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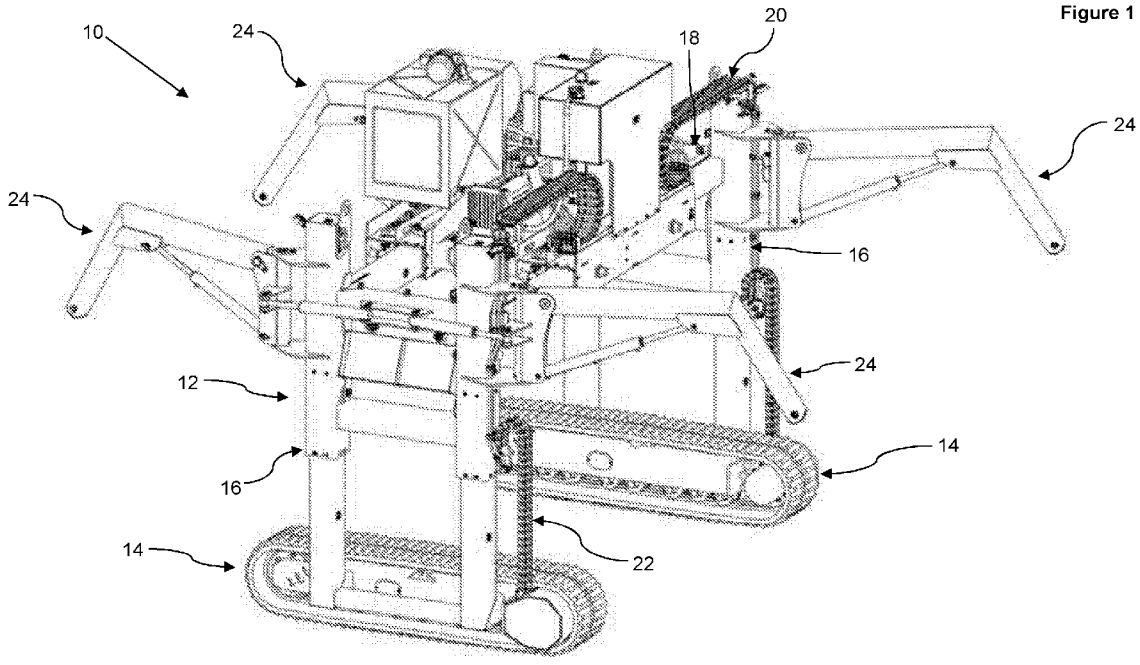
(54) **Title:** RAILWAY-WORKS SUPPORT APPARATUS

Figure 1



(57) **Abstract:** A railway-works support apparatus (10) is provided which comprises a mobile chassis (12) having a chassis top frame member (18) and left and right upright frame members (16) connected to the chassis top frame member (18) and defining a chassis width therebetween. There is also at least one support arm (24) movably connected to the mobile chassis (12) and having a railway-tool end (46). The support arm (24) is movable between a first operative condition in which the railway-tool end (46) is within the chassis width, and a second operative condition in which the railway-tool end (46) is outside of the chassis width.

WO 2023/281237 A1

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Railway-Works Support Apparatus

The present invention relates to a railway-works support apparatus, particularly but not necessarily exclusively of the treaded type for ground movement.

To maintain an existing railway network, constant repair or replacement of the rails and/or sleepers is required. Machinery is utilised to lift and move the railway rails in particular, due to their weight. It is well-known to utilise rail-running equipment for this task, though this evidently carries the disadvantage of the equipment only being usable where existing rails are present.

This issue can be somewhat overcome by the use of road-rail vehicles which can travel on both road or rail tracks, but there are certification issues with obtaining authorisation for such vehicles for use on-rail, which inhibits their widespread use.

One example of plant which is movable completely independently of a rail track is provided in EP1733096A1, which discloses a device capable of progressive bending of a railway rail by the use of a depending engagement mechanism which is completely contained within the footprint of its caterpillar tracks.

What is evident in this disclosure is the limited use scenario for such equipment, since the apparatus must always straddle the rail to be bent.

Furthermore, it is common practice that when long lengths of track are replaced, the old track is removed in pre-assembled sections. The underlying ballast bed is renewed or replaced, and then the sleepers are installed in situ. The railway rails are then threaded into place and secured, with more ballast being applied to prevent movement of the sleepers. The ballast can then be compacted and the railway rails tamped into the precise operating level.

In this replacement process, since the sleepers to be placed on the ballast are smooth-bottomed and resting on a compacted ballast bed, there is little friction to prevent them moving out of alignment until the rails are secured. When a rail is threaded to the sleepers initially, the lateral forces applied by the machine often dislodge or displace the sleepers on the ballast bed. This causes disruption during the threading process.

It is an object of the invention to provide a utility apparatus which can be used in a wider array of railway works settings than known apparatuses in the art and which can obviate the above-described problems.

According to a first aspect of the invention, there is provided a railway-works support apparatus comprising: a mobile chassis having a chassis top frame member and left and right upright frame members connected to the chassis top frame member and defining a chassis width therebetween; and at least one support arm movably connected to the mobile chassis and having a railway-tool end, the support arm being movable between a first operative condition in which the railway-tool end is within the chassis width, and a second operative condition in which the railway-tool end is outside of the chassis width. The ability for a railway-works support apparatus to operate both within its width, which is typically the area in which the existing rail track is positioned, and laterally outside of the width significantly increases the utility of the apparatus. Items can thus be passed between the two areas with ease without significant manoeuvring of the apparatus in the meantime.

Preferably, the at least one support arm may include a railway-tool connector for selectably engaging different railway tools therewith. The railway-works support apparatus may further comprise at least one railway tool releasably connected to the railway-tool connector. Selectable interchanging of the railway tools for use increases the different operations which can be handled by the apparatus. Existing devices are directed towards specific purposes and functions, and as a result, have limited utility. The modularity of the present apparatus resolves this issue.

Optionally, the at least one railway tool may be selected from: a railway-rail handling tool; a hook tool; and a sleeper alignment tool. There are many exemplary tools which can be equipped to the apparatus to increase its functionality, and the skilled person will be aware of more.

Preferably, the at least one support arm may be pivotably engagable with the mobile chassis. Pivotable engagement of the support arm allows for it to be controlled in a swinging manner, which provides the means of operating both on-track and to the side of the track during works.

The railway-works support apparatus may further comprise a pivot control hydraulic mechanism associated with the at least one support arm. Hydraulics are a very suitable mechanism for stably controlling the pivoting of a support arm, safely ensuring that any operational position of the support arm can be held despite the load added.

The at least one support arm may have an angular pivot range of at least 30°, more preferably of at least 60°, and even more preferably of at least 90°. Wide arcs of movement for the support arms can increase the use scenarios of the apparatus. If the support arms can extend close to 90° outwards from the side of the chassis, this increases the reach of the apparatus off-track. Similarly, if the support arms can be folded inwards on themselves within the chassis width, this increases compactness for the apparatus.

Optionally, the at least one support arm may be pivotably connected to the mobile chassis at a vertical hinge. A vertical hinge is a strong mechanism for providing a pivoting action, since there is a long extent which can connect to the support arm to reduce the risk of breaking under strain or stress.

The vertical hinge may be positioned at a front or rear portion of the left or right upright frame member with respect to a direction of motive travel of the mobile chassis. Front and rear positioning of the hinges allows the support arms to be neatly tucked away within the confines of the chassis width, without increasing the overall apparatus width in a stowed condition.

Preferably the vertical hinge may include a vertical support member having a lateral connector which engages with a pivot control mechanism to enable the pivoting movement. A vertical support member provides additional strength to the hinge, whilst the lateral connector has the advantage of being offset from the hinge axis, improving the ease with which pivoting motion can be achieved.

Optionally, the at least one support arm may be vertically movable. Height adjustability via the support arms is advantageous for engaging with or releasing objects on the ground, which is superior to just using the vertical adjustability of the chassis for this purpose.

The railway-works support apparatus may further comprise a height control hydraulic mechanism associated with the at least one support arm. Hydraulics are a very suitable mechanism for stably controlling the height of a support arm, safely ensuring that any operational position of the support arm can be held without buckling.

In a preferred embodiment, a plurality of said support arms may be provided. Whilst all of the operational characteristics of the apparatus can be realised with a single support arm, it will be apparent that the strength of the apparatus is dramatically enhanced by the inclusion of more than one. This allows greater loads to be carried of many different shapes and sizes, greatly increasing the overall utility.

Optionally, four said support arms may be provided at four corners of the chassis top frame member. Corner positioning of the support arms, preferably via their hinges, gives the widest possible reach for the apparatus on- and off-track. The provision of four support arms also has the advantage of permitting the replacement of both rails of pre-existing track to be replaced simultaneously, which reduces the prospect for the sleepers being moved out of alignment upon the application of force from a single rail.

The plurality of said support arms may preferably be independently movable relative to one another. Independent control of the support arms allows for many new and unexpected lifting configurations to be achieved which prior apparatuses with single-use functions cannot achieve.

The railway-works support apparatus may further comprise a controller configured to operate adjacent support arms of the plurality of said support arms in concert. Synchronous or concerted control of the support arms allows for alternative load configurations to be achieved. For instance, all four support arms can be engaged as one so that the apparatus can engage with and lift a pre-assembled track section, without the need to provide two separate apparatuses. This increase in points of contact using multiple support arms is a significant improvement over the state of the art.

