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(73) Patenthaver: **McCloskey International Limited, 1 McCloskey Road, Keen, Ontario K9J 0G6, Canada**

(72) Opfinder: **McCloskey, James Paschal, 1 McCloskey Road, Keen, Ontario K9J 0G6, Canada
Nottingham, Al, 1 McCloskey Road, Keen, Ontario K9J 0G6, Canada**

(74) Fuldmægtig i Danmark: **Budde Schou A/S, Dronningens Tværgade 30, 1302 København K, Danmark**

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DESCRIPTION

Cross Reference to Related Applications

[0001] The present application claims priority to U.S. Provisional Patent Application No. 62/427,091, filed November 28, 2016, entitled "Tracked Radial Stacker with Wheels,".

Technical Field

[0002] The present invention relates to a tracked, portable radial stacker according to the preamble of claim 1.

Background

[0003] Portable radial stackers have been used for many years to stack bulk materials such as aggregate for road construction, grain and coal. Radial stackers, which swing around in a radius to stack material in an arc, permit substantially more material to be stacked than is possible using a conventional stationary stacker that permits only a conical stack. Telescoping radial stackers permit even more material to be stacked as the stacker is extended or retracted during conveying operations.

[0004] Radial stackers typically include a wheeled axle disposed between a hopper and the top of the stacker from which the material is discharged. These wheels permit the stacker to be swung in an arc, with the hopper including a pivot plate on which the stacker pivots.

[0005] An additional advantage of having a wheeled radial stacker is that the stacker may be folded over itself and be ready for road transport in relatively little time, as the wheels that are used for radial travel can be displaced into a position aligned with the stacker to support the stacker for travel.

[0006] In recent years, tracked drives have been used in quarries, agricultural and mining operations to enable equipment to be moved over harsh terrain for ideal positioning for stacking operations. While tracked vehicles have proven to be of great benefit for such purposes, the use of tracks instead of wheels makes it more difficult to shift a stacker radially to facilitate the stacking of material in an arc instead of a cone. Also, because tracked vehicles are not typically permitted to be driven on road surfaces, they are normally loaded onto flatbed trucks for transit from one work site to another. These two drawbacks with the use of tracks has to a certain extent limited the use of tracked vehicles.

[0007] The document EP 2 883 819 A1 discloses a tracked, portable stacker according to the

preamble of claim 1.

Summary of the Disclosure

Brief Description of the Drawings

[0008] Embodiments will be readily understood by the following detailed description in conjunction with the accompanying drawings and the appended claims. Embodiments are illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings.

Figure 1 is a top plan view of an embodiment with the wheels in their lowered position, ready for radial repositioning of the stacker;

Figure 2 is a side elevation view of the embodiment of Fig. 1, showing the wheels in their lowered position in contact with the ground and with the tracks elevated off the ground;

Figure 3 is an end elevation view of a portion of the embodiment of Fig. 1 taken along line 3-3 of Fig. 2, showing the wheels in their lowered position and, in phantom, in their raised position;

Figure 4 is a side elevation view of the embodiment of Fig. 1, showing the wheels in their raised position and the tracks supporting the stacker, with the stacker collapsed over itself for travel around the job site or elsewhere;

Figure 5 is a top plan view of the embodiment of Fig. 1, showing wheels lowered to a 90 degree position for lateral travel, and including a track system mounted to the hopper for repositioning the entire stacker in a lateral direction;

Figure 6 is a side elevation view of the embodiment of Fig. 1, corresponding with Figure 5, including a schematic representation of a barge into which the stacker might be loading material as it is laterally moved from one position to another;

Figure 7 is an end elevation view of a portion of the embodiment of Fig. 1, showing the position of the wheels being controlled by hydraulic cylinders and in their lowered position in contact with the ground;

Figure 7A is a variation of the embodiment of Figs. 1-11 showing the wheels in a lowered, longitudinal position ready to be shifted longitudinally at the work site or to be driven down a road, with the track lifted off the ground;

Figure 8 is an end elevation view of a portion of the embodiment of Fig. 1, corresponding to Figure 7, showing the position of the wheels being controlled by hydraulic cylinders but in their raised position elevated from the ground, and rotated 90 degrees;

Figure 9 is a fragmentary top plan view of the embodiment of Fig. 1 corresponding to Figure 7

with the wheels in their lowered position, ready for radial repositioning of the stacker, with the wheels being powered by a hydraulic planetary drive;

Figure 10 is a fragmentary end elevation view corresponding to that of Fig. 7 showing a single wheel, with the wheel being chain-driven;

Figure 11 corresponds to that of Fig. 10 except that instead of a chain drive, it shows a hydraulic planetary drive;

Figure 12 is a top plan view showing a slightly different, double-wheeled embodiment, with the wheels in their lowered position, ready for radial repositioning;

Figure 13 is a side elevation view corresponding to Fig. 12, with the wheels in their lowered position and the track elevated off the ground, ready for radial repositioning;

Figure 14 is a side elevation view of the embodiment of Fig. 12 with the wheels in their lowered, longitudinal position supporting the tracks above the road for travel, and with the rear end mounted to a tractor fifth wheel;

Figure 15 is a top plan view corresponding to Fig. 14;

Figure 16 is a top plan view of a portion of the embodiment of Fig. 12 showing double wheels in their lowered, longitudinal position ready for road travel;

Figure 17 is a top plan view corresponding to Fig. 16 except that the double wheels are in their lowered position ready for radial displacement of the stacker;

Figure 18 is a side elevation view of a portion of the embodiment of Fig. 12 with double wheels in their raised position and the track on the ground ready for travel around a job site or elsewhere;

Figure 18A is an enlarged side elevation view corresponding to Fig. 18 except that the wheels are shown in their lowered, longitudinal position ready for longitudinal displacement down a road or elsewhere; and

Fig. 19 is a fragmentary top plan view of the embodiment of Fig. 12 with the double wheels in a lowered, 90 degree lateral position showing a tracked bogie disposed below the hopper, ready to move the stacker in a lateral direction.

Detailed Description of Disclosed Embodiments

[0009] In the following detailed description, reference is made to the accompanying drawings which form a part hereof, and in which are shown by way of illustration embodiments that may be practiced. It is to be understood that other embodiments may be utilized and structural or logical changes may be made without departing from the scope of the claims. Therefore, the

following detailed description is not to be taken in a limiting sense.

[0010] Various operations may be described as multiple discrete operations in turn, in a manner that may be helpful in understanding embodiments. However, the order of description should not be construed to imply that these operations are order-dependent.

[0011] The description may use perspective-based descriptions such as up/down, back/front, and top/bottom. Such descriptions are merely used to facilitate the discussion and are not intended to restrict the application of disclosed embodiments.

[0012] The terms "coupled" and "connected," along with their derivatives, may be used. It should be understood that these terms are not intended as synonyms for each other. Rather, in particular embodiments, "connected" may be used to indicate that two or more elements are in direct physical or electrical contact with each other. "Coupled" may mean that two or more elements are in direct physical or electrical contact. However, "coupled" may also mean that two or more elements are not in direct contact with each other, but yet still cooperate or interact with each other.

