



- (51) International Patent Classification:
E01C 23/088 (2006.01)
- (21) International Application Number:
PCT/GB2014/051100
- (22) International Filing Date:
9 April 2014 (09.04.2014)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
1306748.3 13 April 2013 (13.04.2013) GB
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- (81) Designated States (*unless otherwise indicated, for every
kind of national protection available*): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME,
MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,
OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA,
SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM,
ZW.
- (84) Designated States (*unless otherwise indicated, for every
kind of regional protection available*): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,

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(54) Title: GROUND PLANER

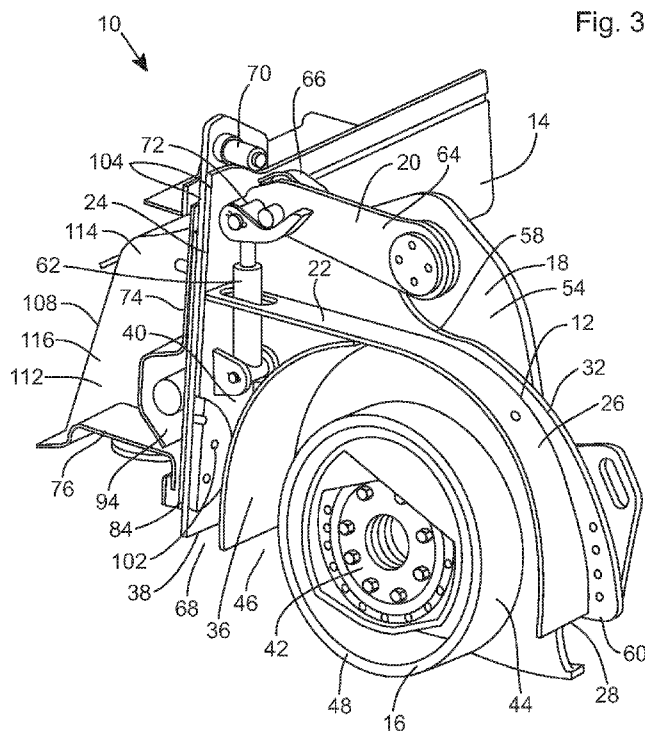


Fig. 3

(57) Abstract: A ground planer (10) comprises a drum housing (12) having a bottom opening (46), a grinding drum (16) which is mounted for rotation in the drum housing (12) and which projects from the bottom opening (46), a linearly-adjustable ground support (18) at each side of the drum housing (12), and an adjustment mechanism (20) for independently raising and lowering each ground support (18). The adjustment mechanism (20) includes an upright or substantially upright remotely-operable actuator (62) associated with each ground support (18), and a rocker arm (64) pivotably connected to each ground support (18). Pivotable movement of the rocker arm (64) by its actuator (62) thereby causes linear displacement of the associated ground support (18).



MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, **Published:**

SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,

GW, KM, ML, MR, NE, SN, TD, TG).

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Ground Planer

The present invention relates to a ground planer, and more particularly to an adjustment mechanism for independently raising and lower a ground support and/or an integrally formed liquid container for supplying a damping liquid to the grinding drum.

- 5 A self-levelling ground planer is known from Simex s.r.l. of San Giovanni in Persiceto, Bologna, via Newton, 31 – 40017, Italy. This provides side plates which are manually rotatable based on a cant, tilt or offset of ground to be worked. However, this arrangement is relatively complex and manual, and does not provide for remote height adjustability at each side of the drum housing.
- 10 Furthermore, it is a requirement to provide a compact and substantially protected remotely operable adjustment mechanism that can better withstand the relatively harsh working environment in which ground planers are utilised. In particular, by having hydraulic rams open to the, typically dusty, environment without shielding leads to premature wear and failure.
- 15 Additionally, it is beneficial to provide a damping liquid to the grinding drum to reduce the amount of suspended particulate matter and detritus within the drum housing. However, it is a problem trying to incorporate a reservoir for the damping liquid without making the apparatus unduly large and thus costly to produce.

The present invention seeks to provide a solution to these problems.

- 20 According to a first aspect of the invention, there is provided a ground planer comprising a drum housing having a bottom opening, a grinding drum which is mounted for rotation in the drum housing and which projects from the bottom opening, a linearly-adjustable ground support at each side of the drum housing, and an adjustment mechanism for independently raising and lowering each ground support, the
- 25 adjustment mechanism including an upright or substantially upright remotely-operable actuator associated with each ground support and a rocker arm pivotably connected to each ground support, so that pivotable movement of a said rocker arm by its actuator causes linear displacement of the associated ground support.

