Oct. 10, 1967 A. C. MALSAM 3,345,764

TWO-WAY TERRACING DEVICE

Original Filed May 27, 1963 4 Sheets-Sheet 1

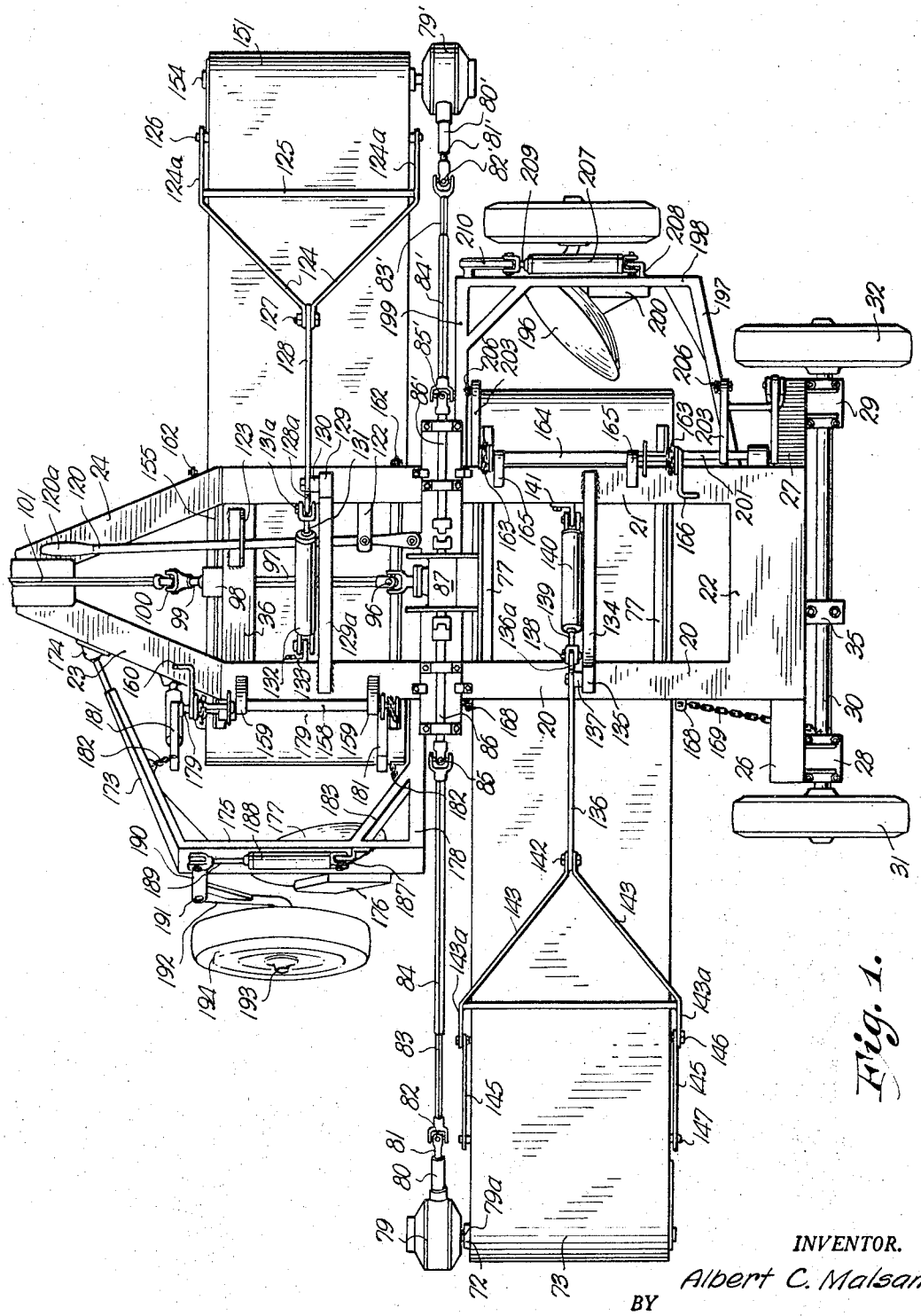


Fig. 1.