[0013] For the purposes of the description, a phrase in the form "A/B" or in the form "A and/or B" means (A), (B), or (A and B). For the purposes of the description, a phrase in the form "at least one of A, B, and C" means (A), (B), (C), (A and B), (A and C), (B and C), or (A, B and C). For the purposes of the description, a phrase in the form "(A)B" means (B) or (AB) that is, A is an optional element.

[0014] The description may use the terms "embodiment" or "embodiments," which may each refer to one or more of the same or different embodiments. Furthermore, the terms "comprising," "including," "having," and the like, as used with respect to embodiments, are synonymous, and are generally intended as "open" terms (e.g., the term "including" should be interpreted as "including but not limited to," the term "having" should be interpreted as "having at least," the term "includes" should be interpreted as "includes but is not limited to," etc.).

[0015] With respect to the use of any plural and/or singular terms herein, those having skill in the art can translate from the plural to the singular and/or from the singular to the plural as is appropriate to the context and/or application. The various singular/plural permutations may be expressly set forth herein for sake of clarity. Although certain embodiments have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art that a wide variety of alternate and/or equivalent embodiments or implementations calculated to achieve the same purposes may be substituted for the embodiments shown and described without departing from the scope. Those with skill in the art will readily appreciate that embodiments may be implemented in a very wide variety of ways. This application is intended to cover any adaptations or variations of the embodiments discussed herein. Therefore, it is manifestly intended that embodiments be limited only by the claims and the equivalents thereof.

[0016] A tracked, portable radial stacker for stockpiling bulk material may be provided that includes a linear conveyor having a rear portion and a front portion and being designed to carry bulk material from a lower position adjacent the rear portion to a raised position adjacent the front portion. A continuous track system may also be included, having a frame to which the conveyor is mounted, the track system including a pair of driven, parallel tracks. A pair of wheels can be mounted to the frame, the wheels being displaceable between a raised lateral position in which they do not contact the ground and a first lowered position in which they are laterally disposed and engage the ground to facilitate lateral conveyance of the conveyor, the pair of wheels also being rotatably mounted to the frame such that they can swivel at least 90 degrees to a raised longitudinal position and can be lowered to a second lowered position in which they are longitudinally disposed and engage the ground to facilitate longitudinal conveyance of the conveyor. Wheel displacement means may also be included for powering the pair of wheels from the raised lateral position to the first lowered position, the wheel displacement means also powering the wheels when in the first lowered position to lift the tracks off the ground to permit the conveyor to be conveyed in a lateral direction, the wheel displacement means also powering the pair of wheels from the raised longitudinal position to the second lowered position, the wheel displacement means also powering the wheels when in the second lowered position to lift the tracks off the ground to permit the conveyor to be conveyed in a longitudinal direction.

[0017] The wheel displacement means may comprise a pair of hydraulic cylinders, each of which powers a wheel.

[0018] Means swiveling the pair of wheels from a lateral position to a longitudinal position may also be provided.

[0019] The pair of wheels may be mounted to a pair of posts that are rotatably mounted to the frame to facilitate swiveling of each of the pair of wheels.

[0020] Alternatively, a system for raising and lowering a tracked bogie used with a stacker for stacking bulk materials may be provided. Such a system may include a stacker having a linear conveyor having front and rear portions, the front and rear portions being displaceable between raised and lowered positions. The system may also include a bogie having a pair of continuous tracks. A pair of wheels may be mounted to the bogie that are displaced both upwardly and downwardly, the wheels defining axes that may be shifted by at least 90 degrees to position the wheels in either a lateral or longitudinal direction. The system may further include a hydraulic cylinder system mounted between the bogie and the wheels for controlling the position of the wheels and to rotate them upwardly and downwardly with respect to the bogie on axes that are offset by 90 degrees. This way, by displacing the wheels to a lowered, lateral position, the tracks are elevated off the ground and the stacker is ready to be laterally repositioned around the job site, and such that by displacing the wheels to a lowered, longitudinal position, the tracks are elevated off the ground and the stacker is ready to be longitudinally conveyed down a roadway.

[0021] A tracked stacker is identified generally at 10 in the figures. Figures 1 and 2 show stacker 10 to be ready to be radially shifted (sometimes referred to herein as "lateral movement" or "laterally"). Stacker 10 includes a conveyor, indicated generally at 12, a track system, indicated generally at 14, and a wheel system, indicated generally at 16. A system for elevating and lowering stacker 10, indicated generally at 18, is shown in Fig. 3, taken along line 3-3 of Fig. 2.

[0022] More specifically, conveyor 12 may include a hopper 20, a main conveyor portion 22 and a discharge end 24. The depicted conveyor includes a joint 26, which may permit the conveyor to double back over itself as shown in Fig. 4 to facilitate road travel. Hydraulic cylinders 28 may be provided at either side of conveyor 12 to facilitate the pivot action and control the position of discharge end 24 relative to main conveyor portion 22. Rollers 30 are typically included to guide a belt, which has been deleted from the figures to better show the features of the conveyor. A pivot point 32 may be provided under hopper 20 to facilitate the radial shifting of the conveyor. Pivot point 32 is typically designed to be readily replaced with a fifth wheel king pin mount 33 (see Fig. 14) to be mounted to a tractor for transport to another site, as will be explained more fully as this discussion continues.

[0023] Conveyor 12 is designed to be disposed in various angular positions for various levels of stacking and for transit. This capability may be facilitated by a pair of support frames disposed at each end of main portion 22 of the conveyor. These support frames also help raise and lower track system 14, as will be explained more fully below. Rear support frames 34 extend from track system 14 to the underside of rearward aspect of main portion 22 of the conveyor. Normally, rear support frames 34 will be of telescoping construction. One of the rear support frames 34 may be disposed on each lateral side of conveyor 12 to provide sufficient support and balance to the conveyor. A pair of rear intermediate support frames 36 may also be included, and in the depicted embodiment extend from a track system mounting frame 38 to the underside rear aspect of main portion 22 of the conveyor. Rear intermediate support frames 36 may also be telescoping, but typically are not.

[0024] Rear support frames 34 may be provided with hydraulic rams 39 to provide power to reposition the rear support frames and to raise and lower the rear end of conveyor 12 to permit stacker 10 to be repositioned to lower the tracks to the ground and to facilitate mounting of king pin 33 to a fifth wheel of a tractor. Rear support frames 34 may also be provided with pegs and complementing holes (not shown) to fix the support frame in position during operations when the hydraulic rams are not changing the position of the rear support frames.

[0025] A pair of front support frames 40 may also be provided to extend from track system 14 to the underside of a forward aspect of main portion 22 of the conveyor. Front support frames 40 are normally telescoping in configuration. One of the front support frames 40 may be disposed on each lateral side of conveyor 12 to provide sufficient support and balance to the conveyor. Front support frames 40 are normally provided with hydraulic rams 41 to provide power to reposition the support frames, and may be provided with pegs and complementing holes (not shown) to fix the support frame in position during operations when the hydraulic

rams are not changing the position of the front support frame.

[0026] Track system 14 is conventional in that it includes a pair of continuous tracks 42 mounted to track system mounting frame 38. Tracks 42 are driven by an engine through either a mechanical transmission or hydraulic drive. The drive typically provides the capability of reversability to maximize the maneuverability of the unit.