Preferable and/or optional features of the first aspect of the invention are set forth in claims 2 to 19, inclusive.

According to a second aspect of the invention, there is provided a ground planer comprising a drum housing having a bottom opening, a grinding drum which is
5 mounted for rotation in the drum housing and which projects from the bottom opening, and a hollow drum-housing support to which the drum housing is slidably mounted and which is connectable to a vehicle, the hollow drum-housing support including an integrally formed liquid container for supplying a damping liquid to the grinding drum.

Preferable and/or optional features of the second aspect of the invention are set forth in
10 claim 21 and claim 22.

According to a third aspect of the invention, there is provided a ground planer comprising a drum housing having a bottom opening, a grinding drum which is mounted for rotation in the drum housing and which projects from the bottom opening, an adjustable ground support at each side of the drum housing, and an adjustment
15 mechanism for independently adjusting each ground support, the adjustment mechanism including an upright or substantially upright remotely-operable actuator associated with each ground support provided in a shielded actuator compartment at a rear of the drum housing.

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

Figure 1 is a perspective view from above and to one side of one embodiment of a ground planer, in accordance with the present invention;

Figure 2 is a perspective view from above and the other side of the ground planer;

25 Figure 3 is a lateral cross-sectional view, taken at or adjacent to a midpoint on the longitudinal extent, through the ground planer;

Figure 4 is a perspective view of the ground planer, similar to Figure 2, showing the adjustable ground supports in a raised condition and also, in phantom lines, a

lowered condition; and

Figure 5 is a side elevational view of the ground planer showing the adjustable ground supports in a raised condition and again, in phantom lines, in a lowered condition.

- 5 Referring to the drawings, there is shown one embodiment of a ground planer 10 for milling or otherwise cold grinding a ground surface, such as that of a concrete or tarmac covered road, to a predetermined depth. The ground planer 10 comprises a drum housing 12, a drum-housing support 14 for attachment of the ground planer 10 to a prime mover, such as a skid steer loader, a grinding drum 16 within the drum housing
- 10 12, a linearly-adjustable ground support 18, and a remotely-operable adjustment mechanism 20 for controlling the ground support 18.

The drum housing 12 includes a top wall 22 which extends from a rear wall 24 to meet a curving front wall 26 which substantially follows a curvature of the grinding drum 16 from the top wall 22 to a leading bottom edge 28. An at least substantially continuous

15 first side wall 30 closes the drum housing 12 on one side and extends from the front wall 26 to the rear wall 24. A second side wall 32 in this case partially closes the drum housing 12 on the other side, and again extends from the front wall 26 to the rear wall 24. The second side wall 32 may include an access aperture 34 to allow hydraulic hoses or other actuator lines or cables to pass into and out of the drum housing 12.

- 20 A debris shield 36 extends from or adjacent to the top wall 22 and the front wall 26 arcuately towards a lower edge 38 of the rear wall 24. The debris shield 36 is preferably unbroken and shields the rear wall 24 from strikes by debris thrown up or off by the grinding drum 16.

The debris shield 36, rear wall 24 and opposing side walls 30, 32 therefore conveniently

25 provide a shielded actuator compartment 40 at a rear of the drum housing 12 and behind the grinding drum 16. See Figure 3.

The grinding drum 16 is mounted for rotation within the drum housing 12. Preferably, a hydraulically operable motor hub 42 is provided at one axial end of the grinding drum 16, accessible via the access aperture 34 in the second side wall 32 for attaching one or

more hydraulic lines thereto. A support bracket or hub having a bearing in which the other axial end of the grinding hub is journaled is therefore preferably provided on an interior surface of the first side wall 30.

The grinding drum 16 includes one or more tools or picks on an outer mounting surface 44, and the or each tool or pick is preferably replaceable, for example, when worn or damaged.

A bottom 46 of the drum housing 12 is open, so that a lowermost portion 48 of the grinding drum 16 protrudes therefrom in order to contact a surface to be planed. It may be feasible to include one or more flexible skirts at the lowermost leading front edge 28 and/or lowermost rear edge 38, if required, to again prevent or limit flying debris.