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TWO-WAY TERRACING DEVICE

Original Filed May 27, 1963 4 Sheets-Sheet 2

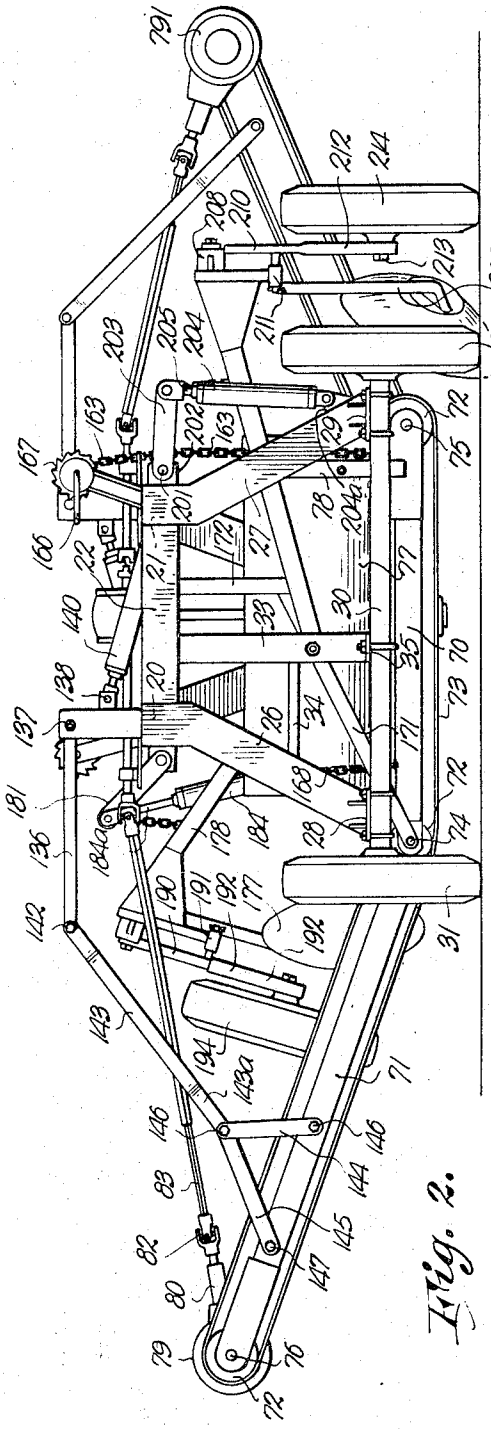


Fig. 2.

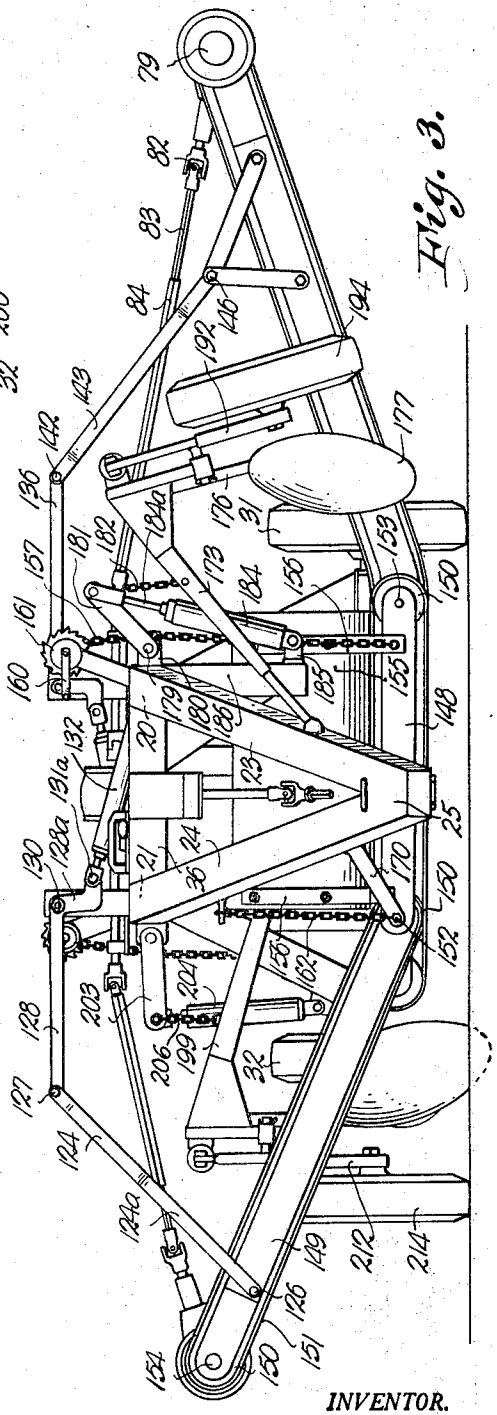


Fig. 3.