The chassis top frame member may be extendable to alter the chassis width. Railways may have different track dimensions, or may have multiple tracks adjacent to one another, particularly at intersections. Adjustability of the width of the apparatus allows for different track dimensions to be utilised.

The left and right upright frame members may be adjustable to alter the height of the mobile chassis. Height adjustability may be necessary for obstacle avoidance, and/or engagement with low objects, for instance.

According to a second aspect of the invention, there is provided a railway-works support apparatus comprising: a mobile chassis; and a plurality of support arms movably connected to the mobile chassis, each of the plurality of support arms having a railway-tool connector for selectably engaging different railway tools therewith. Selectable replacement of the tools provides the apparatus with a far wider array of functionality than existing apparatuses, reducing the need for plant expenditure on the user's part.

According to a third aspect of the invention, there is provided a railway-works support apparatus comprising: a mobile chassis having ground support treads, the ground support treads defining a footprint of the apparatus; and a plurality of support arms movably connected to the mobile chassis, each of the plurality of support arms having a railway-tool end which is operable only outside of the footprint of the apparatus. The operation outside of the footprint of the apparatus has significant performance advantages over prior apparatuses, since a greater range of activities and operations can be performed.

According to a fourth aspect of the invention, there is provided a railway-works support apparatus comprising: a mobile chassis; and a plurality of support arms movably connected to the mobile

chassis, each of the plurality of support arms being independently movable in both horizontal and vertical directions.

Independent motion of the support arms to one another in multiple planes provides a simple mechanism for a huge variety of operations to be performed, which cannot be achieved within the state of the art.

The invention will now be more particularly described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows an isometric representation of one embodiment of a railway-works support apparatus in accordance with the first aspect of the invention;

Figure 2 shows an enlarged representation of one of the support arms of the railway-works support apparatus of Figure 1;

Figure 3 shows a plan view of the railway-works support apparatus of Figure 1, showing three of the support arms in a first operative condition, and a fourth support arm in a second operative condition;

Figure 4 shows an isometric representation of the railway-works support apparatus of Figure 1, with the support arms each supporting a railway-rail handling tool;

Figure 5 shows an isometric representation of the railway-rail handling tool shown in Figure 4;

Figure 6 shows an isometric representation of the railway-works support apparatus of Figure 5, supporting two railway rails simultaneously in first and second operative conditions;

Figure 7 shows a side representation of the railway-works support apparatus of Figure 6;

Figure 8 shows an isometric representation of the railway-works support apparatus of Figure 4 threading a pair of railway rails onto sleepers;

Figure 9 shows an isometric representation of two railway-works support apparatuses supporting an assembled railway track section;

Figure 10 shows an isometric representation of a single railway-works support apparatus supporting the assembled railway track section of Figure 9;

Figure 11 shows an isometric representation of the railway-works support apparatus of Figure 1, with the support arms each supporting a hook tool; and

Figure 12 shows an isometric representation of the railway-works support apparatus of Figure 11 supporting a sleeper alignment tool.

Referring to Figure 1, there is illustrated a railway-works support apparatus, referenced globally at 10, and which is suitable for a wide range of railway-works support tasks.

The depicted embodiment has a mobile chassis 12 having a pair of ground support treads 14 which are connected to left and right upright frame members 16, and which in turn support a chassis top frame member 18.

In this arrangement, the ground support treads 14 are positionable either side of an existing railway track to perform works thereover, with the chassis top frame member 18 spanning the width of the railway track. The mobile chassis 12 thus has a chassis width which is defined as the region between the left and right upright frame members 16 which is intended to overlie the railway track to be worked on in use.

To accommodate railway tracks of different width, the chassis top frame member 18 may be adjustable. This may preferably utilise a hydraulic extension mechanism 20, and which is more preferably symmetric about a centre of the mobile chassis 12. The working height of the railway-works support apparatus 10 may also be adjustable, preferably by extension or retraction of the height of the left and right upright frame members 16. Again, a hydraulic extension mechanism 22 is preferred.

It will be appreciated that the present invention could be readily applied to apparatuses which run on-rail, and thus have rail contact means. The embodiment illustrated having treads is indicative only.

The railway-works support apparatus 10 includes at least one, and preferably a plurality of, support arms 24, designed to perform supporting and lifting tasks during railway works. Four such support arms 24 can be seen in Figure 1.

A preferred structure of the support arms 24 is as an elongate strut 26 having an angled neck portion 28, with a brace 30 therebetween to act not only to brace the support arm 24, but also to provide a mounting point for at least one of the movement control mechanisms.

Each support arm 24 is connected to the mobile chassis 12 at a first end. In the arrangement shown, there are four vertical hinges 32 which are mounted to the mobile chassis 12 at brackets 34 respectively at the four corners thereof, that is, at the front and rear of the left and right upright support members 16 with respect to a motive direction of the mobile chassis 12.

Figure 2 shows a support arm 24 in more detail. The vertical hinge 32 includes a vertical support member 36 to which the support arm 24 is mounted at its first end. The support arm 24 is mounted to an upper portion 38 of the vertical support member 36 in a pivotable manner. A height control hydraulic mechanism 40 is provided which interconnects a lower portion 42 of the vertical support member 36 with the brace 30 of the support arm 24. Extension or retraction of the hydraulic ram 44 of the height control hydraulic mechanism 40 causes pivoting of the support arm within a vertical plane defined through the support arm 24. This results in raising or lowering of a railway-tool end 46 of the support arm 24.

As illustrated, the railway-tool end 46 comprises a railway-tool connector, illustrated as a coupling point 48 here, for selectably mounting a railway tool thereto. Possible options for mountable railway tools will be discussed in more detail below. The railway-tool end 46 has a slightly chamfered or rounded tool-facing surface 50 to prevent or inhibit catching of the railway tool thereon.

Whilst a selectably demountable railway-tool connector is preferred, it will be apparent that specific railway tools could be mounted directly and fixedly onto the support arms. These could then be integral to the support arm, so that each apparatus has a sole and predefined purpose. The present invention, however, realises a modular apparatus which can perform many different tasks.

The vertical support member 36 here includes a lateral connector 52 which allows for pivotable engagement with a pivot control hydraulic mechanism 54, here comprising a hydraulic ram 56 which is connected at one end at the lateral connector 52 and to the mobile chassis 12 at the other end. Since the lateral connector 52 is offset relative to the axis of the vertical hinge 32, extension and retraction of the pivot control hydraulic mechanism 54 generates a pivoting action of the support arm 24 in a horizontal plane. As such, the railway-tool end 46 is pivotable along an arcuate path using the pivot control hydraulic mechanism 54. This will have a typical arc range of at least 30°, more preferably of at least 60°, and even more preferably of at least 90°, thereby providing a wide range of movement for the railway-tool end 46.

The consequence of this pivoting action in the horizontal plane can be seen in Figure 3. Three of the support arms 24 are in a first operative condition, in which the railway-tool end 46, and by

extension a railway tool secured thereto, is within the chassis width. The fourth support arm 24' has been pivoted into a second operative condition, however, in which the railway-tool end 46 is outside of the chassis width.

The term chassis width is used here as a means of identifying the positions of the railway-tool ends 46 in one direction. Unlike existing apparatuses, the support arms 24 are operative outside of the footprint of the ground support treads 14, which greatly increase their utility. The first and second operative conditions are therefore determined by viewing the railway-works support apparatus 10 end-on, rather than using any plan representation thereof.

This arrangement allows for operations to be carried out by the railway-works support apparatus 10 both on a track or track area which is straddled by the ground support treads 14, or at the trackside without the railway-works support apparatus 10 needing to leave its track-straddling state.

One example of a use-case of the railway-works support apparatus 10 is shown in Figure 4. In this arrangement, each of the support arms 24 has been equipped with a railway-rail handling tool 58, which is shown in more detail in Figure 5. The specific tool shown is an example of a threader dragger, but it will be appreciated that alternative rail handling tools could be utilised.

The railway-rail handling tool 58 comprises an upper connection portion 60 mounted to a clamping head 62 using a gimbal 64. The upper connection portion 60 is engaged with the coupling point 48 using a removable pin 66, though other fastening methods will be apparent to the skilled operator.

The clamping head 62 comprises clamping jaws 68 and at least one set of hydraulic clamping members 70 which releasably engage with a railway rail, typically via the head and/or web thereof.

Figure 6 illustrates how the railway-works support apparatus 10 might be used to carry a pair of railway rails 72 simultaneously, here illustrated respective in first and second operative positions of pairs of support arms 24, 24'.

The right pair of support arms 24 are provided in the first operative condition, that is, are carrying a railway rail 72 within the chassis width. The railway-rail handling tools 58 engage with the railway rail 72 at front and rear points thereof, creating a stable engagement condition. The railway-works support apparatus 10 can safely move the railway rail 72 around to be place withing the region below the chassis top frame member 18.

The left pair of support arms 24' are provided in the second operative condition. That is are carrying a railway rail 72 outside of the chassis width, and outside of the area defined by the chassis top frame member 18 or ground support treads 14. The second pair of support arms 24' are shown in an elevated condition, which is best illustrated in Figure 7. This vertical adjustability provided significant advantages to the railway-works support apparatus 10 when avoiding low obstacles.