The linearly-adjustable ground support 18 comprises, in this embodiment, a slidable side plate 54 which is engaged with each side wall 30, 32. The first and second side walls 30, 32 include opposing rectilinear or straight edge channels 56 in which the respective side plates 54 can run, and each side plate 54 extends upwardly beyond an upper edge 58 of its associated side wall 30, 32.

Each ground support 18 also preferably includes a skid 59 which extends outwardly from a lowermost end of each side plate 54. The skids 58 support the drum housing 12, when in use, and also act as stops against ends of the edge channels 56 to prevent or limit the side plates 54 from being raised beyond a lowermost edge 60 of the drum housing 12.

The remotely-operable adjustment mechanism 20 comprises an upright actuator 62, in this case being a hydraulic ram, and a rocker arm 64 which is pivotably connected to an upwardly projecting portion 66 of a respective side wall 30, 32 and side plate 54. Each said side plate 54 is therefore associated with a respective actuator 62 and rocker arm 64 to enable independent adjustment.

Each actuator 62 is beneficially at least in part housed in the shielded actuator compartment 40, and extends through the top wall 22 to engage with the respective rocker arm 64, as shown in Figure 5. The opening in the top wall 22 may include a flexible closure device, such as brush or rubber gasket, to prevent or limit the ingress of

debris. A bottom 68 of the actuator compartment 40 may in any event be open to allow debris to exit. Conveniently, the arcuate debris shield 36 facilitates the movement of debris to the bottom 68 and thus out of the actuator compartment 40.

5 A further stop 70 is also included adjacent to a piston head 72 of each actuator 62, thereby preventing or limiting the possibility of overshoot of the actuator 62 and the side plate 54 being lowered too far, whereby a connection of the rocker arm 64 with the side plate 54 impacts the upper edge 58 of the side wall 30, 32, potentially damaging the interconnection.

10 Each actuator 62 includes a hydraulic hose connector or other hose or line connector for providing power thereto, thus enabling remote operation from an associated vehicle or other chassis.

15 The rear wall 24 of the drum housing 12 is slidably engaged with a front wall 74 of a support body 76 of the drum-housing support 14. Upper and lower support channels 78, 80 extend along upper and lower portions 82, 84 of the rear wall 24 for slidably receiving upper and lower edges 86, 88 of the support body 76 of the drum-housing support 14.

A further actuator 90 is recessed into the front wall 74 of the support body 76, being received in a longitudinal channel 94 extending from one side 96 of the support body 76 to the other side 98.

20 An actuator connector 100 is utilised to engage the rear wall 24 of the drum housing 12 with the further actuator 90, so that the drum housing 12 can be remotely slid along the longitudinal extent of the drum-housing support 14.

25 Beneficially, the actuator connector 100 may be angularly adjustable, for example, utilising a locking pin and pin-receiving apertures 102 to allow indexing of the actuator connector 100 to various angular displacements. To this end, the rear wall 24 of the drum housing 12 may comprise two substantially overlying plates 104 which are engaged with the rotatable actuator connector 100. The further stops 70 described previously therefore also function as stops for realigning the drum housing 12 to the horizontal, and side stops 106 may also be utilised for further security.

Consequently, by releasing the actuator connector 100, one or other of the rear wall plates 104 can be urged to rotate in the directions of arrows A and B in Figure 1. This allows the drum housing 12 to be tilted and the grinding drum 16 to be offset from the horizontal, as required, and then held in place by relocking the actuator connector 100.

- 5 A rear wall 108 of the support body 76 of the drum-housing support 14 preferably includes a vehicle hitch or connector 110 for releasable attachment to a suitable vehicle, preferably being a hydraulic machine. For example, the drum-housing support 14 is intended for releasable connection with the front hydraulic-actuable arms of a skid-steer loader or digger, or an articulatable arm of a backhoe. However, it may be
10 mountable on its own dedicated wheeled or tracked chassis, if required.

- A liquid damping system is preferably included as part of the ground planer 10, and to this end the drum-housing support 14 includes an integrally formed internal liquidtight cavity 112 forming part of an onboard liquid container 114. The liquid damping system also comprises a liquid feed from the liquid container 114 to one or more spray nozzles
15 at an interior of the drum housing 12, and preferably above the grinding drum 16. A liquid pump, in this case being hydraulically operable, therefore pumps liquid, typically being water, from the liquid container 114 to the or each spray nozzle, thereby damping dust and other particulate matter which may be suspended within the drum housing 12 during operation.