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TWO-WAY TERRACING DEVICE

Original Filed May 27, 1963 4 Sheets-Sheet 3

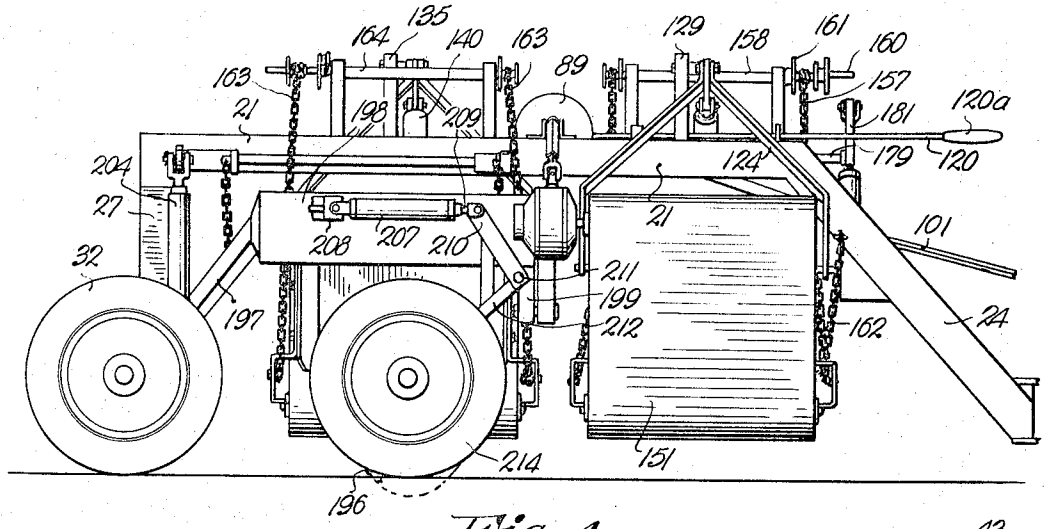


Fig. 4.

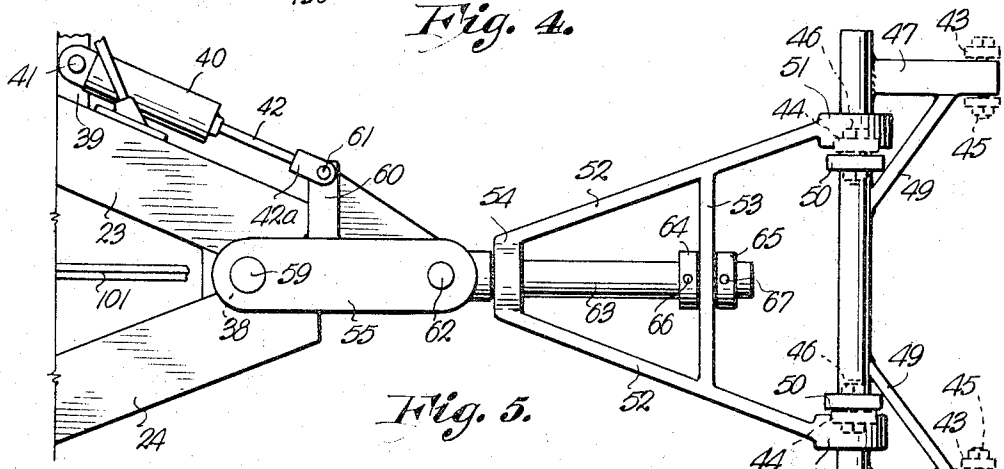


Fig. 5.

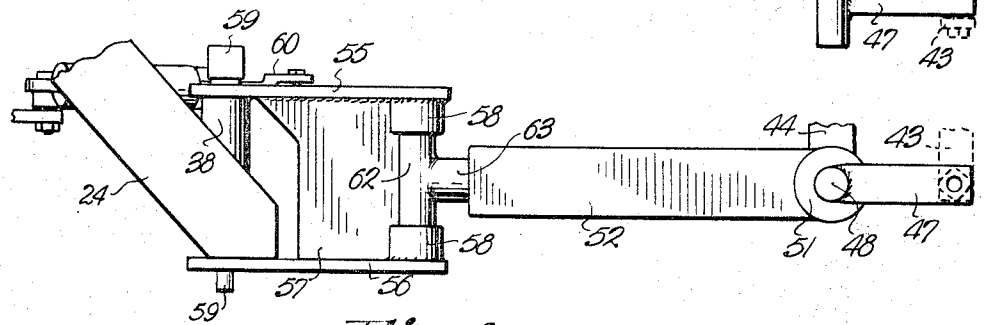


Fig. 6.