It will be preferred that the support arms 24 be linked by a common controller. Whilst independent operation of the support arms 24 is a preferred feature for flexibility of use, it will be apparent that in a railway rail lifting condition that paired action and support is required. As such, it is advantageous for the controller to be configured to control the pivot control hydraulic mechanism 54 and height control hydraulic mechanism 40 of adjacent support arms 24 to be operated in tandem, so as to achieve synchronous motion. This will avoid twisting or bending the railway rails 72.

It is notable that the present railway-works support apparatus 10 is able to support a pair of railway rails 72 simultaneously. Not only does this double the output of the apparatus compared with devices known in the art, but it also allows for balanced dual-threading of railway rails 72 which applies a symmetric force onto the sleepers during the threading process. By applying the railway rails 72 synchronously, there is less likelihood of slippage of the sleepers during threading. This process is shown in detail in Figure 8. The leading support arms 24 hold the railway rails in position above the sleepers 86, with the trailing support arms 24' providing a progressive bending action to the rear of the footprint of the apparatus 10, thereby laying the rails 72 in an even manner onto the sleepers 86.

An alternative use case for the railway-works support apparatus 10 is shown in Figure 9, in which a pair of railway-works support apparatuses 10 is shown lifting a pre-assembled track section 74. All support arms 24 of the apparatuses 10 are in the first operative condition, and as such the track section 74 is carried within the chassis width of both apparatuses 10.

It will be appreciated that communicative control between the two apparatuses 10 is desirable, so that they move in concert and do not apply any twisting forces to the track section 74 during motion. This could be in the form of control signals sent from a centralised controller remote to both apparatuses 10, or one apparatus 10 could be configured to operate as a slave to the other master apparatus 10.

It is also noted that the large footprint of the railway-works support apparatus 10 means that it is highly resistant to tipping over. Thus, as shown in Figure 10, a single railway-works support

apparatus 10 can be used to transport a pre-assembled track section 74 by engaging with the rails thereof in the centre of the pre-assembled track section 74.

As previously discussed, the railway-works support apparatus 10 is selectably configurable according to the requirements of the user. This is achievable by replacement of the tool at the railway-tool ends 46 of the support arms 24.

Figure 11 shows an alternative arrangement in which hook tools 76 are coupled to the coupling points 48. This shown how the railway-works support apparatus 10 can be used to transport multiple heavy loads simultaneously, such as large bags 78 of aggregate, which could each weigh approximately 1 tonne. Having bags 78 having a single point of connection 80 has the advantage of allowing four such bags 78 to be transported at once, which is not feasible in existing apparatus types.

A hook tool 76 configuration of the railway-works support apparatus 10 can also be used to support multi-point supported tools, such as the sleeper alignment tool 82 shown in Figure 12. This is illustrated as a template having a plurality of hydraulically operable clamps 84 which engage with the ends of sleepers 86, and which can then be aligned and correctly spaced relative to one another. The balanced support offered by four support arms 24 provides superior holding of the set of sleepers 86 compared with other suspended templating arrangements.

It will be appreciated that several of the features of the embodiments disclosed could be omitted without deviating from the scope of the invention. For instance, support arms having no pivoting action could be provided but having modularly selectable tools to be attached thereto. Support arms which are independently operable to one another with some or all of the additional limitations of the invention as laid out above. Furthermore, a support arm arrangement could be envisioned which allows for operation solely outside of the footprint of the apparatus, without necessarily needing the multiple

It is therefore possible to provide a railway-works support apparatus having many useful advantages. Firstly, the provision of at least one support arm mounted to a mobile chassis which can move between operative conditions within and outside of the chassis width, without the apparatus toppling, greatly increases the utility of the apparatus within railway works contexts. In the described embodiment, the support arms can only operate outside of the footprint of the ground contacting treads of the apparatus, which means that there is a greater freedom of movement for the apparatus as a whole.

Furthermore, the replaceable tool heads of the apparatus have the advantage of enabling a single device to be used in a wide range of contexts, greatly improving the utility of the apparatus in question.

The words 'comprises/comprising' and the words 'having/including' when used herein with reference to the present invention are used to specify the presence of stated features, integers, steps, or components, but do not preclude the presence or addition of one or more other features, integers, steps, components, or groups thereof.

It is appreciated that certain features of the invention, which are, for clarity, described in the context of separate embodiments, may also be provided in combination in a single embodiment. Conversely, various features of the invention which are, for brevity, described in the context of a single embodiment, may also be provided separately or in any suitable sub-combination.

The embodiments described above are provided by way of examples only, and various other modifications will be apparent to persons skilled in the field without departing from the scope of the invention as defined herein.

Claims

1. A railway-works support apparatus (10) comprising:

a mobile chassis (12) having a chassis top frame member (18) and left and right upright frame members (16) connected to the chassis top frame member (18) and defining a chassis width therebetween; and

at least one support arm (24) movably connected to the mobile chassis (12) and having a railway-tool end (46), the support arm (24) being movable between a first operative condition in which the railway-tool end (46) is within the chassis width, and a second operative condition in which the railway-tool end (46) is outside of the chassis width.

2. A railway-works support apparatus (10) as claimed in claim 1, wherein the at least one support arm (24) includes a railway-tool connector for selectably engaging different railway tools therewith.

3. A railway-works support apparatus (10) as claimed in claim 2, further comprising at least one railway tool releasably connected to the railway-tool connector.

4. A railway-works support apparatus (10) as claimed in claim 2 or claim 3, wherein the at least one railway tool is selected from: a railway-rail handling tool (58); a hook tool (76); and a sleeper alignment tool (82).

5. A railway-works support apparatus (10) as claimed in any one of the preceding claims, wherein the at least one support arm (24) is pivotably engagable with the mobile chassis (12).

6. A railway-works support apparatus (10) as claimed in claim 5, further comprising a pivot control hydraulic mechanism (54) associated with the at least one support arm (24).

7. A railway-works support apparatus (10) as claimed in claim 5 or claim 6, wherein the at least one support arm (24) has an angular pivot range of at least 30°.

8. A railway-works support apparatus (10) as claimed in claim 7, wherein the at least one support arm (24) has an angular pivot range of at least 60°.

9. A railway-works support apparatus (10) as claimed in claim 8, wherein the at least one support arm (24) has an angular pivot range of at least 90°.

10. A railway-works support apparatus (10) as claimed in any one of claims 5 to 9, wherein the at least one support arm (24) is pivotably connected to the mobile chassis (12) at a vertical hinge (32).

11. A railway-works support apparatus (10) as claimed in claim 10, wherein the vertical hinge (32) is positioned at a front or rear portion of the left or right upright frame member (16) with respect to a direction of motive travel of the mobile chassis (12).

12. A railway-works support apparatus (10) as claimed in claim 10 or claim 11, wherein the vertical hinge (32) includes a vertical support member (36) having a lateral connector (52) which engages with a pivot control mechanism (54) to enable the pivoting movement.

13. A railway-works support apparatus (10) as claimed in any one of the preceding claims, wherein the at least one support arm (24) is vertically movable.

14. A railway-works support apparatus (10) as claimed in claim 13, further comprising a height control hydraulic mechanism (40) associated with the at least one support arm (24).

15. A railway-works support apparatus (10) as claimed in any one of the preceding claims, wherein a plurality of said support arms (24) is provided.

16. A railway-works support apparatus (10) as claimed in claim 15, wherein four said support arms (24) are provided at four corners of the chassis top frame member (18).

17. A railway-works support apparatus (10) as claimed in claim 15 or claim 16, wherein the plurality of said support arms (24) are independently movable relative to one another.

18. A railway-works support apparatus (10) as claimed in any one of claims 15 to 17, further comprising a controller configured to operate adjacent support arms (24) of the plurality of said support arms (24) in concert.

19. A railway-works support apparatus (10) as claimed in any one of the preceding claims, wherein the chassis top frame member (18) is extendable to alter the chassis width.

20. A railway-works support apparatus (10) as claimed in any one of the preceding claims, wherein the left and right upright frame members (16) are adjustable to alter the height of the mobile chassis (12).

21. A railway-works support apparatus (10) comprising:

a mobile chassis (12); and

a plurality of support arms (24) movably connected to the mobile chassis (12), each of the plurality of support arms (24) having a railway-tool connector for selectably engaging different railway tools therewith.