- 20 A liquidtight liner 116 is integrally formed on the interior surfaces of the front wall 74, rear wall 108, bottom wall 122, top wall 124 and side walls 96, 98 of the drum-housing support 14 to form the integrated liquid container 114. A closure element 128, such as a screw-threaded cap, is preferably provided at at least one end of the drum-housing support 14, and preferably in the top wall 124 for ease of access and refilling.

- 25 Optional grips, loops or eyelets 130 may also be included at or adjacent to a front edge of the drum housing 12 to improve manoeuvrability during attachment to and release from a support vehicle.

Although preferably hydraulically operable, other energisation means for powering the actuators may be utilised, such as electric motors or pneumatics.

Although the ground supports are described as including skids, these may be replaced or supplemented by rollers or wheels, for example.

The ground planer may be utilised without the drum-housing support having the integrally formed liquid container. For example, a hitch or other mounting means may
5 be provided directly on the drum housing.

Additionally, the ground planer may utilise the drum-housing support with integrally formed liquid container whilst dispensing with the linearly-adjustable ground supports.

The ground supports described above preferably comprise side plates. However, it is feasible that the side plates may be dispensed with in favour of a frame, or by use of an
10 upright strut interconnecting an end of the rocker arm to lower perpendicularly extending strut including or to which is mounted the skid or other ground engagement element. In this case, it may only be necessary to include one guide channel for the upright strut, instead of a guide channel at or adjacent to each side of the side wall.

It is also feasible that the linear actuators of the adjustment mechanism may be inverted,
15 whereby the rocker arms are mounted at or adjacent to a lower edge of the drum housing. This would potentially enable the side plates to be dispensed with and only ground engagable elements, such as skids, to be required.

Although rocker arms are preferred, other linkage means may be considered for operation by the upright actuator extending from the shielded actuator compartment at
20 the rear of the drum housing.

By providing such a remotely-operable adjustment mechanism with an actuator associated with each adjustable ground support, it is thus possible to raise and lower each ground support independently of the other. Furthermore, by providing a shielded actuator compartment in which the actuators are uprightly mounted, space utilisation is
25 optimised whilst the actuators are substantially protected from the surrounding environment during use, improving the longevity of the device. The utilisation of an upright actuator and rocker arm linkage again provides a compact and robust arrangement for actuating the linearly-adjustable ground supports. It is also possible to provide an integrated liquid reservoir formed as part of the drum-housing support,

which again reduces a requirement for additional components whilst also improving space utilisation.

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
5 from the scope of the invention as defined by the appended claims.

Claims

1. A ground planer (10) comprising a drum housing (12) having a bottom opening (46), a grinding drum (16) which is mounted for rotation in the drum housing (12) and which projects from the bottom opening (46), a linearly-adjustable
5 ground support (18) at each side (30, 32) of the drum housing (12), and an adjustment mechanism (20) for independently raising and lowering each ground support (18), the adjustment mechanism (20) including an upright or substantially upright remotely-operable actuator (62) associated with each ground support (18) and a rocker arm (64) pivotably connected to each ground
10 support (18), so that pivotable movement of a said rocker arm (64) by its actuator (62) causes linear displacement of the associated ground support (18).
2. A ground planer (10) as claimed in claim 1, wherein the adjustable ground supports (18) are side plates (54).
3. A ground planer (10) as claimed in claim 2, wherein the side plates (54) are
15 slidably mounted to respective sides (30, 32) of the drum housing (12).
4. A ground planer (10) as claimed in claim 2 or claim 3, wherein the sides (30, 32) of the drum housing (12) include opposing guide channels (56) in which the side plates (54) run.
5. A ground planer (10) as claimed in any one of claims 2 to 4, wherein the side
20 plates (54) project above the drum housing (12) for engagement with a respective said rocker arm (64).
6. A ground planer (10) as claimed in any one of claims 1 to 5, wherein each ground support (18) includes a skid (59) defining its lowermost edge.
7. A ground planer (10) as claimed in any one of claims 1 to 6, wherein each
25 upright actuator (62) is housed between sides (30, 32) of the drum housing (12).
8. A ground planer (10) as claimed in any one of claims 1 to 7, wherein each upright actuator (62) is positioned at a rear of the drum housing (12).