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Oct. 10, 1967 A. C. MALSAM 3,345,764

TWO-WAY TERRACING DEVICE

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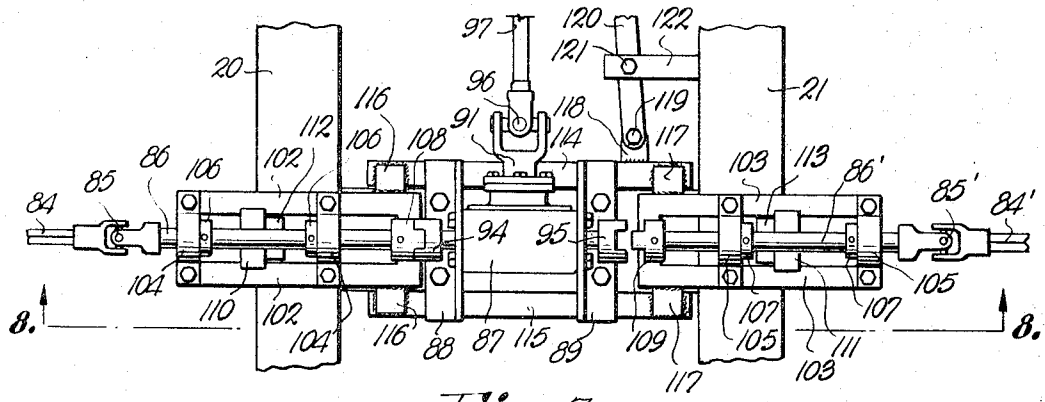


Fig. 7.

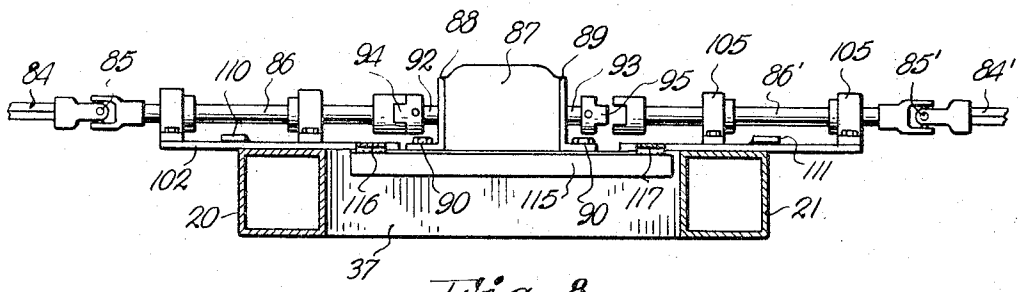


Fig. 8.

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United States Patent Office 3,345,764 Patented Oct. 10, 1967

3,345,764

TWO-WAY TERRACING DEVICE

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Continuation of application Ser. No. 283,364, May 27, 1963. This application June 13, 1966, Ser. No. 562,419
6 Claims. (Cl. 37—110)

ABSTRACT OF THE DISCLOSURE

The terracing device or elevating grader operates to throw dirt from either side thereof. The device comprises a frame provided with two transverse belt conveyors, each having a loading plow at one end thereof. Each plow loads earth on its respective conveyor on one side of the grader which transports the same across and under the grader frame and deposits it at the point of desired use, such as onto a terrace. Means are provided for suspending the conveyor from the frame and securing it against lateral and longitudinal movement. Means are provided to telescopingly fold the conveyors, particularly when same are not in use. Means are provided for respectively raising and lowering the disc relative to the frame. Power means and power transmission means are provided to alternately drive each conveyor in continuous manner when in use, as well as disengage the operation of same when not in use. Gaging means are provided in contact with the ground over which the device is moving to space the discs upwardly therefrom. One conveyor is provided longer than the other whereby to obtain a better dirt distribution and flatter terrace hill in a terracing operation. A tractor hitch connection for a terracing device wheeled frame permitting variation of the width of the cut of the plow discs is provided.