[0027] A bogie 44 for wheel system 16 is shown best in Fig. 3. Wheel system 16 typically includes a pair of wheels 46, although in Figs. 12 - 19, in a slightly different embodiment, a pair of coaxial wheels 47 are depicted. However, coaxial wheels 47 will be sometimes described herein as though they are a single wheel. Because the embodiment of Figs. 12-19 is slightly different in the arrangement of the wheels but the rest of the stacker is the same, the numbers for this slightly different embodiment have are not different from the numbers in embodiment 1-11.

[0028] When in their lowered, lateral position (ready for either radial or 90 degree displacement of stacker 10) shown in Figs. 1-3, 5-7, 9, 12-13, 17 and 19, wheels 46 or 47 support tracks 42 in an elevated position. With the wheels in the radial, lateral position, stacker 10 can be driven in a radial direction to provide a second conical stack of bulk material, or to provide additional stacks in an arc. With the wheels in a 90 degree lateral position, and pivot point 32 or king pin 33 mounted to a tracked bogie, such as that shown in Figs. 5, 6 and 19, the stacks can take the form on a long pile, or the stacker can be used to fill one or more barges, trucks or rail cars. The additional tracked bogie 66 may be used to reposition a stacker for longitudinal displacement by shifting the additional bogie and wheels 47 by 90 degrees if for some reason that is preferable to operating the stacker through longitudinal movement of the tracks 42 of bogie 44.

[0029] To provide power drive to wheels 46 or 47, a chain drive 62 may be included as shown schematically in Fig. 10 or a hydraulic planetary drive motor 64 as shown in Figs. 9 and 11.

[0030] After stacker 10 is properly positioned, wheels 46 can be translated to a raised position in which they no longer contact the ground, one of such positions being shown in Figs. 3 (in phantom) and 8. In this raised position, wheels 46 also may rotate approximately 90 degrees, to the depicted position such that the axes of the wheels extend laterally of stacker 10. This rotation may be effected using hydraulics or some other power means or may be performed manually with pegs and complementing holes (not show).

[0031] The raised position of wheels 47 is shown in Fig. 18, although they may alternatively be raised from one of their lateral (radial or 90 degree) positions.

[0032] When wheels 46 are in their raised positions, tracks 42 contact the ground to ensure maximum maneuverability around the job site. With wheels 46 well up and out of the way as depicted in Fig. 3, there is little risk of the wheels and their tires being damaged despite the rough environment in which the stacker is operating. Wheels 46 are each supported by a leg

50, and are outfitted with a web 52. A hydraulic cylinder 54 extends between each of the two webs 52 of wheels 46 and bogie 44. The pair of hydraulic cylinders 54 maintain the two wheels in their lowered and raised positions, although pegs with complementing apertures (not shown) or other support means may also be included.

[0033] As shown in Fig. 7A, an additional set of hydraulic cylinders 55 may be included to pivot wheels 46 clockwise from the position shown in Fig. 4 to one in which the wheels contact the ground to raise tracks 42 off the ground. This longitudinal disposition of wheels 46 would permit stacker 10 to be pulled down the road from one site to another.

[0034] The arrangement shown in Figs. 12-19 is slightly different in that each wheel 47 includes a slightly different leg 56 that may be mounted to a vertical post 58. Post 58 may be rotatably mounted to bogie 44 so that wheels 47 may be swiveled from the longitudinal positions shown, for example, in Fig. 16, to the radial, lateral position shown in Fig. 17, or the 90 degree, lateral position. This swiveling may be performed manually or may be provided by a hydraulic motor or hydraulic cylinder drive. Wheels 47, legs 56 and posts 58 may also be provided with a hydraulic cylinders 60 for raising and lowering wheels 47.

[0035] Thus, with wheels 47 elevated off the ground as shown in Fig. 18, post 58 may be swiveled to a 90 degree lateral position or to a radial position such as that shown in Fig. 17. Wheels 47 may then be lowered to the ground and, powered by hydraulic cylinders 60, can then raise tracks 42 off the ground. Stacker 10 then is ready to be maneuvered around the job site if wheels 47 are in a lateral position as shown in Fig. 12, 13 or 17 or can be pulled to another site if wheels 47 are in a longitudinal position as shown in Fig. 16 and 18A. As described earlier, pegs and complementing apertures (not shown), or other fixation systems, might be included to lock the wheels in their lowered or raised positions.

[0036] Once the stacker has reached its destination, in order to prepare the stacker for operations, king pin mount 33 would first be disconnected from the fifth wheel of the tractor and would be replaced with pivot point 32. Any positioning pegs or other fixation means in hydraulic cylinders 50 would be removed and wheels 46 would be raised to their position shown in Fig. 4 or 18. This permits tracks 42 to be lowered to the ground so they now support stacker 10. Hydraulic cylinders 28 may then be operated to cause conveyor discharge end 24 to be pivoted from the position shown in Fig. 4, and hydraulic cylinder 41 in front support frames 40 is extended so conveyor 12 takes the position shown in Figs. 2, 6 and 13.

[0037] If it is desired to move stacker 10 radially, either before, after or during this operation to raise the front of the conveyor, wheels 46 may be lowered from the raised position to the lowered position shown in Fig. 3. This may be done by extending hydraulic cylinders 54 until they reach the position depicted in solid lines in Fig. 3. This will raise tracks 42 off the ground as shown in Fig. 2. Or, if the radial position of stacker 12 is where it is desired, wheels 46 may be maintained in their raised position.

[0038] During operations, it is up to the operator to decide if the tracks or the wheels are in

contact with the ground; that is, whether the wheels are in their raised position with the tracks in contact with the ground or in their lowered position, with the tracks elevated from contact with the ground. It is also up to the operator to decide, if the wheels are down, whether they be in a radial or longitudinal position. In any event, the operator is provided with a number of options.

[0039] With the embodiment of Figs. 12-19, to move stacker radially, either before, after or during the unfolding operation of the conveyor, wheels 47 and their legs 56 can be swiveled on posts 58 and then lowered by hydraulic cylinders 54. This will raise tracks 42 off the ground as shown in Fig. 13. Or, if the radial position of stacker 12 is where it is desired, wheels 47 may be maintained in their raised position, depending upon whether the operator wants to perform conveying operations with tracks 42 or wheels 47 on the ground supporting the stacker. When operations are completed and stacker 10 is to be moved to another site, hydraulic cylinders 54 raise legs 56 and wheels 47, posts 58 are swiveled to position wheels 47 longitudinally, and the cylinders can then lower the wheels to the position shown in Figs. 14, 15 and 18A. Conveyor discharge end 24 is then pivoted through the operation of cylinders 28 to the position shown in Fig. 14 while cylinder 41 lowers that front end of the conveyor. In some instances, cylinders 39 may need to be operated to raise the rear end of conveyor 12 as necessary to facilitate the replacement of pivot point 32 with king pin mount 33, and position stacker 10 on the fifth wheel of the tractor as shown in Fig. 14.

[0040] Although certain embodiments have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art that a wide variety of alternate and/or equivalent embodiments or implementations calculated to achieve the same purposes may be substituted for the embodiments shown and described without departing from the scope of the claims. Those with skill in the art will readily appreciate that embodiments may be implemented in a very wide variety of ways. This application is intended to cover any adaptations or variations of the embodiments discussed herein. Therefore, it is manifestly intended that embodiments be limited only by the claims and the equivalents thereof.