9. A ground planer (10) as claimed in any one of claims 1 to 8, wherein each upright actuator (62) extends through a top cover (22) of the drum housing (12).
10. A ground planer (10) as claimed in any one of claims 1 to 9, wherein a pivot point of the rocker arm (64) is off-centre between connections with the ground support (12) and the actuator (62).
5
11. A ground planer (10) as claimed in claim 10, wherein the pivot point of the rocker arm (64) is closer to the actuator (62) connection than the ground support (18) connection.
12. A ground planer (10) as claimed in any one of claims 1 to 11, further comprising a drum-housing support (14) for releasable attachment to a hydraulic machine.
10
13. A ground planer (10) as claimed in claim 12, wherein the drum housing (12) is adjustably slidable in a direction of the rotational axis of the grinding drum (16).
14. A ground planer (10) as claimed in claim 12 or claim 13, wherein a liquid container (114) is provided within the drum-housing support (14) for damping the grinding drum (16).
15
15. A ground planer (10) as claimed in claim 14, wherein the drum-housing support (14) is hollow and the liquid container (114) is integrally formed as part of the drum-housing support (14).
16. A ground planer (10) as claimed in claim 14 or claim 15, wherein the drum-housing support (14) includes a front wall (74) along which the drum housing (12) is slidable, the front wall (74) forming part of the liquid container (114).
20
17. A ground planer (10) as claimed in claim 16, further comprising a further actuator (62) for slidably moving the drum housing (12) and which is recessed in the front wall (74).
18. A ground planer (10) as claimed in any one of claims 14 to 17, wherein the drum-housing support (14) includes a rear wall (108) having a vehicle hitch, the rear wall (108) forming part of the liquid container (114).
25

19. A ground planer (10) as claimed in any one of claims 14 to 18, wherein a liquidtight liner (116) is provided on interior surfaces of the drum-housing support (14) to form the liquid container (114).
20. A ground planer (10) comprising a drum housing (12) having a bottom opening (46), a grinding drum (16) which is mounted for rotation in the drum housing (12) and which projects from the bottom opening (46), and a hollow drum-housing support (14) to which the drum housing (12) is slidably mounted and which is connectable to a vehicle, the hollow drum-housing support (14) including an integrally formed liquid container (114) for supplying a damping liquid to the grinding drum (16).
21. A ground planer (10) as claimed in claim 20, wherein the liquid container (114) extends a length of the hollow drum-housing support (14).
22. A ground planer (10) as claimed in claim 20 or claim 21, wherein a cavity (112) defined by interior surfaces of the hollow drum-housing support (14) includes an integral liquidtight liner (116) forming a part of the liquid container (114).
23. A ground planer (10) comprising a drum housing (12) having a bottom opening (46), a grinding drum (16) which is mounted for rotation in the drum housing (12) and which projects from the bottom opening (46), an adjustable ground support (18) at each side (30, 32) of the drum housing (12), and an adjustment mechanism (20) for independently adjusting each ground support (18), the adjustment mechanism (20) including an upright or substantially upright remotely-operable actuator (62) associated with each ground support (18) provided in a shielded actuator compartment (40) at a rear of the drum housing (12).