22. A railway-works support apparatus (10) comprising:

a mobile chassis (12) having ground support treads (14), the ground support treads (14) defining a footprint of the apparatus (10); and

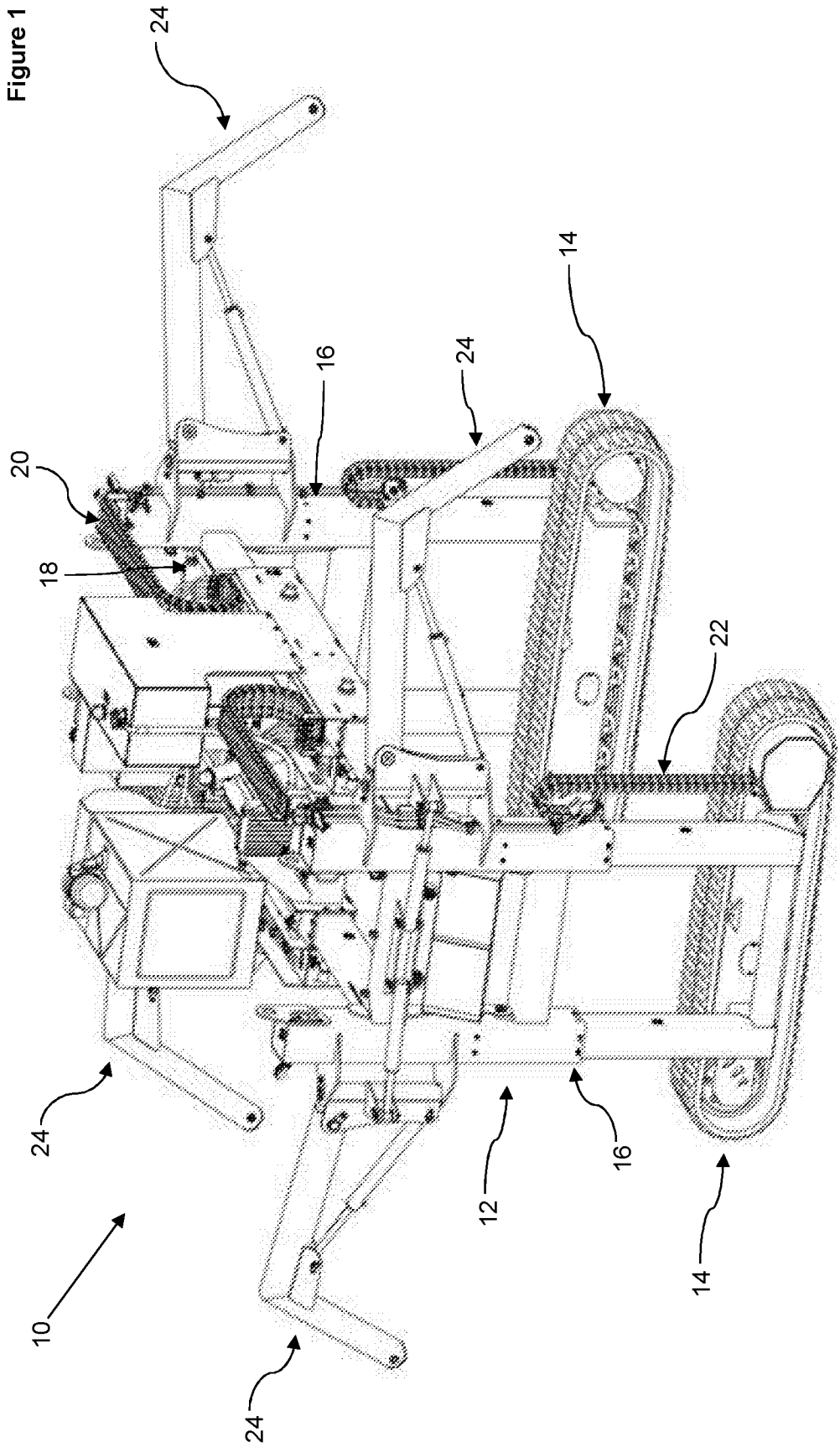
a plurality of support arms (24) movably connected to the mobile chassis (12), each of the plurality of support arms (24) having a railway-tool end (46) which is operable only outside of the footprint of the apparatus (10).

23. A railway-works support apparatus (10) comprising:

a mobile chassis (12); and

a plurality of support arms (24) movably connected to the mobile chassis (12), each of the plurality of support arms (24) being independently movable in both horizontal and vertical directions.

Figure 1



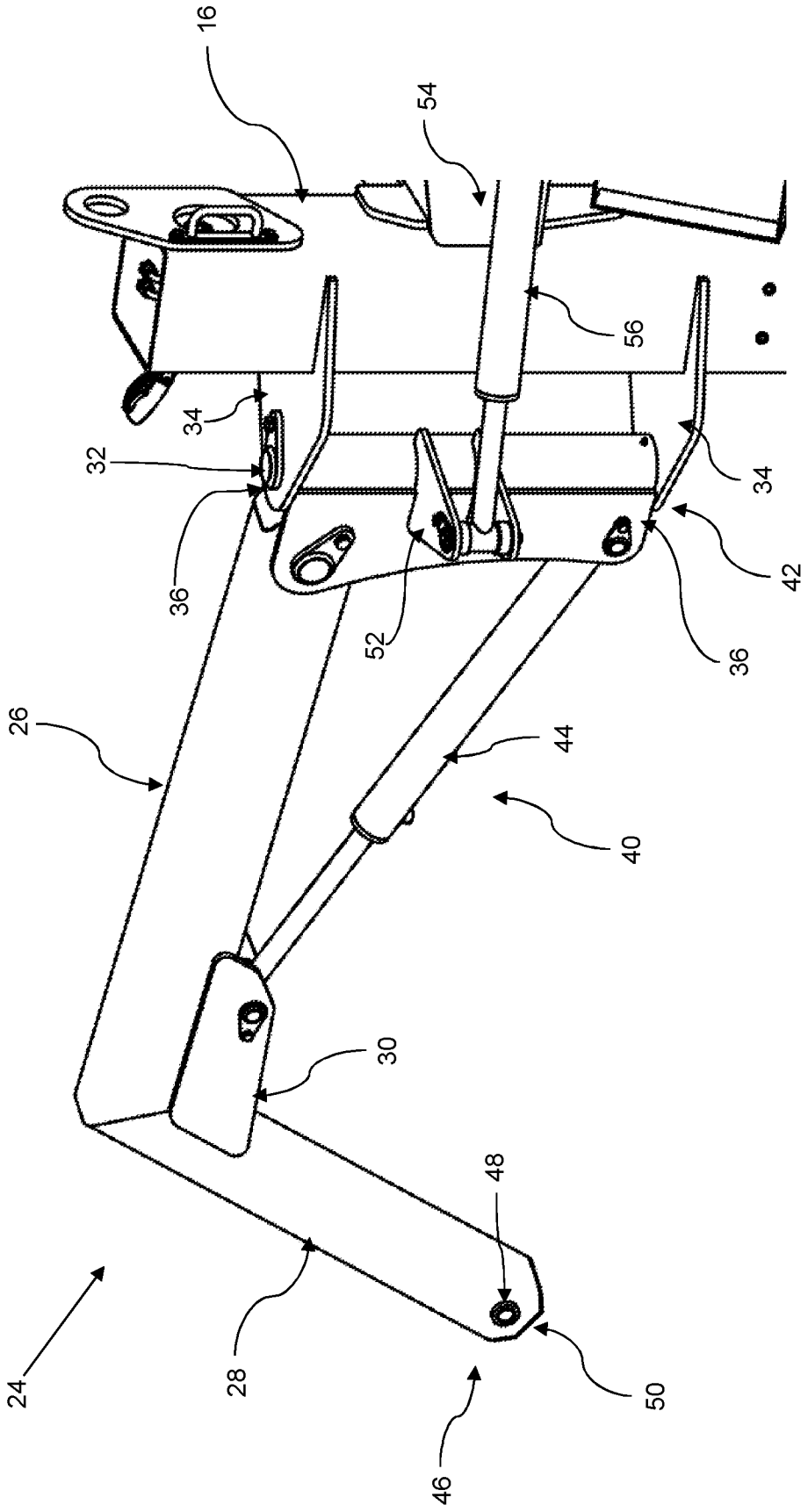
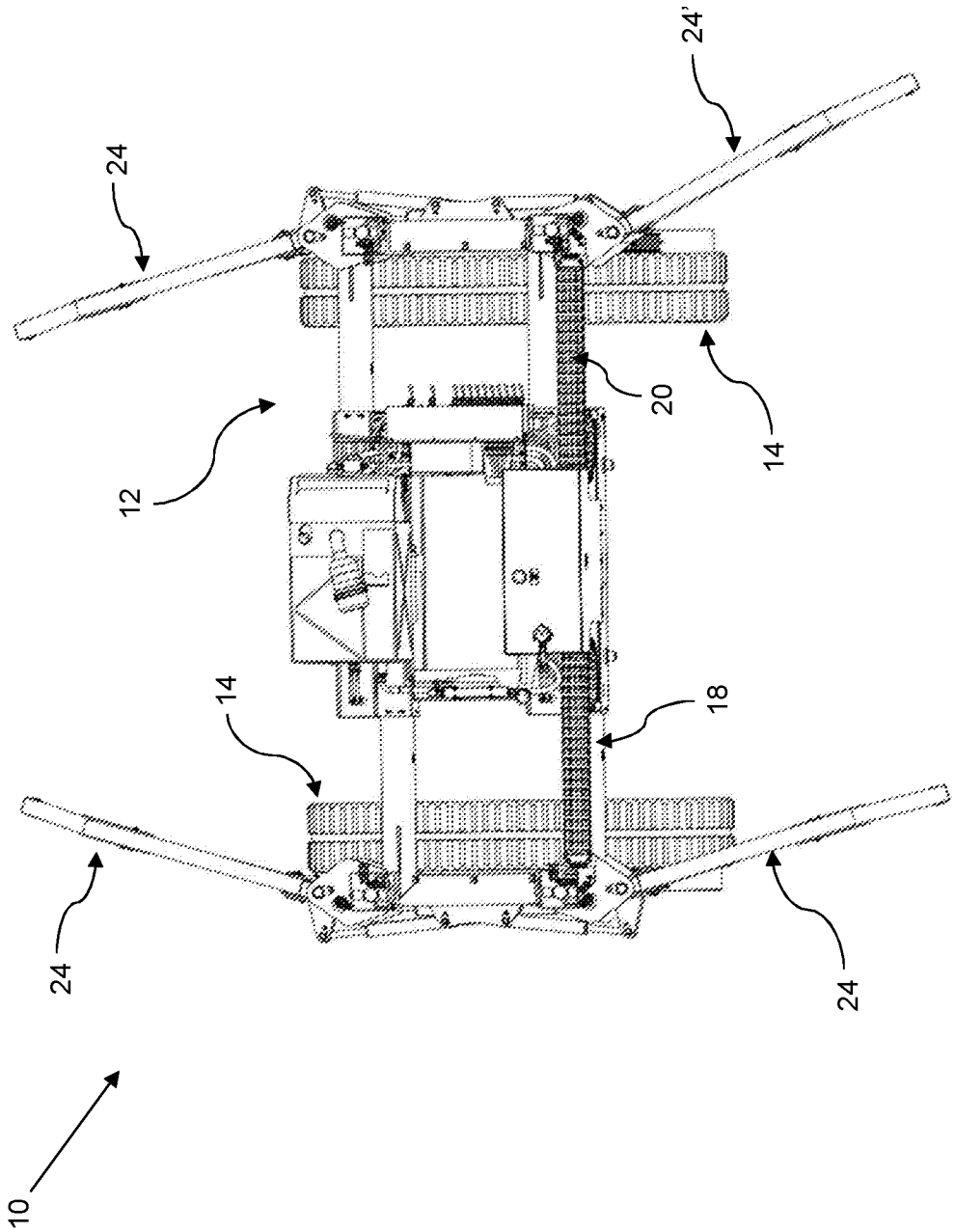