This application is a continuation of my application Ser. No. 283,364, filed May 27, 1963, entitled, "Two-Way Terracing Device," now abandoned.

This invention relates to terracing devices and elevating graders and refers more particularly to such a device which is operative to throw dirt from either side thereof, rather than one side as has been previously known.

The patents to Russell 806,431, Clapp 834,455, Gustafson 1,828,532, Berry 1,837,753, Kugler 1,912,583, Wallace et al. 1,924,055, Wooley et al. 2,089,319, Gustafson, 2,109,794, Tucker 2,489,991, Hancock 2,527,415, Gulick 2,555,335, Clark 2,756,521 and Ronk 2,939,226 disclose various modifications of terracing devices and elevating graders.

Such devices generally comprise a frame which is either pulled or self-driven and provided with a transverse belt conveyor having a loading plow at one end thereof. The plow loads earth on the conveyor on one side of the grader which transports the same across and under the grader frame and deposits it at the points of desired use, such as onto a terrace, into a dump truck or the like. There are generally provided (1) means for suspending the conveyor from the frame and securing it against lateral and longitudinal movement, (2) means for telescoping or folding the conveyor, particularly when same is not in use, and (3) means for raising and lowering the plow or disc with respect to the frame. Suitable power means or a power source on the frame (transmission means in the first instance) are usually provided to drive the conveyor in continuous manner when in use, as well as disengage the operation of same when not in use. Gauging means may be provided in contact with the ground over which the device is moving to space the disc upwardly therefrom. While it is generally the case that dirt is fed onto the conveyor on one side of the frame with transportation under

and across the frame by the conveyor, in some instances, as in the Tucker patent, supra, the disc and feed end of the conveyor are on the outside of the tractor with no feed across or under the tractor body or frame. Such latter construction may raise balance problems for the frame or tractor body in such use.

All of the above-listed patents disclose terracing devices and elevating graders which are operative to throw dirt only one way with only a single conveyor belt and disc plow provided. In use of these devices in terracing, cuts must be made either on both sides of the terrace or, alternatively, if the tractor works only one side of the terrace, it must return therealong in one direction with the terracing elements not in operation. In the terracing operation, the disc plow engages the ground and delivers a furrow slice onto the inclined transverse conveyor, the conveyor being arranged to carry the dirt to and deposit it onto the ground at a distance spaced therefrom whereby to build up the terrace. It is also known, although not seen in the above-mentioned art, to employ oppositely feeding paired conveyors and discs with each set feeding from an outer side of a tractor frame or body with either frame feeding under the tractor.

Excavators and road scraping machines wherein paired, opposed conveyor belt excavators and scrapers are employed on a single frame and extending under same are known from Culbreath 1,166,188 and Snyder 2,381,085, wherein the operation may either comprise scraping from the outside toward the center or vice versa. In such devices, a plow or disc is not employed and the results are not similar to the elevating graders or loaders and terracing devices listed immediately above.

For the purpose of soil conservation, it has become an extremely common practice to terrace farm land. Disc terracers of the types listed above are among the many types of apparatus used for terracting land as a means of land conservation. Disc terracers, per se (without cooperating conveyors), are often rigidly attached to a tractor body so as to become part of the tractor. However, as disclosed above in the listed art, the disc alone is generally not sufficiently effective under all conditions, whereby that deficiency must be overcome by use of a dirt elevator, also as disclosed above.

In an elevating loader, grader or terracer of the type described, as noted, when only one conveyor belt is provided, the operator either has to cut the low side of the terrace on the return or make a dry run on the high side with the machine not in operation. It is most desirable to do all of the cutting on the uphill side of the terrace. It is also most desirable to cut both ways on the uphill side whereby to avoid a dry run every other cut. Yet further, it is desirable to transport the dirt as long a distance from the cutting disc as possible whereby to build a most effective terrace. However, the absolute length of the conveyor is determined both by economy and by conditions of stability of the machine. By cutting the dirt on one side of the machine, passing it under the machine on the conveyor and discharging it at a point spaced from the other side, the maximum distance of travel for the dirt with a minimum extension of the conveyor out from the side is achieved, whereby to achieve maximum stability, due both to the conveyor partly passing under the machine and also to the counterbalancing effect of the plow and conveyor weights. For a single conveyor type grader, loader or terracing device, the patents disclosed above have thus discovered the most optimum stability arrangement for a single conveyor.