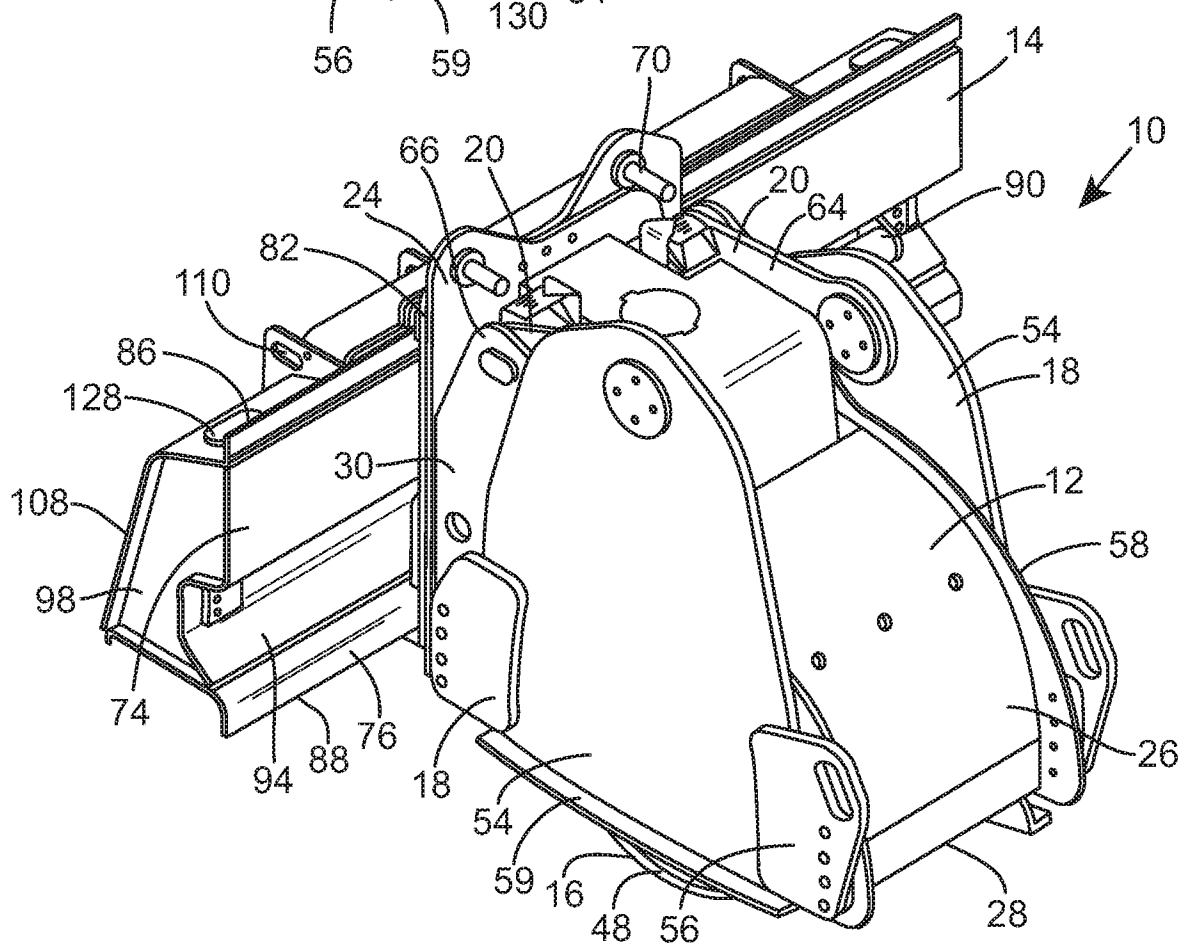