REFERENCES CITED IN THE DESCRIPTION

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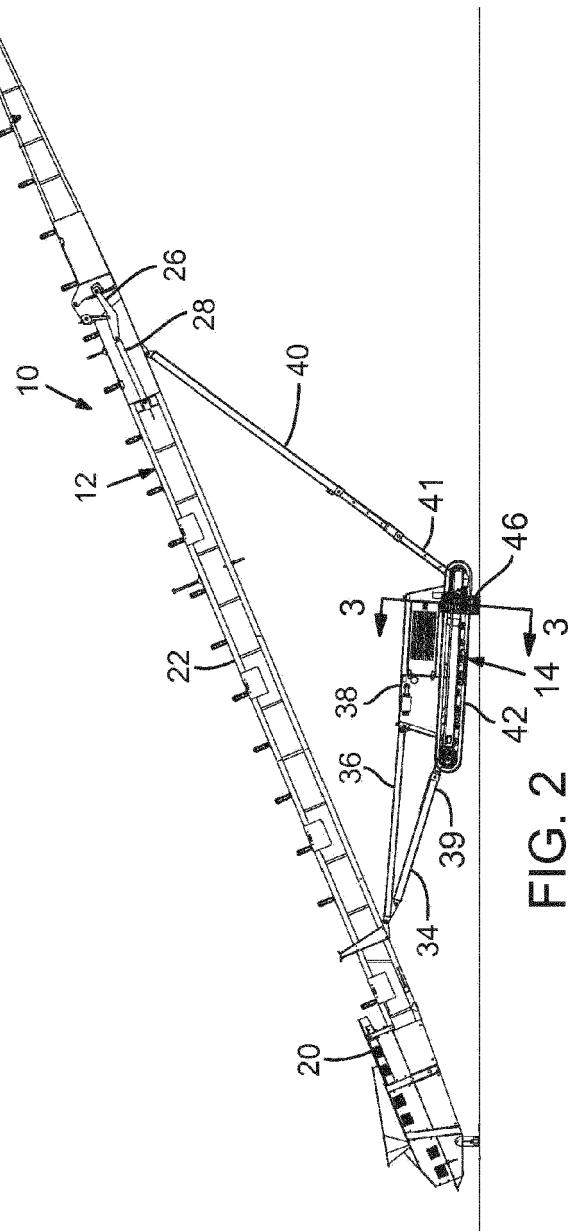
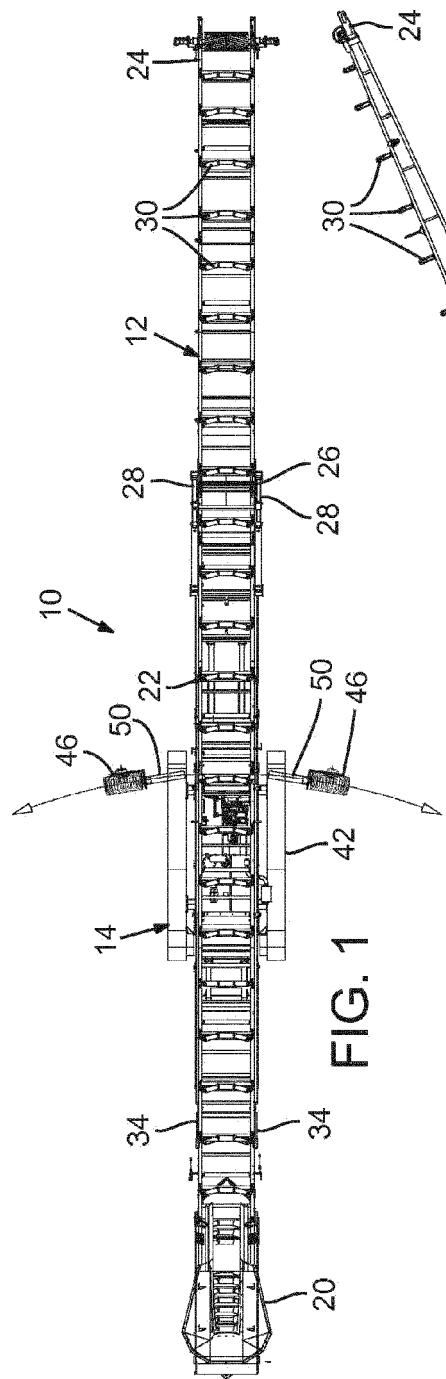
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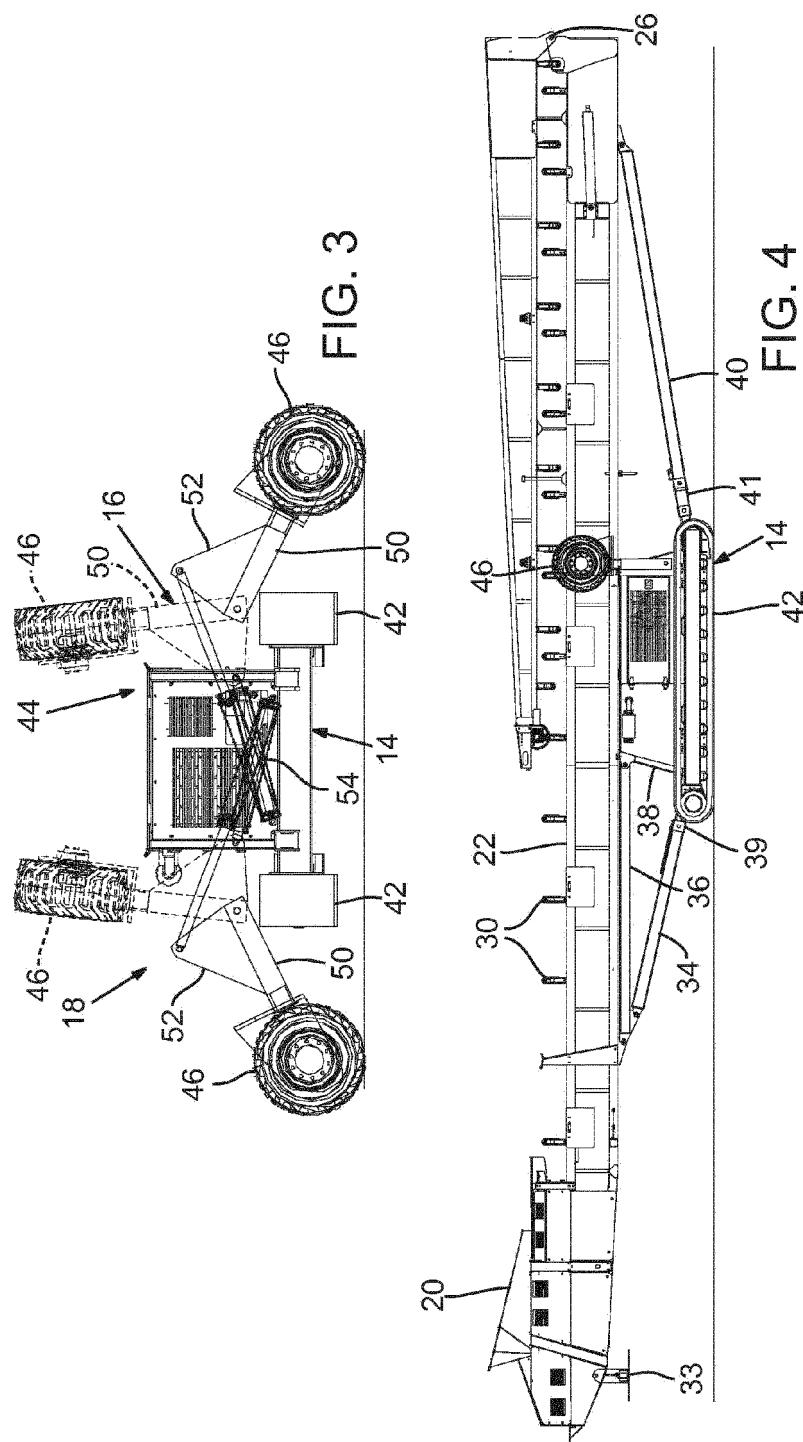
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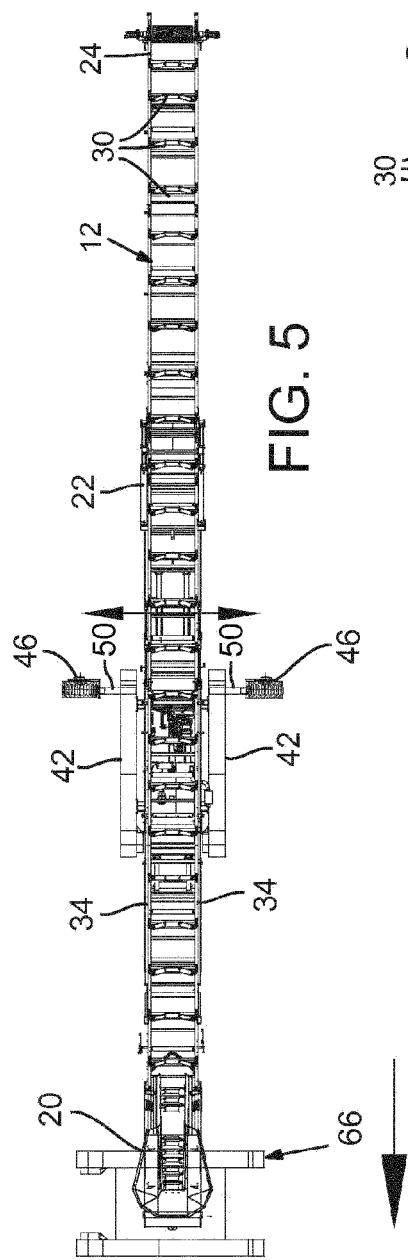
1. Flytbar radialstakker (10) med bælter til opstakning af løsgodsmateriale, omfattende:
 - 5 en lineær transportør (12) med en bageste del og en forreste del og som er udformet til at føre løsgodsmateriale fra en lavere position i tilstødning til den bageste del til en hævet position i tilstødning til den forreste del;
 - 10 et kontinuert bæltesystem (14), omfattende en ramme (38), hvortil transportøren (12) er monteret, hvilket bæltesystem (14) omfatter et par drevne, parallelle bælter (42);
 - 15 et par hjul (46, 47) monterede på rammen (38), som er forskydelige imellem en hævet sideværts position, i hvilken de ikke er i kontakt med jorden og en første sænket position, i hvilken de er sideværts placerede og indgriber med jorden for at muliggøre sideværts bevægelse af transportøren (12); og
 - 20 hjulforskydningsorganer til at drive parret af hjul (46, 47) fra den hævede sideværts position til den første sænkede position;
kendetegnet ved, at parret af hjul (46, 47) er drejeligt monterede på rammen (38) således, at de kan svinge i det mindste 90° til en hævet langsgående position og kan sænkes til en anden sænket position, i hvilken de er anbragt langsgående og indgriber med jorden for at muliggøre langsgående bevægelse af transportøren (12); og
 - 25 hjulforskydningsorganerne driver også hjulene, når de er i den første sænkede position til at løfte bælterne (42) fri af jorden for at muliggøre at transportøren (12) bevæges i en sideværts retning, idet hjulforskydningsorganerne også driver parret af hjul (46, 47) fra den hævede langsgående position til den anden sænkede position, idet hjulforskydningsorganerne også driver hjulene (46, 47) når de er i den anden sænkede position til at løfte bælterne (42) fri af jorden for at muliggøre at transportøren (12) bevæges i en langsgående retning.
- 30 2. Radialstakker (10) ifølge krav 1, hvor hjulforskydningsorganerne omfatter et par hydrauliske cylindere (54), som hver især driver et hjul (46, 47).
3. Radialstakker (10) ifølge krav 1 eller krav 2, som yderligere omfatter organer til at svinge parret af hjul (46, 47) fra en sideværts position til en langsgående position.