An object of the invention is to provide a terracing machine having two opposed sets of plows and conveyors operating in different directions which permit building and constructing of a terrace solely from the (optimum) upper side thereof, with the terracing device operating in

both directions of travel along the terrace, thus omitting any "dry run" back to the starting end, as is the case when a terracing device throws dirt only one way.

Another object of the invention is to provide a terracing device having two opposed sets of plows and conveyor belts which sets of apparatus are arranged in the optimum manner with respect to the supporting and carrying frame whereby to achieve an optimum stability, indeed, a stability greater than the stability of the devices presently in use in all cases.

Another object of the invention is to provide a two-way terracing device utilizing two sets of plows and conveyor belts wherein optimum means are provided for supporting both the plows and conveyor belts with respect to vertical and lateral movement and, additionally, optimum means are provided for regulating the bite of the disc or plow in operation, raising and lowering the disc or plow not in use on a given pass, folding and unfolding the conveyor belts as they come into and out of use, sequentially adjusting the vertical orientation of the conveyor belts for operation.

Another object of the invention is to provide a two-way terracing device having one conveyor longer than the other whereby to obtain a better dirt distribution and flatter terrace hill, the longer conveyor also moving faster, optionally, whereby to throw further by virtue of its gearing.

Another object of the invention is to provide a two-way terracing device having optimum gauging or depth control means for the individual disc or plows, said gauging means independent of the means for lifting up the disc or plow not being used in order to avoid dragging of the same, which depth or gauge control means does not interfere with the conveyor in front of it in the case of the rear depth wheel and, additionally, provides optimum maneuverability as opposed to the known art as well as markedly less tire wear.

Another object of the invention is to provide a two-way terracing device with opposed sets of plows and conveyors having simple mechanical means, easily operable by the tractor driver, for engaging and disengaging the power connections to the separate conveyors.

Another object of the invention is to provide a tractor hitch connection for a terracing device wheeled frame, which hitch connection permits variation of the width of the cut of the plow discs (the depth of the cut being varied by the gauge control means) whereby a desired shallow and wide cut at the upper edge of the cutting zone may be obtained, with a desired narrower and deeper cut obtainable at the lower boundary of the cut zone.

Another object of the invention is to provide a two-way terracing device employing paired, opposed plows and conveyor belts, the arrangement and construction simple, effective and efficient for performing the terracing operation, the conveyors alternatively driven from the power take-off shaft of the tractor.

Another object of the invention is to provide an elevating loader, grader or terracing device which is a supremely sturdy design, capable of long and continued use, with a minimum requirement for maintenance and repair.

Another object of the invention is to provide an improved tractor-drawn and operated terracing machine which is provided on each side thereof with a vertically adjustable disc plow and also on each side thereof in opposition to each of said disc plows, laterally extending adjustable endless conveyors operated by the tractor power take-off, said conveyors operative alternatively to receive and discharge earth piled and shoveled thereon by said disc plows as the tractor pulls the terracing machine along a line parallel with the terrace being formed.

Another object of the invention is to provide a two-way terracing device having hydraulic ram-operated lift beams for the disc plows, further, hydraulic ram-operated gauge control means also associated with the disc plow lift means, and yet further hydraulic ram-operated means for folding and extending the terracing conveyors.

Other and further objects of the invention will appear in the course of the following description thereof.

In the drawings, which form a part of the instant specification and are to be read in conjunction therewith, an embodiment of the invention is shown and, in the various views, like numerals are employed to indicate like parts.

FIG. 1 is a plan view from above of the subject terracing, loading and grading device with both conveyors in their operating (loading) position in the view, the rearmost disc plow positioned down in ground engaging position, the foremost disc plow raised to retracted position. Additionally, the rearmost conveyor has the power engaged with respect thereto, with the front conveyor power disengaged.

FIG. 2 is a rear view of the device of FIG. 1 with the parts thereof in the same relative position as in FIG. 1.

FIG. 3 is a front view of the device of FIGS. 1 and 2 with the parts thereof in the same relative operating position as in FIG. 1.

FIG. 4 is a side view of the device of FIGS. 1–3 taken from the right-hand side of FIG. 1, the right-hand side of FIG. 2 and the left-hand side of FIG. 3.

FIG. 5 is a top view of an improved hitch connection between the tractor and the frame carrying device of the previous figures, the view taken from above in plan.

FIG. 6 is a side view taken from the lower side of FIG. 5 of the hitch shown therein.