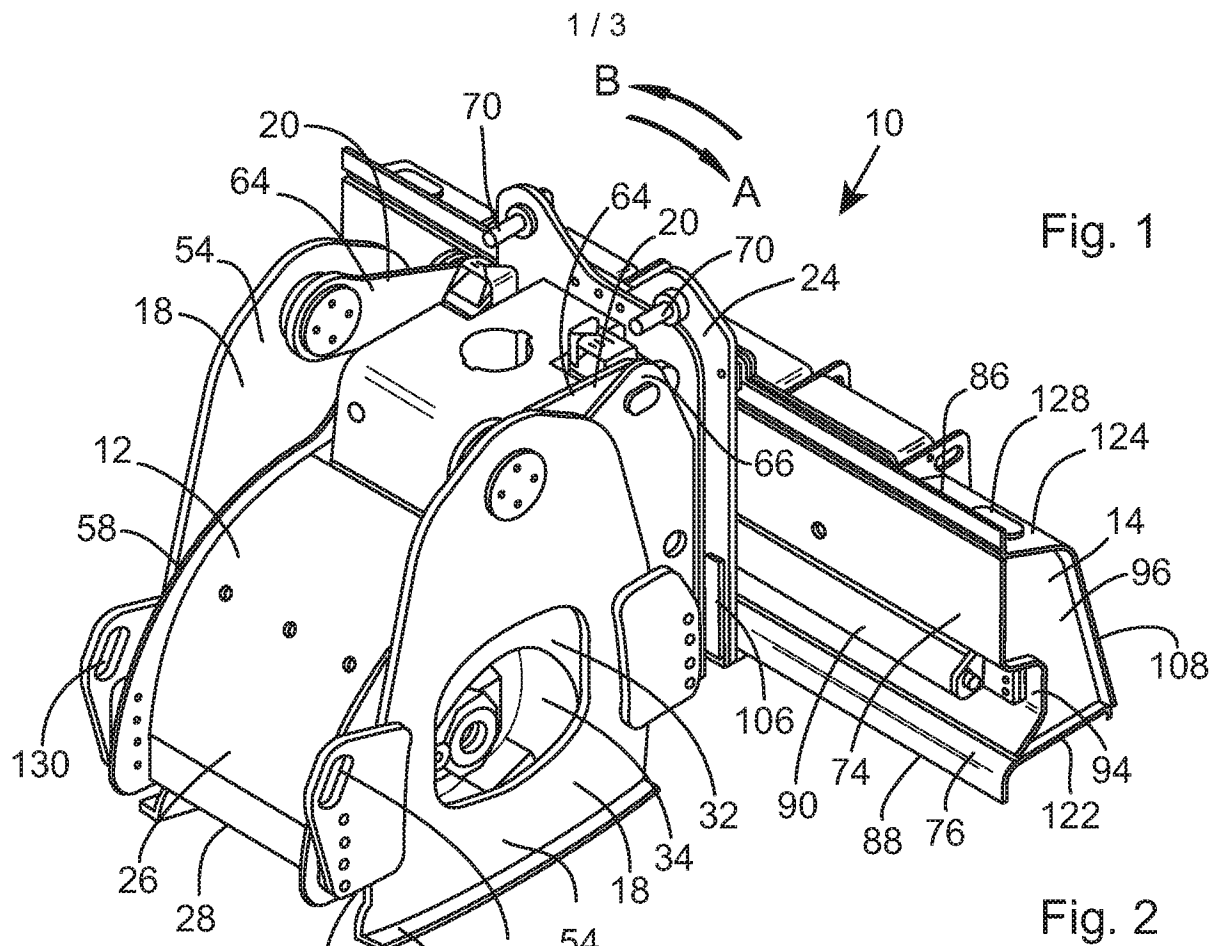