4. Radialstakker (10) ifølge ethvert af kravene 1 til 3, som yderligere omfatter forreste og bageste teleskoperende rammeelementer (36, 40), som strækker sig imellem rammen (38) og foreenden henholdsvis bagenden af transportøren (12).
5. Radialstakker (10) ifølge krav 4, hvor det forreste teleskoperende rammeelement (40) omfatter organer til at drive forlængelsen af det forreste teleskoperende rammeelement (40).
6. Radialstakker ifølge ethvert af de foregående krav, hvor parret af hjul (46, 47) er monterede på et par stolper (58), som er drejeligt monterede på rammen (38) for at muliggøre svingning af hvert af parret af hjul (46, 47).

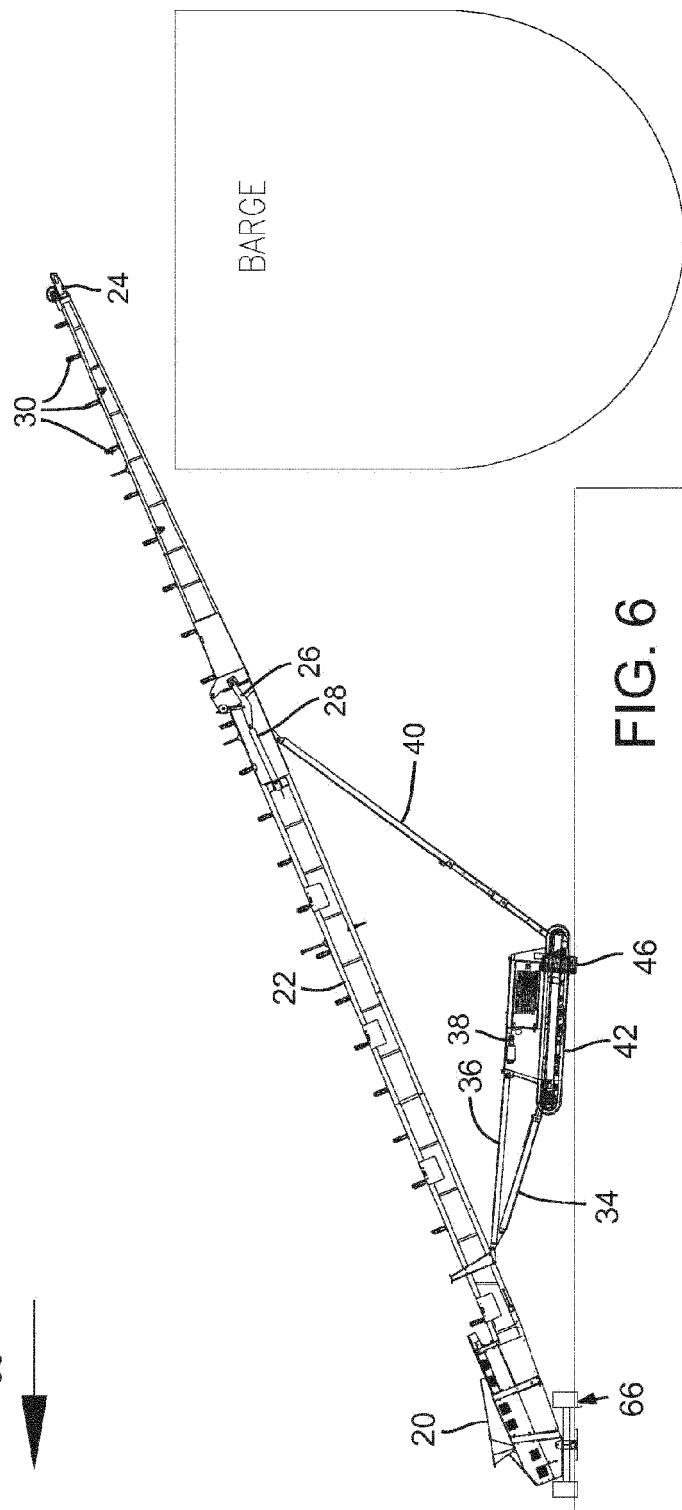
DRAWINGS



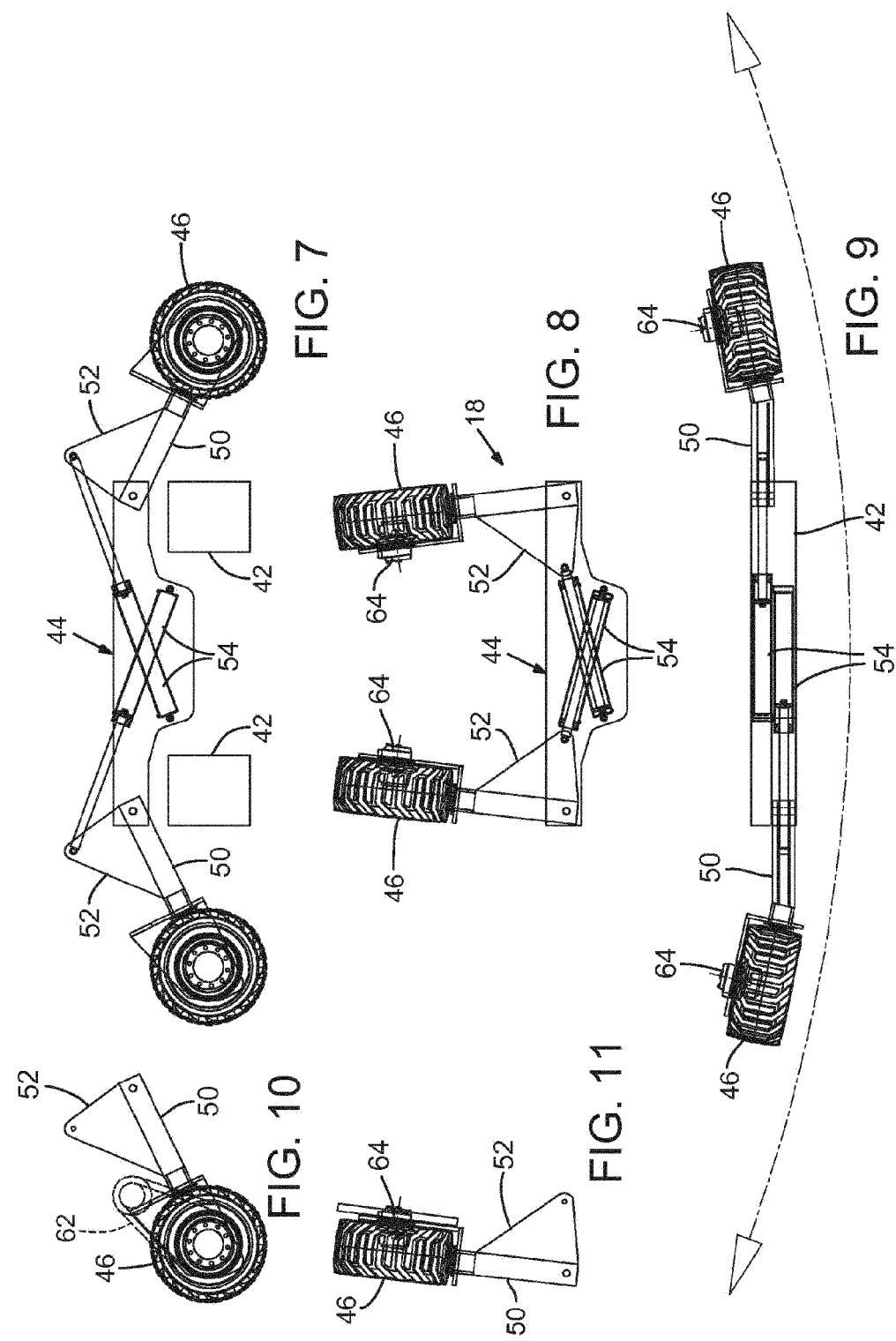




5
FIG



6
FIG.



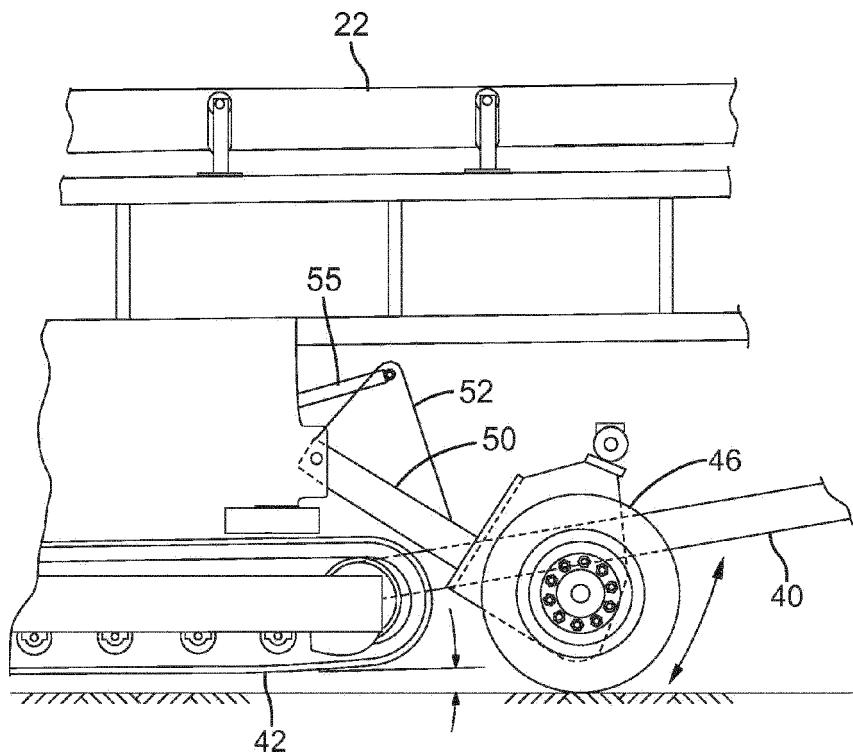


FIG. 7A

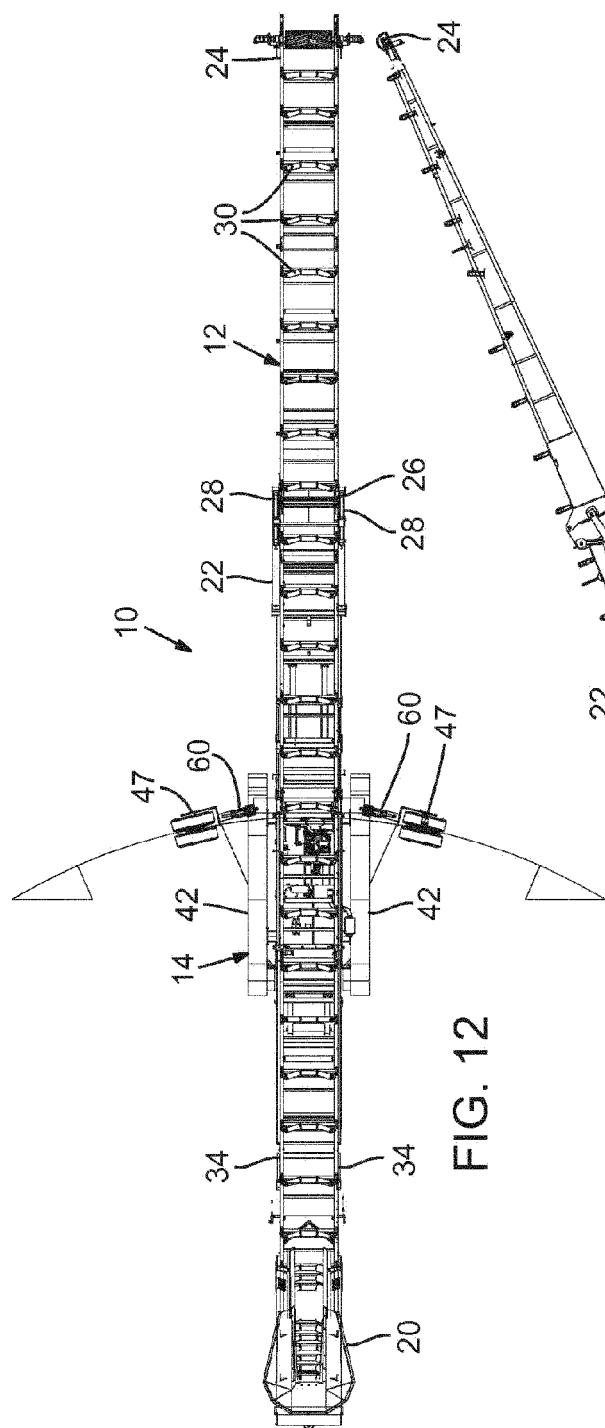


FIG. 12

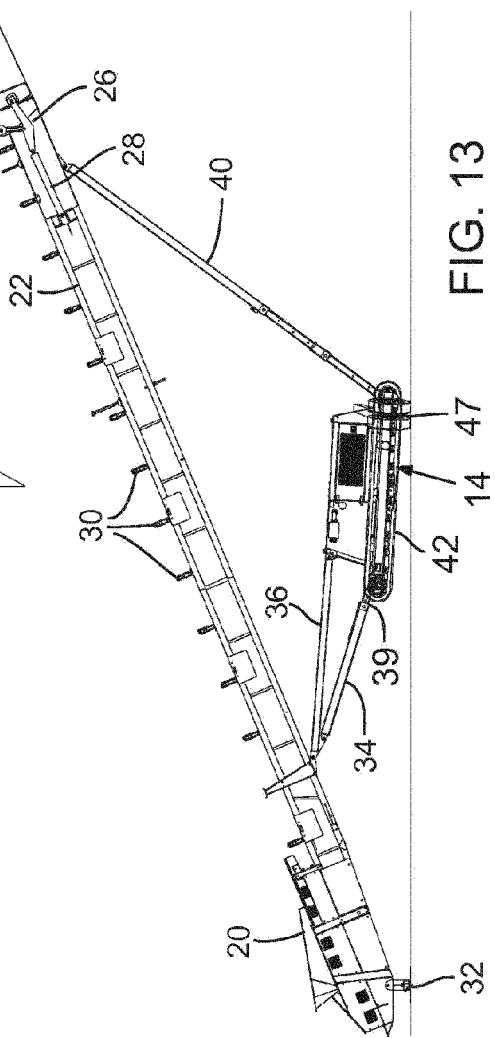
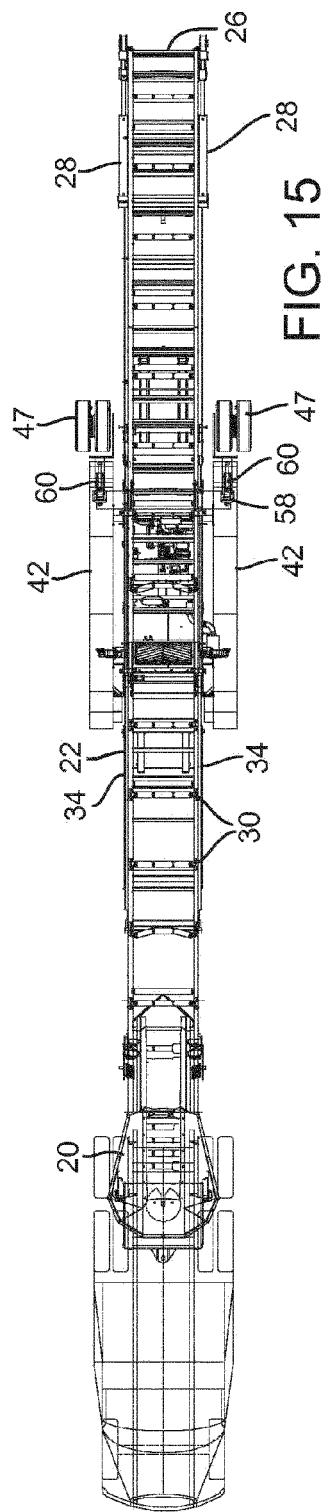
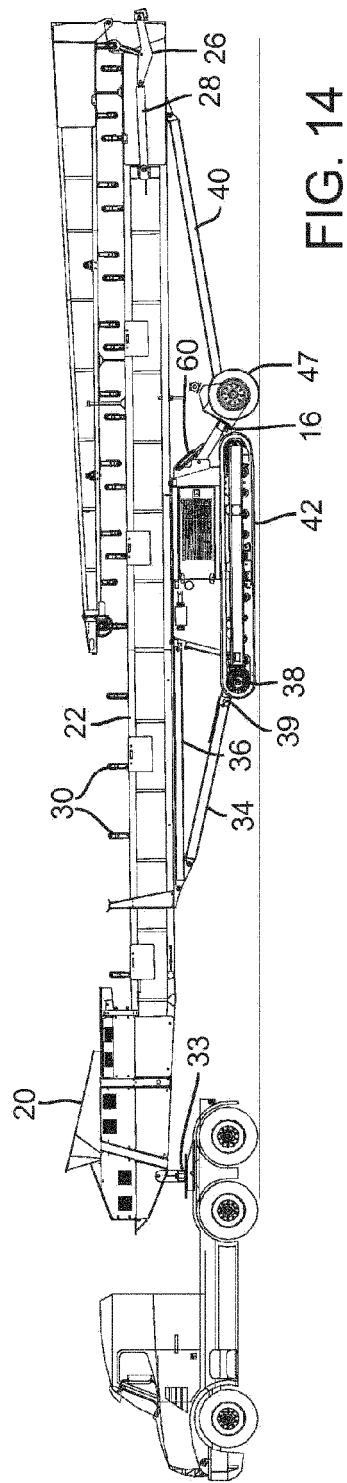