Figure 2

Figure 3



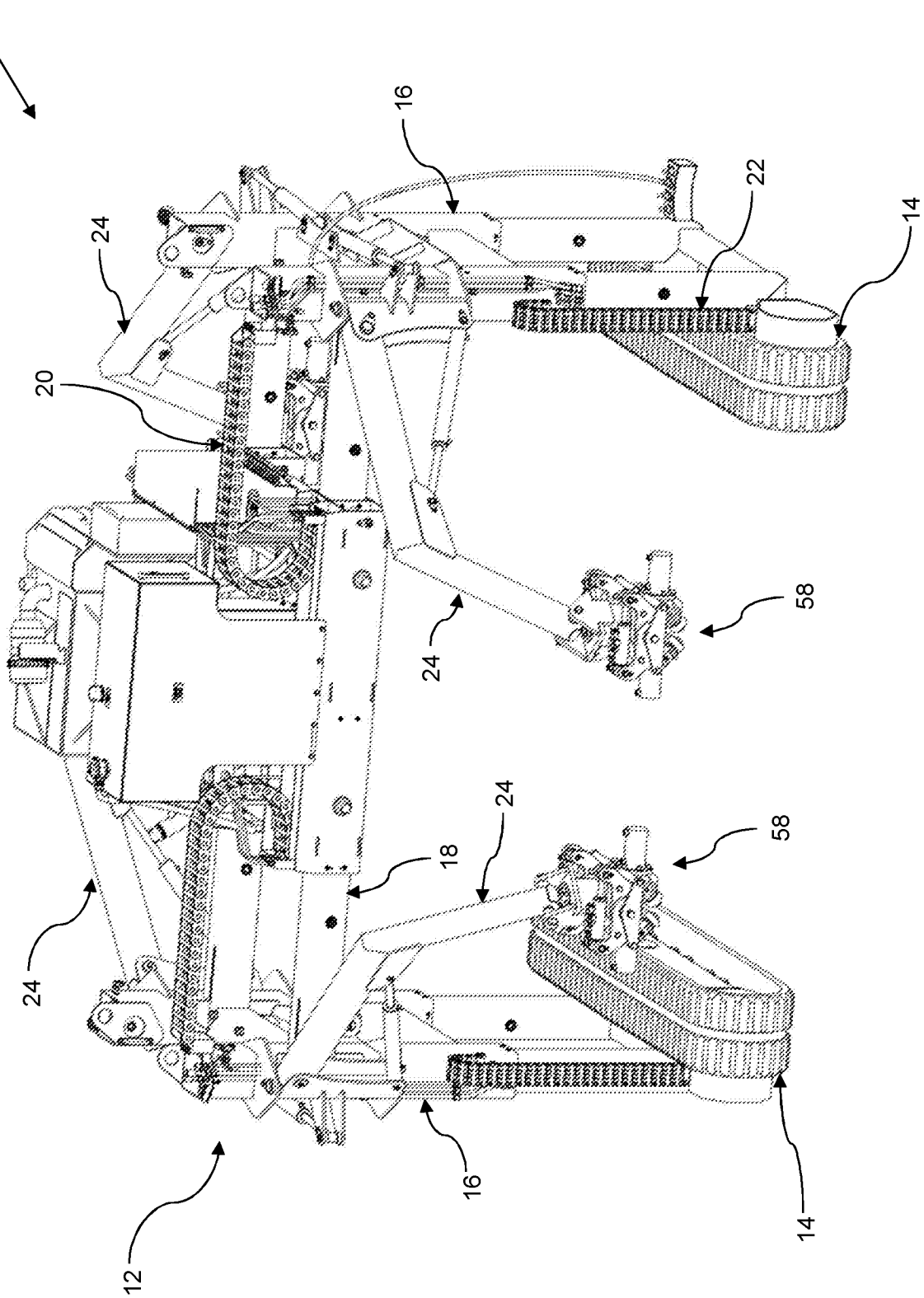
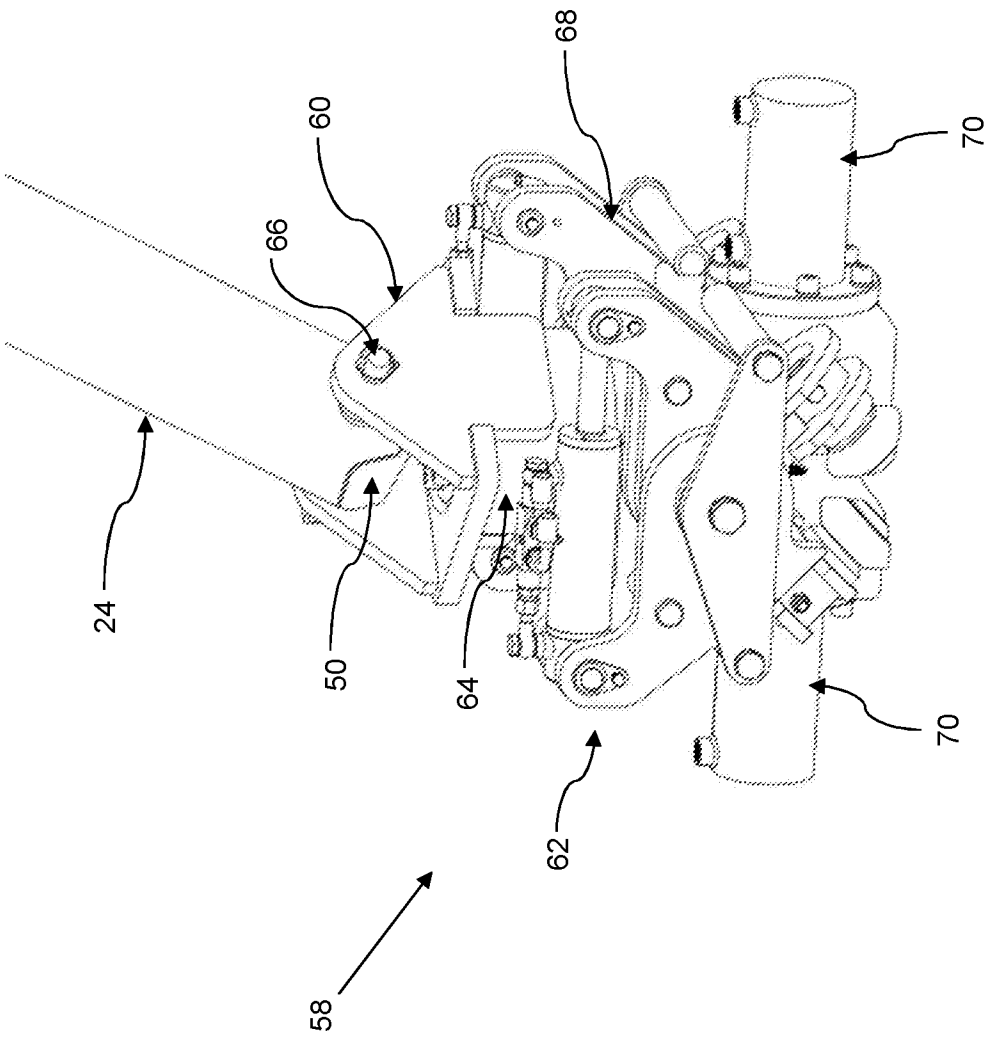