Fig. 3

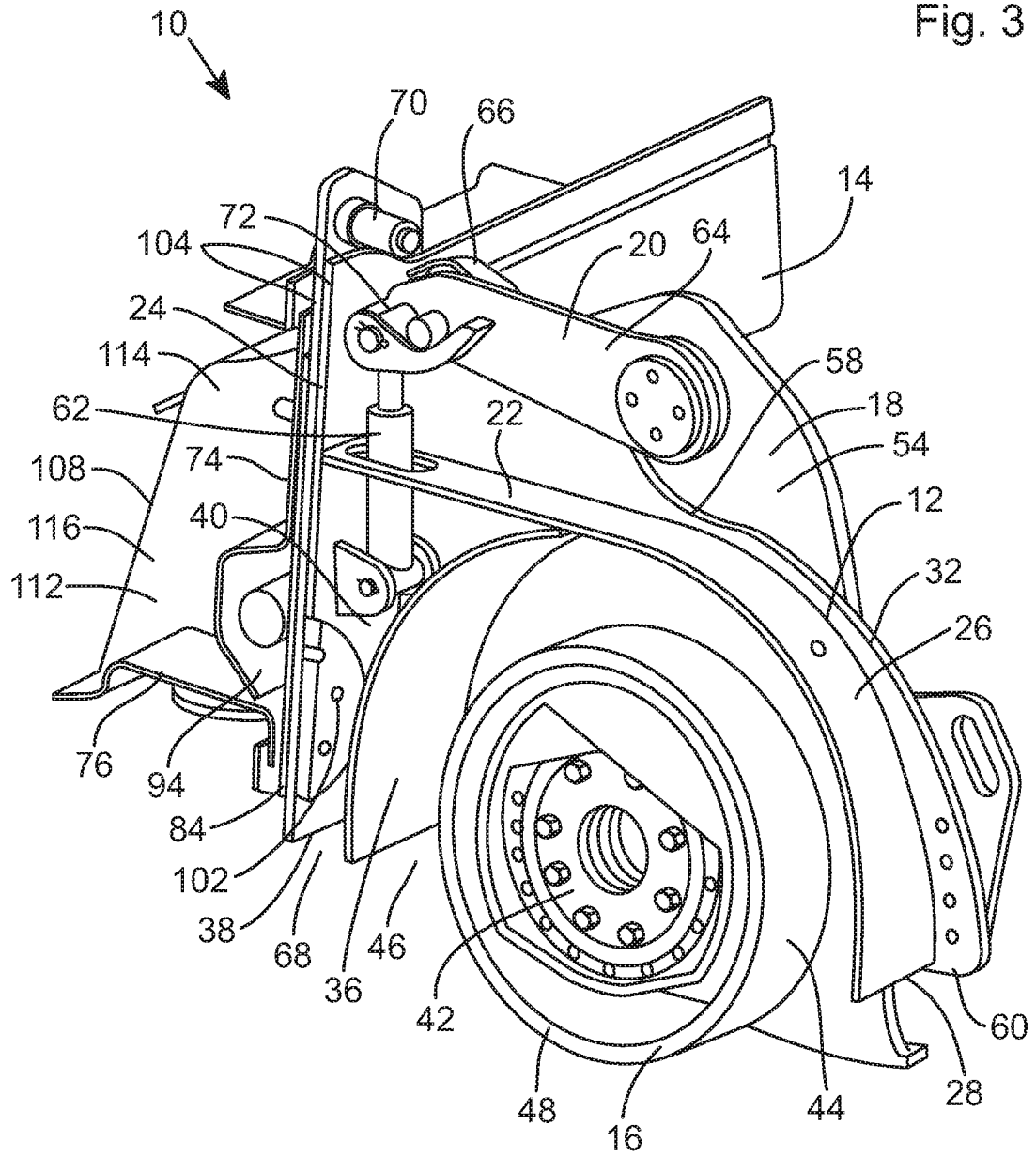


Fig. 4

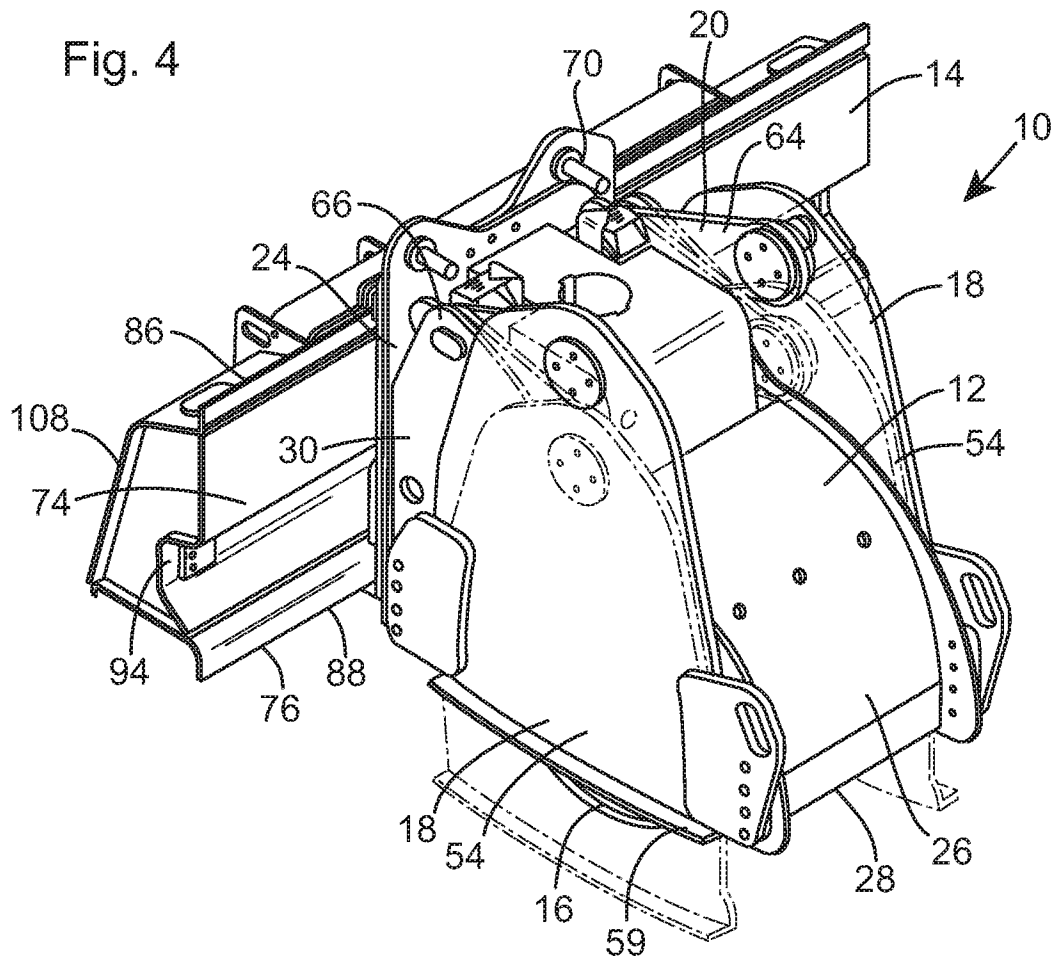


Fig. 5