FIG. 13



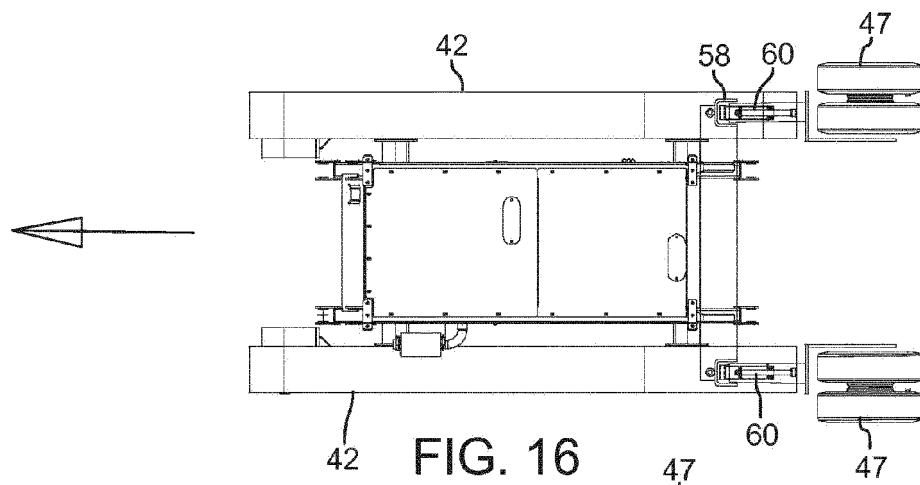


FIG. 16

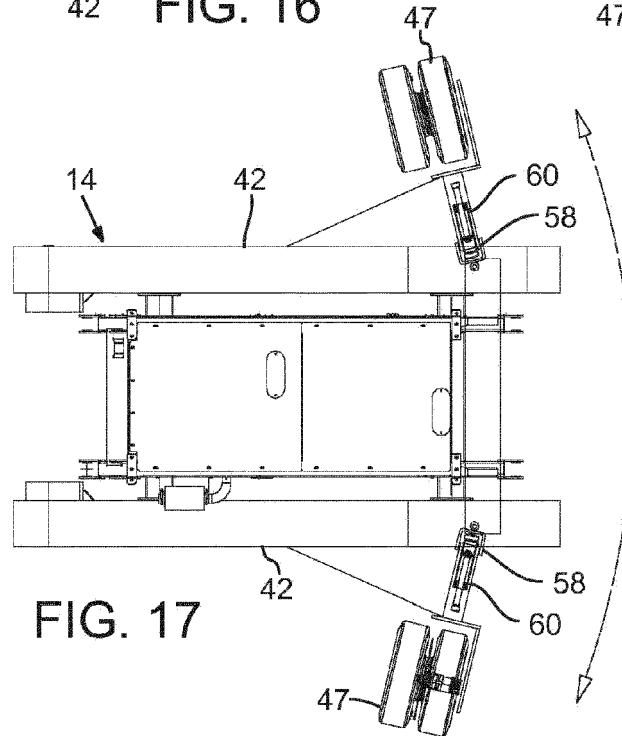


FIG. 17

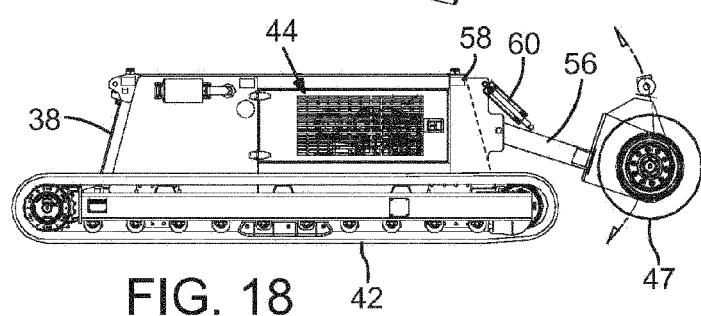


FIG. 18

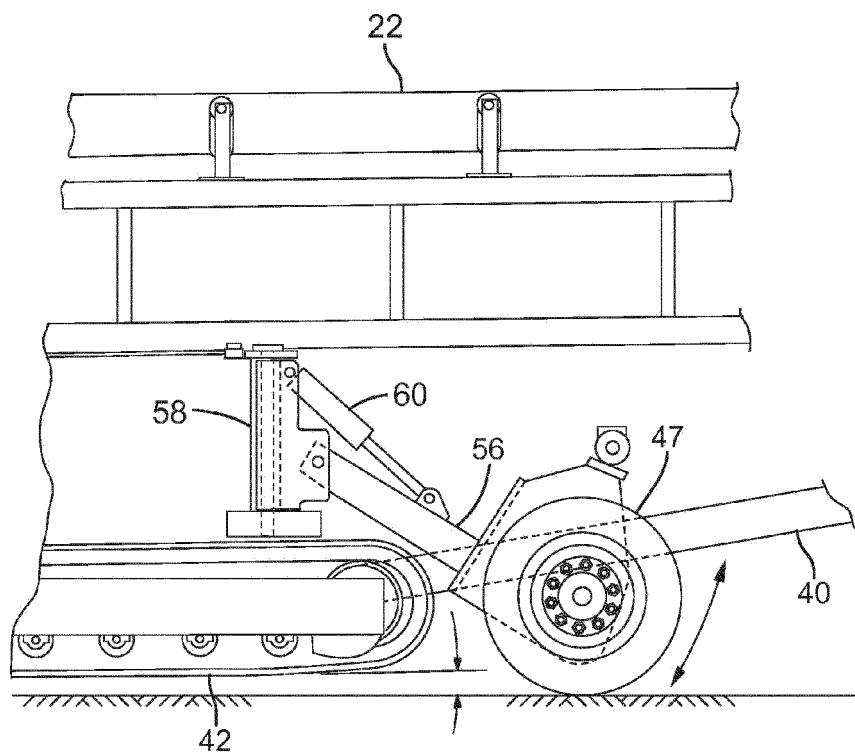


FIG. 18A