Figure 4

Figure 5



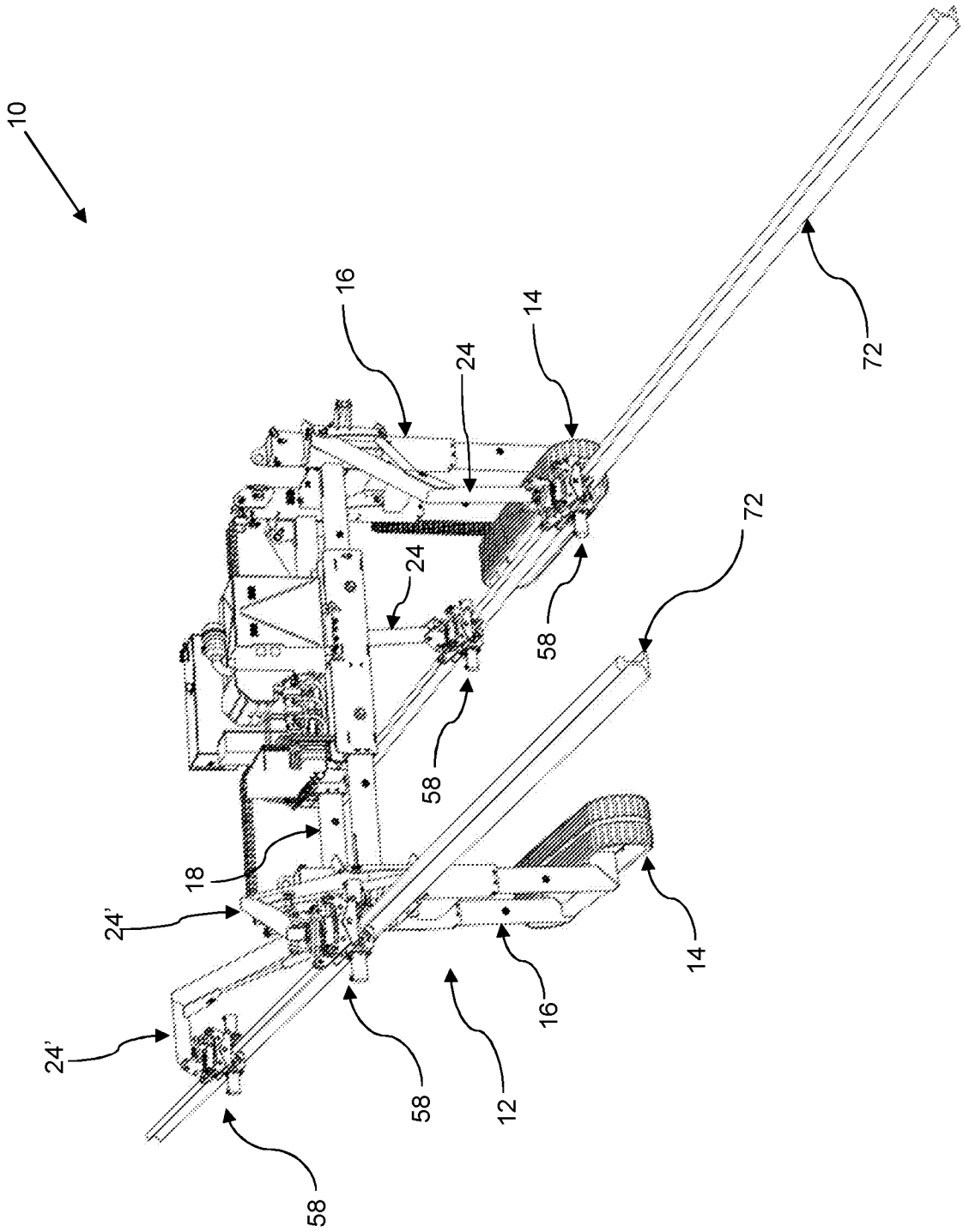
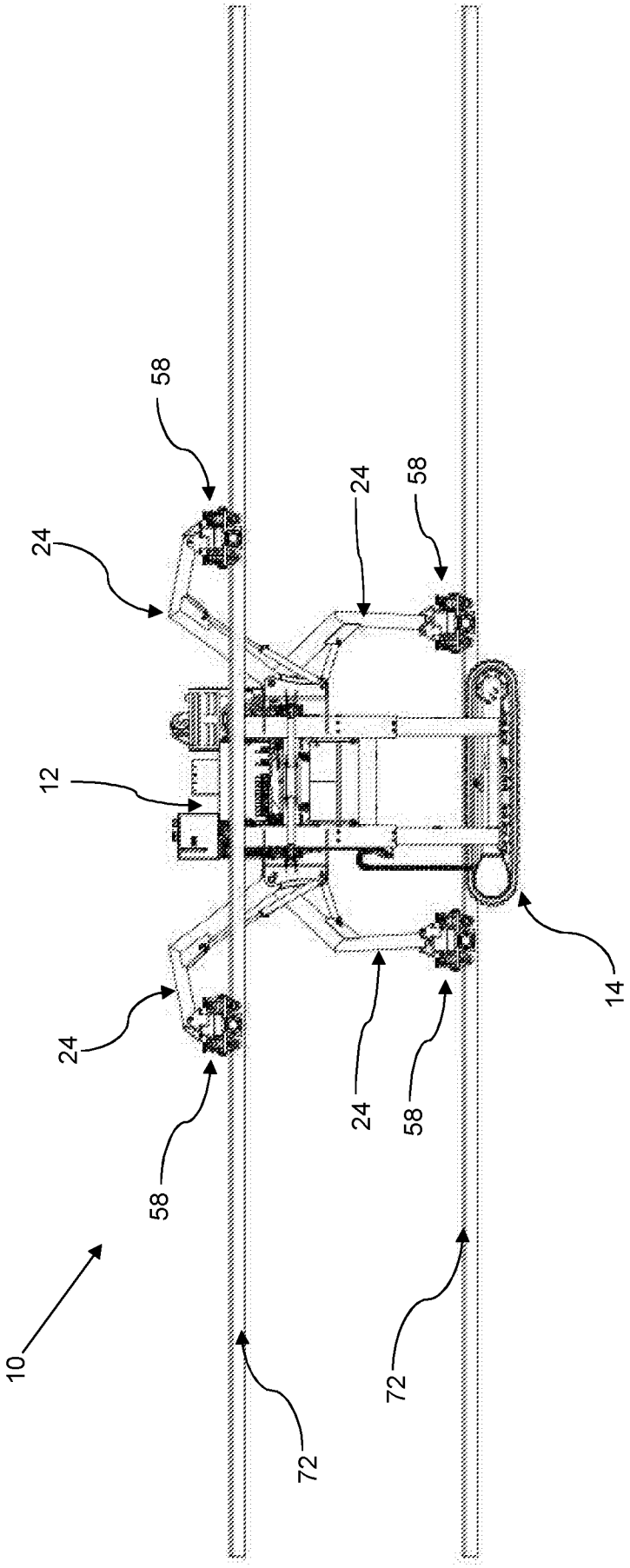


