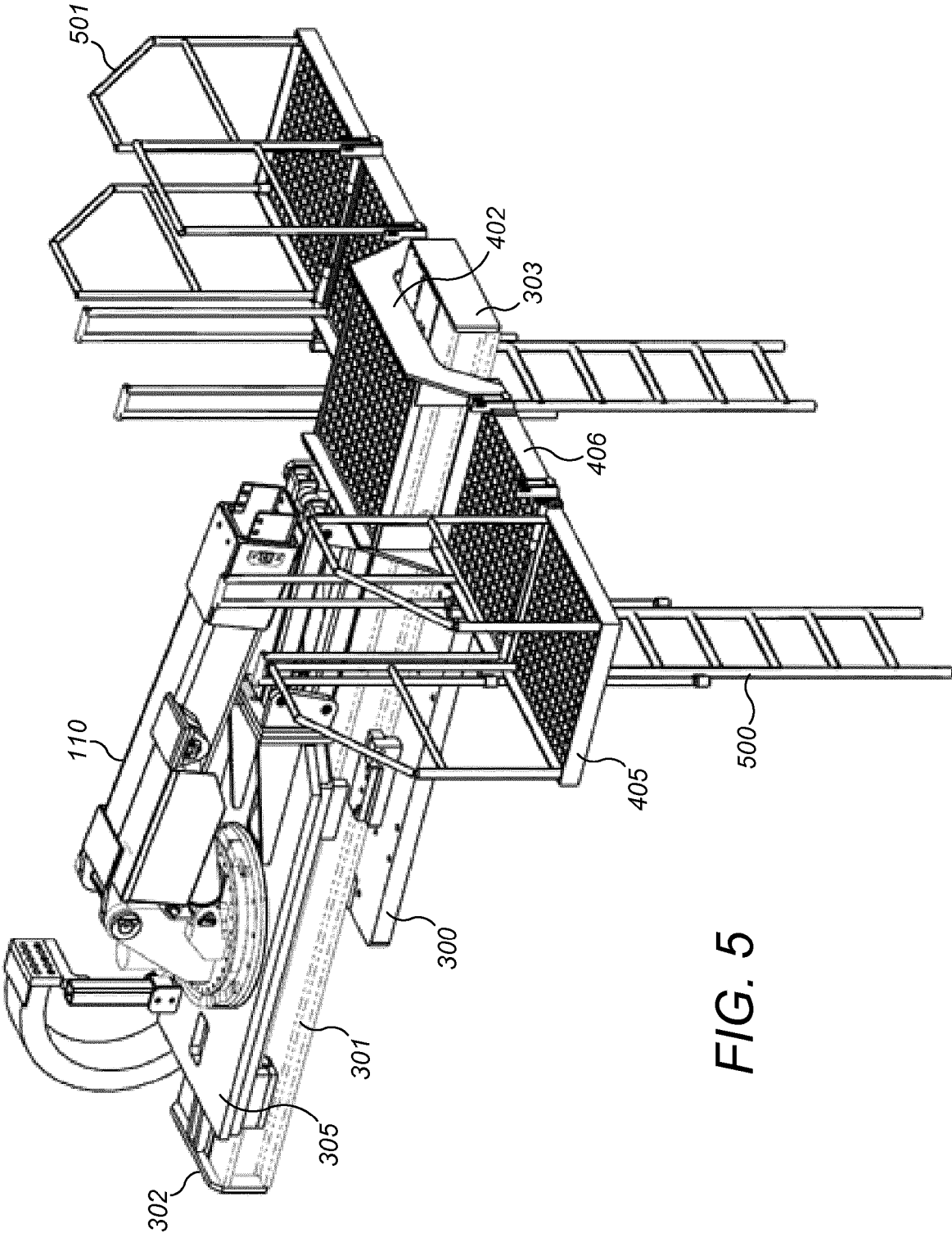


FIG. 5

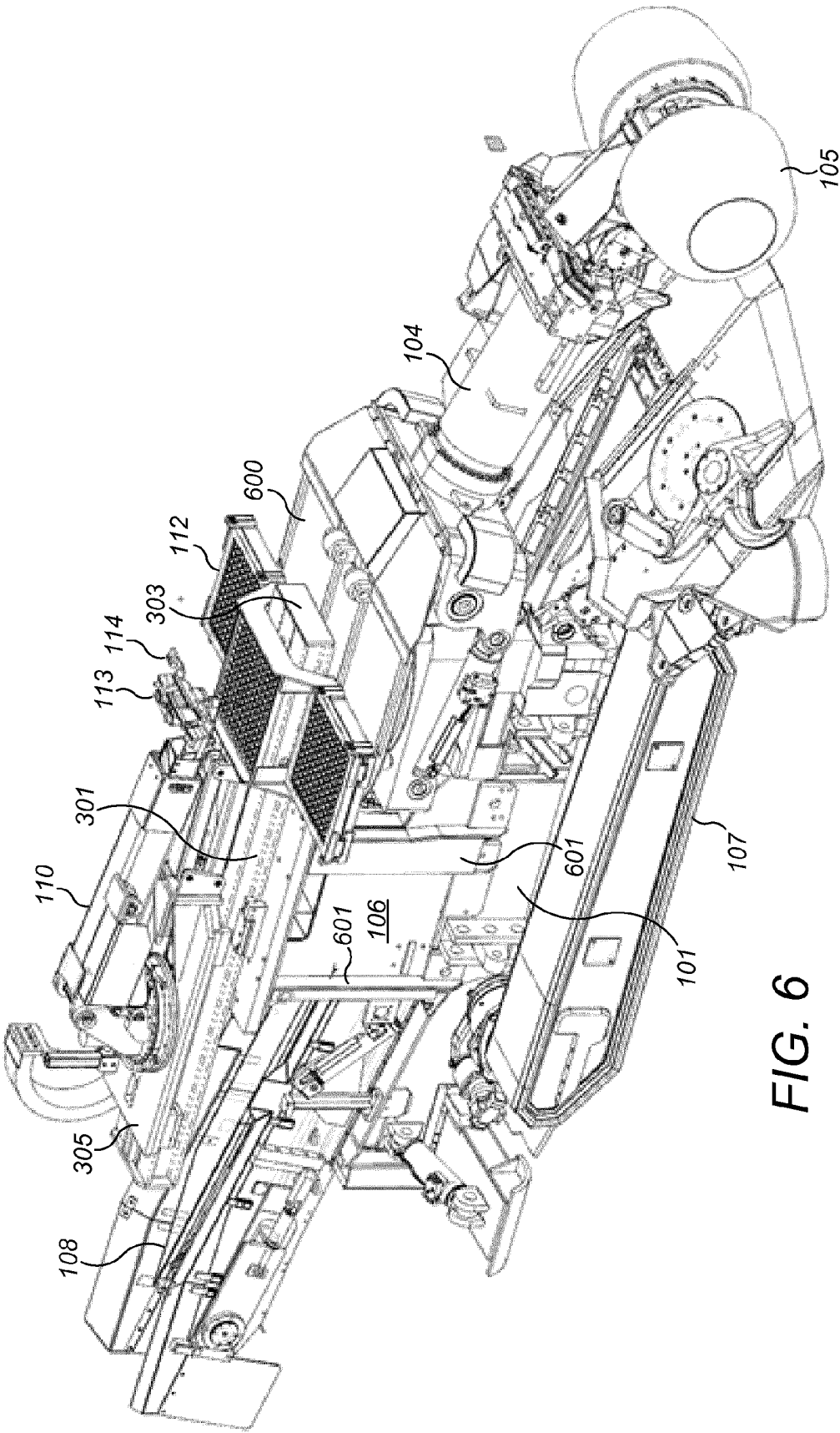


FIG. 6

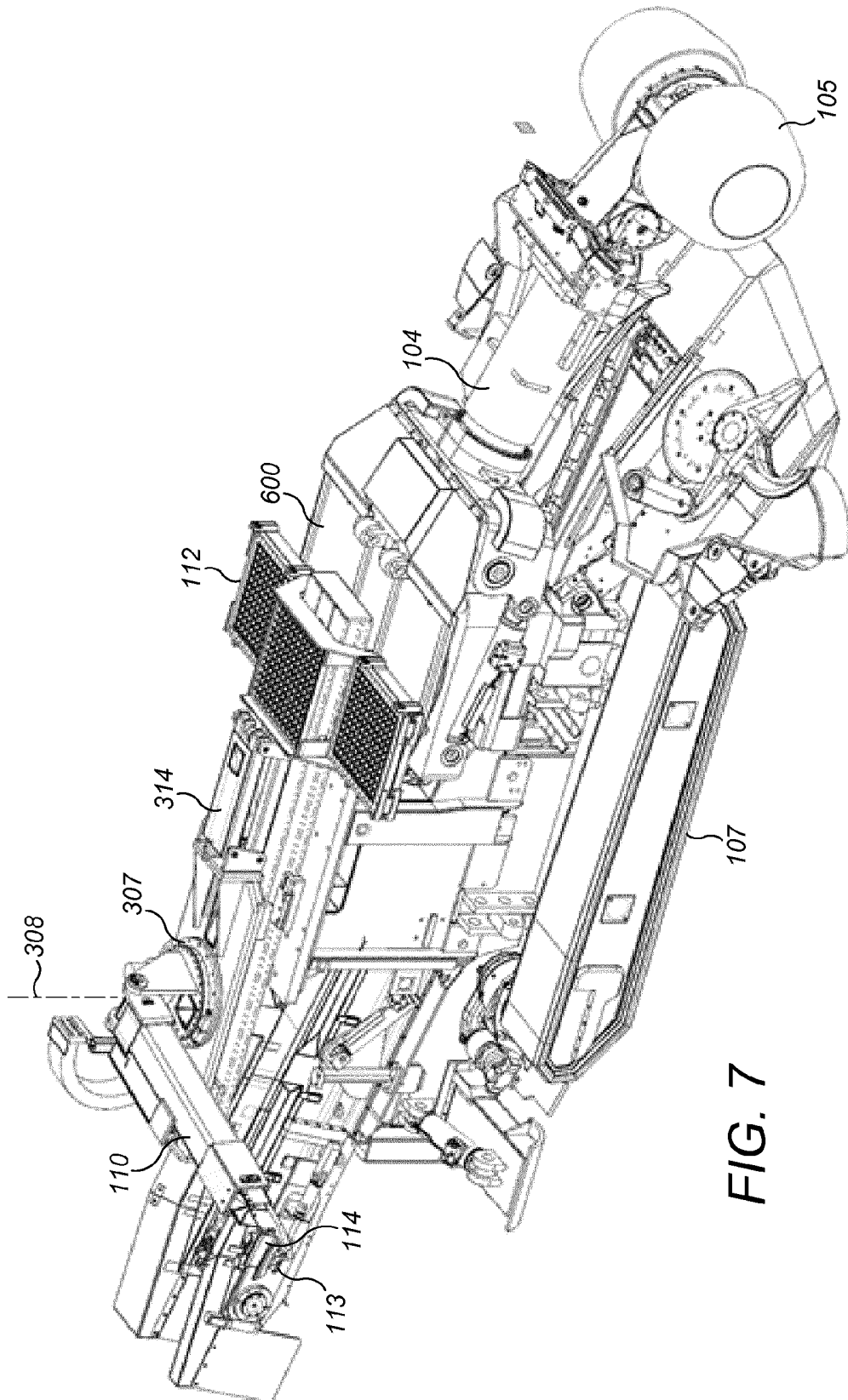


FIG. 7

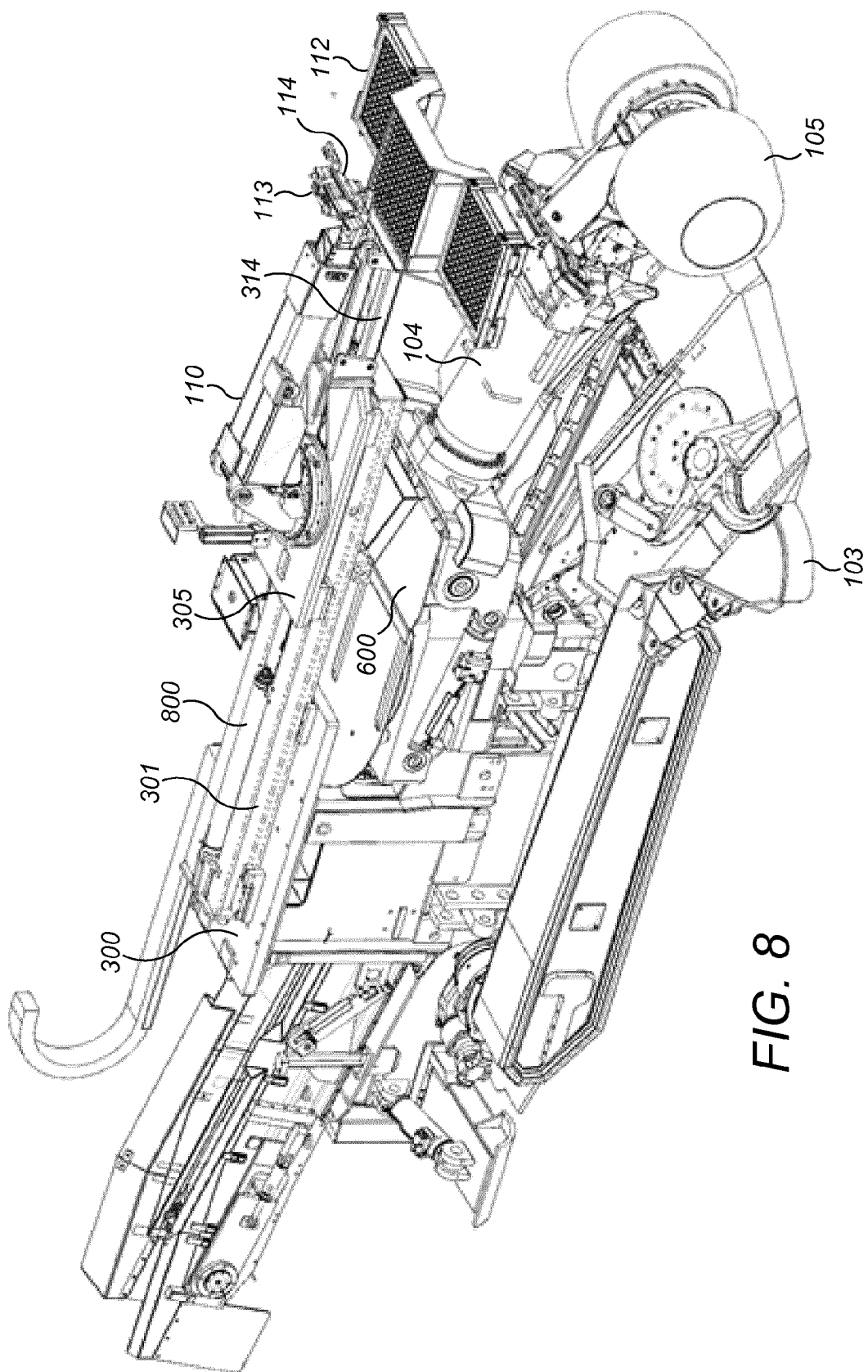


FIG. 8

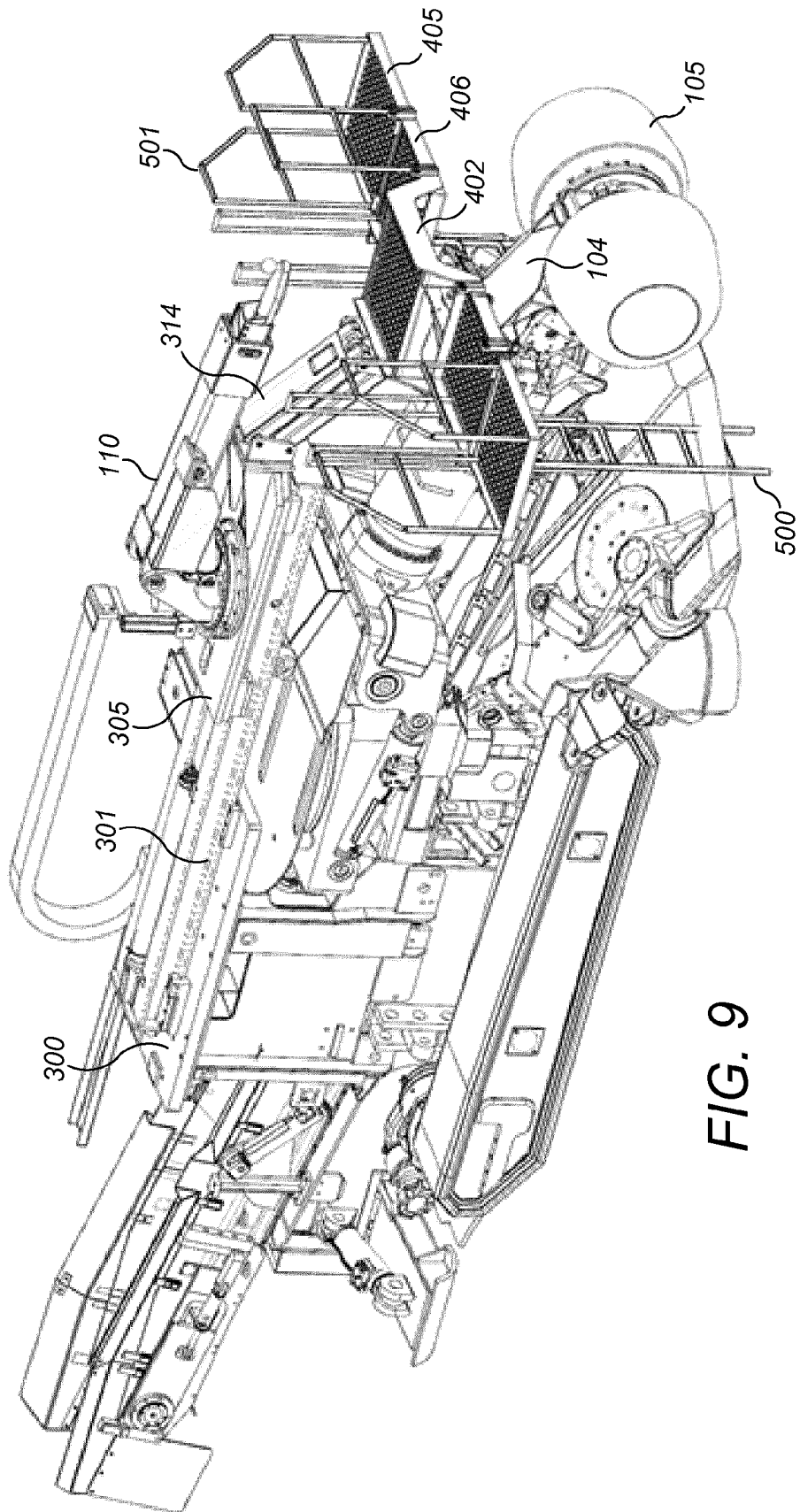


FIG. 9



## EUROPEAN SEARCH REPORT

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| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                |                                  |                                         |
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| Place of search                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                | Date of completion of the search | Examiner                                |
| The Hague                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                | 24 February 2015                 | Rampelmann, Klaus                       |
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EPO FORM 1503 03.82 (P04C01)



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**CLAIMS INCURRING FEES**

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

**LACK OF UNITY OF INVENTION**

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



**LACK OF UNITY OF INVENTION  
SHEET B**

Application Number  
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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-6, 12-15

Apparatus to install a structural support with base,  
guiderail, support platform  
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2. claims: 7-11

Apparatus to install a structural support with working  
platform  
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**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 14 17 4880

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
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24-02-2015

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