Figure 6

Figure 7



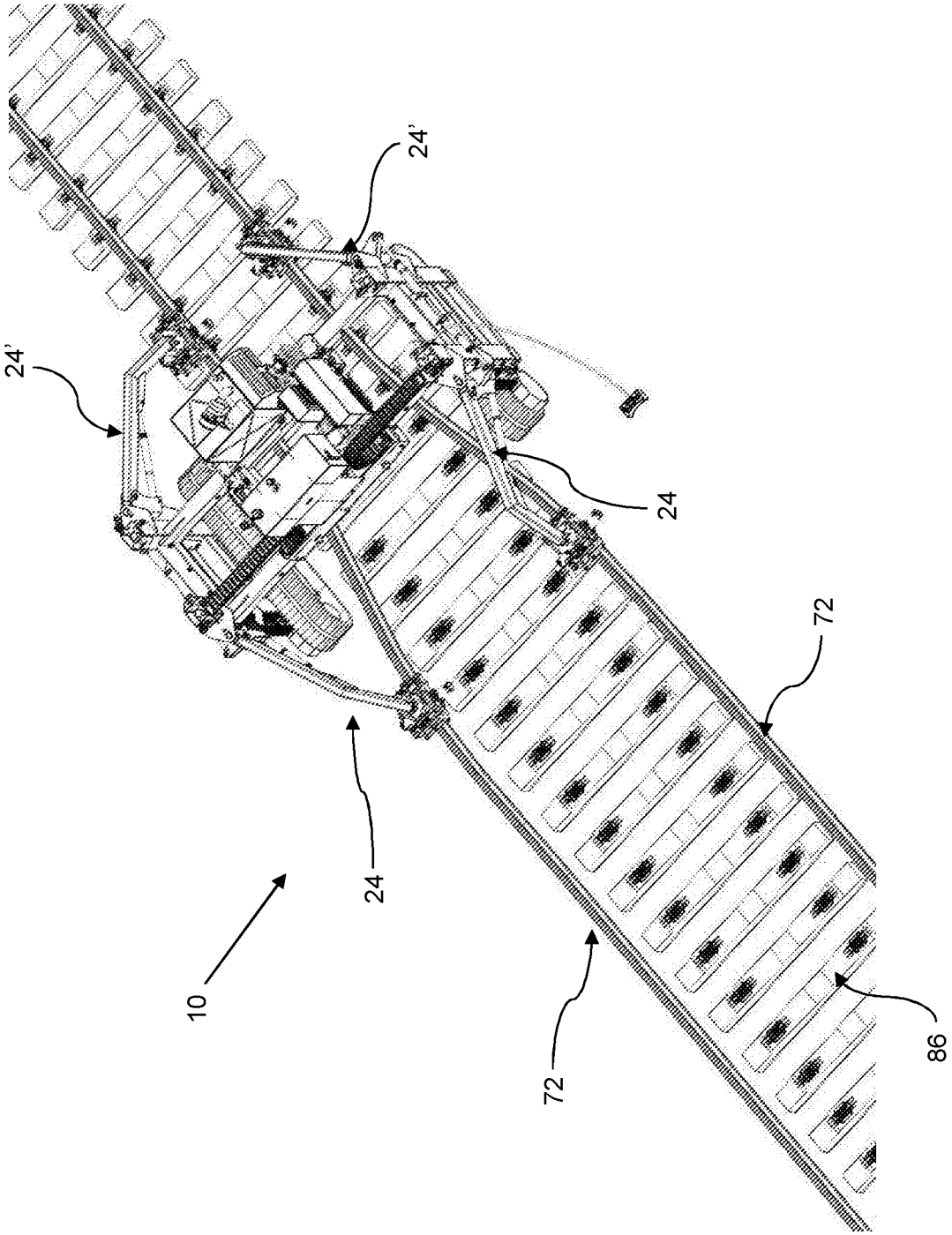


Figure 8

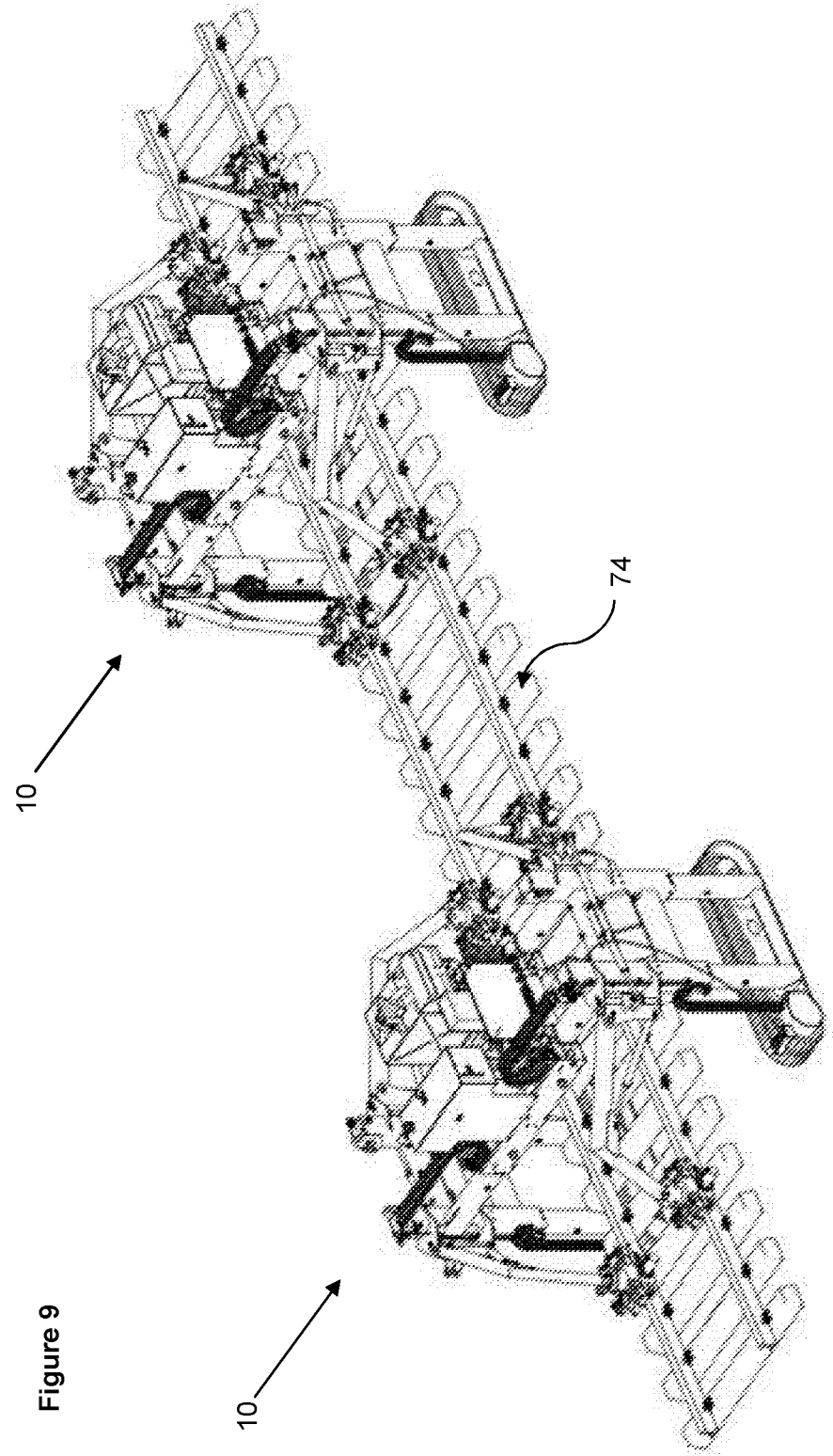
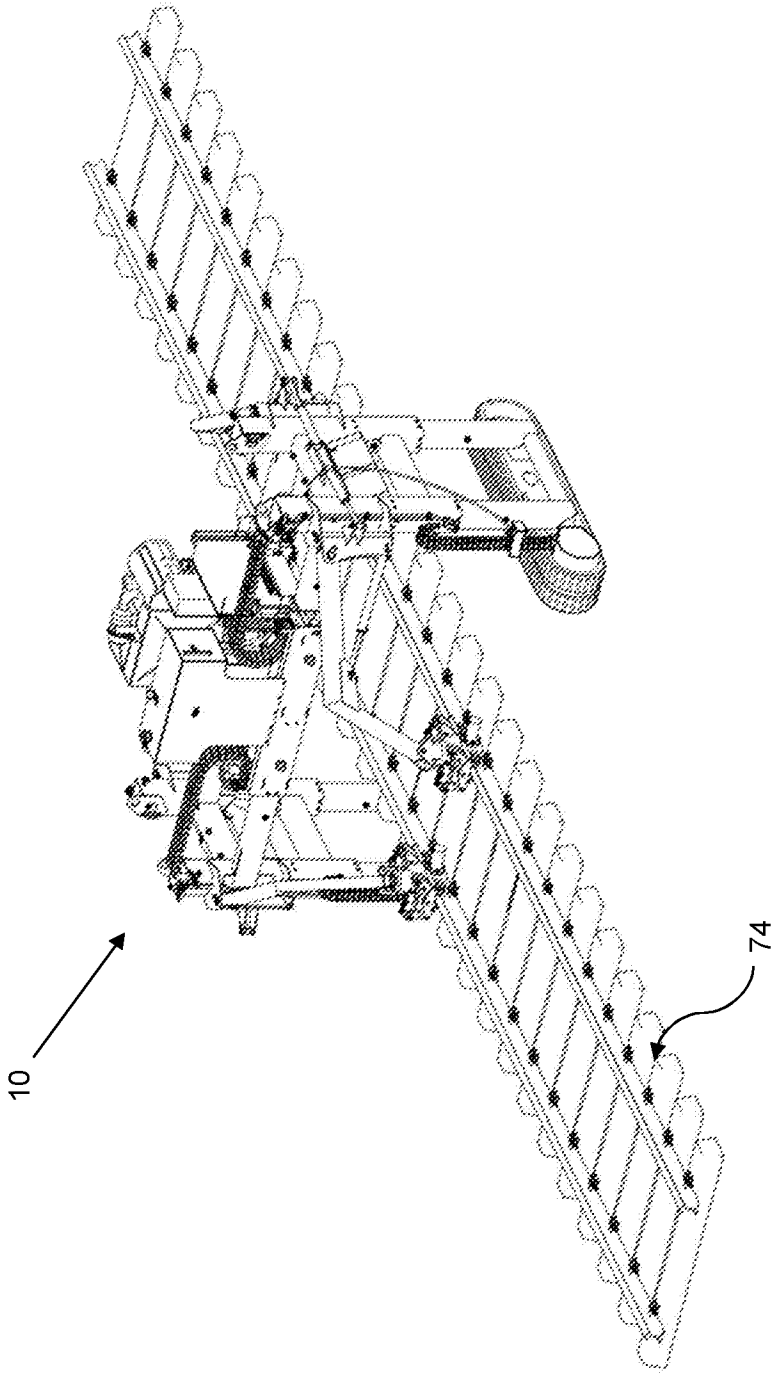


Figure 9

Figure 10



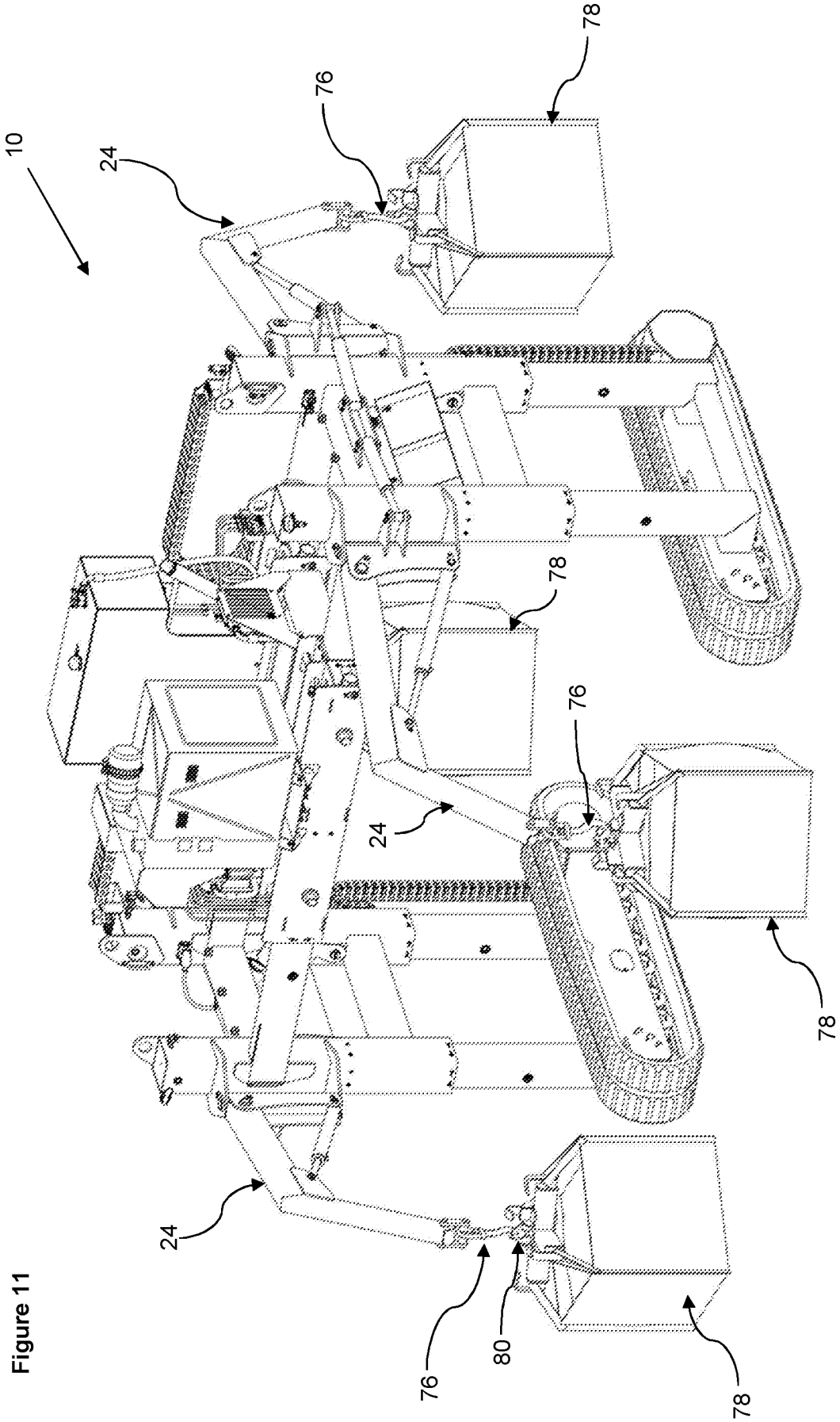
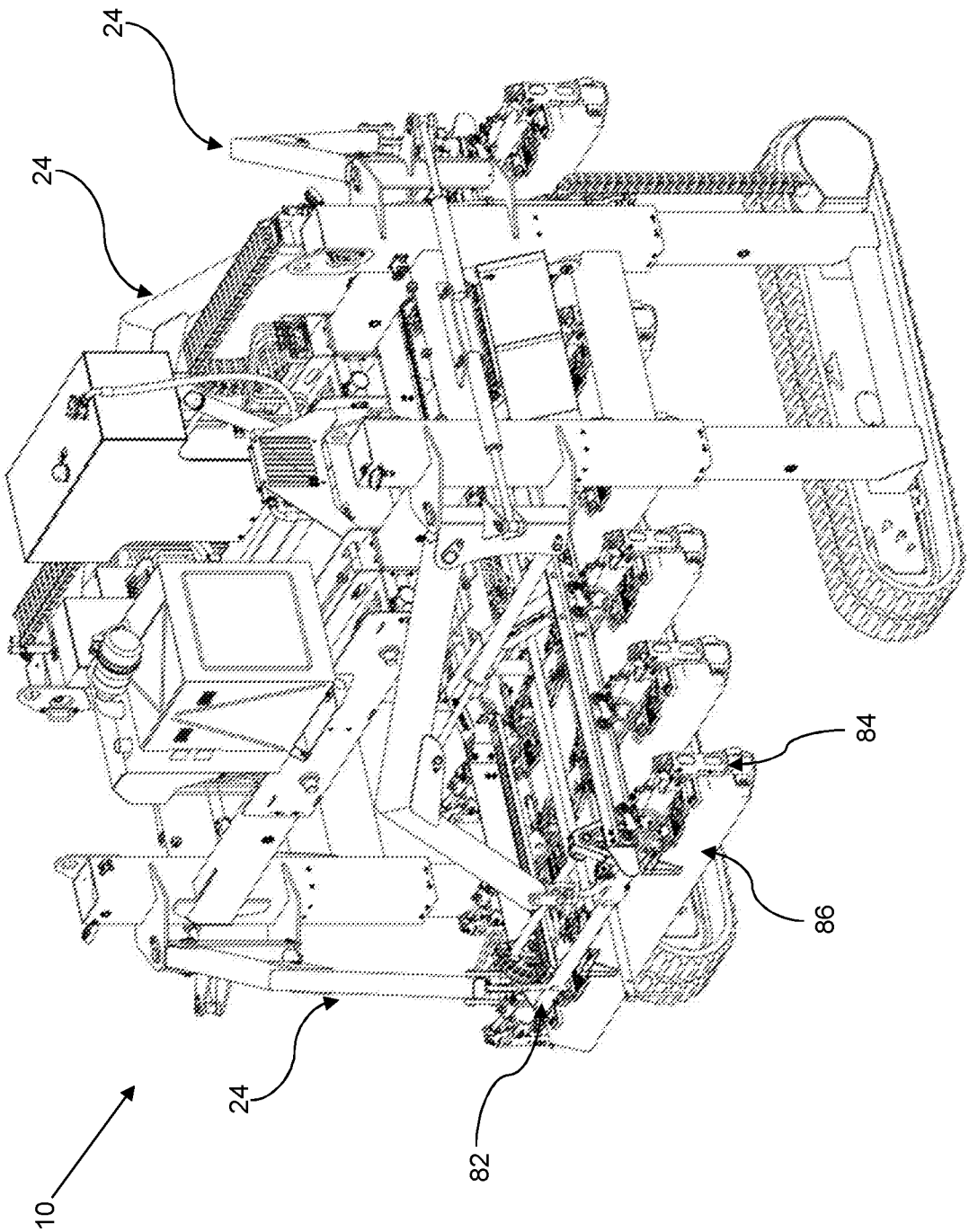


Figure 11

Figure 12



INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2022/051427

A. CLASSIFICATION OF SUBJECT MATTER
INV. E01B27/00 E01B29/00 E01B29/02 E01B29/16
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)
E01B

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	DE 20 2007 004544 U1 (ROBEL BAHNBAUMASCHINEN GMBH [DE]) 6 June 2007 (2007-06-06)	1,5, 7-10, 12-15, 17,18, 20,23
Y	paragraphs [0006] - [0021]; figures	2-4
X	JP H10 338902 A (NISHINIPPON RYOKAKU TETSUDO KK; TETSUYUU KOGYO KK) 22 December 1998 (1998-12-22)	1,5, 7-10,13, 15-17,23
Y	paragraphs [0011] - [0024]; figures	19,20
X	DE 20 2016 004571 U1 (ROBEL BAHNBAUMASCHINEN GMBH [DE]) 18 August 2016 (2016-08-18) paragraphs [0014] - [0030]; figures	1,5-9, 13,15, 17,23

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

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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
30 September 2022	12/12/2022

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	Movadat, Robin

1

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2022/051427

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CA 2 246 112 A1 (TURNER CHARLES W [US]) 27 February 1999 (1999-02-27) claims; figures	1,23
Y	DE 10 2019 212186 A1 (ROBEL BAHNBAUMASCHINEN GMBH [DE]) 18 February 2021 (2021-02-18) paragraphs [0022] - [0040]; figures	2-4,19, 20
A	DE 22 37 159 A1 (KNAPE FRITZ DIPL ING) 14 February 1974 (1974-02-14) the whole document	1-20

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2022/051427

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims;; it is covered by claims Nos.:

1-20, 23

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-20, 23

Railway-works support apparatus with first and second operative conditions;

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2. claim: 21

Railway-works support apparatus with selective railway-tool connector;

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3. claim: 22

Railway-works support apparatus with railway-tool end operable only outside of the footprint of the apparatus.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/GB2022/051427

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 202007004544 U1	06-06-2007	NONE	
JP H10338902 A	22-12-1998	JP 3854368 B2	06-12-2006
		JP H10338902 A	22-12-1998
DE 202016004571 U1	18-08-2016	NONE	
CA 2246112 A1	27-02-1999	NONE	
DE 102019212186 A1	18-02-2021	DE 102019212186 A1	18-02-2021
		WO 2021028372 A1	18-02-2021
DE 2237159 A1	14-02-1974	NONE	