FIG. 7 is a fragmentary top plan view of the center of the device shown in FIG. 1 showing in detail the transmission means.

FIG. 8 is a view taken along the line **8—8** of FIG. 7 in the direction of the arrows.

Basic frame

Referring to FIGS. 1–4, inclusive, the basic supporting frame comprises a pair of elongate horizontal members **20** and **21** which are joined at the rearward ends by a transverse member **22** and at their forward ends by a downwardly angled pair of members **23** and **24** which meet together at a central lower point **25**. A pair of downwardly and outwardly extending rear members **26** and **27** are fixed to the rear ends of beams or members **20** and **21** and carry brackets or plates **28** and **29** attached to the lower and rearward portions thereof and extending rearwardly of same. Fixed to the undersides of plates **28** and **29** is hollow sleeve **30** which carries the axle (not seen) of wheels **31** and **32**. Roughly centrally connected of rear member **22** is downwardly extending member or beam **33**, same braced laterally to leg **26** by member or beam **34** and having plate **35** connected to the lower end thereof extending rearwardly thereof and fixed centrally to shaft sleeve **30**. Transverse upper beams **36** and **37** connect elongate horizontal members **20** and **21** forwardly and centrally thereof, respectively.

Hitch

Turning to FIGS. 5 and 6, therein is shown a preferred type of hitch for use with the subject terracing device. At the juncture of arms or members **23** and **24** at the front of the frame of the terracing device, there is fastened a hollow sleeve **38**. Clip **39** is fixed to the outer surface of leg or member **23** and has hydraulic cylinder **40** fixed thereto by pin or shaft **41** with operating piston arm **42**. (In all cases of showings of hydraulic pistons in this specification, no showing or description will be made of the conventional fluid feed tubes thereto and controls thereof as such are conventional and the showing of the multiplicity of lines and controls in view of the multiplicity of cylinders employed on the device would be exceedingly confusing. However, it is understood that the hydraulic cylinders shown in the various views are fully controlled conventional cylinders with piston rods adapted to extend and retract therefrom, the cylinders and their

controls adapted to maintain extension of the pistons thereof at any desired fixed extension.)

On the frame of any conventional tractor, adjacent the power take-off thereof and the rear axle thereof, there are provided places for attachment of various split attachments or arms in the manner shown at 43 and 44 in FIG. 5 or the attachment and arms themselves. To these means (split attachments at 43 and single arms at 44), there are attached by shafts 45 (suitable bolt members) and 46 (same) longitudinal, horizontal beams 47. Shaft 48 connects the latter beams. Braces 49 communicate between and further rigidly connect bars 47 and shaft 48. Vertical arm members 50 connect rigidly to shaft 48 and are secured to arm members 44 by bolt means 46. Thus, shaft 48 is rigidly secured with respect to the tractor frame by means of, as a first connection, members 50 and 44, and as a second connection, members 47 and 43.

A pair of collars 51 rotatably encircle shaft 48 between members 47 and 49 and have elongate inwardly converging arms 52 connected thereto. A centrally perforated transverse horizontal beam 53 is connected across the inner sides thereof, while a perforated central rearward fitting 54 joins the rearward ends thereof.

Referring particularly to FIG. 6, a pair of flat horizontal longitudinal plates 55 and 56 are connected vertically by web 57 and have short collars 58 attached to the inward sides thereof adjacent the front thereof. The rear ends thereof are perforated to receive therethrough an enlarged head shaft or pin 59 adapted to pass through and be pivotally engaging by sleeve 38. Arm 60 (FIG. 5) is pinned by shaft 61 to the free end 42*a* of piston arm 42 of hydraulic cylinder 40. Vertical shaft 62 is pivotally received in collars 58 and has an elongate rod 63, circular in cross section, extending forwardly and horizontally therefrom. Rod 63 extends through the openings in collar 54 and arm 53 and has a pair of removable collars 64 and 65 removably fixed thereon by set screws 66 and 67.

In operation, when the hitch is longitudinally aligned with the frame, as seen in the views, piston rod 42 is preferably at 50 percent extension whereby to be able to shift the frame with respect to the hitch in either direction by being retracted into the cylinder or extended fully therefrom. It may be seen that there are pivots around vertical axes at 38 and 58, with a pivot around a horizontal axis 63. Piston 40 maintains the frame position with respect to the tractor around vertical pivot at 38 and 59, while the vertical pivot at 58 and 62 allows for turning action in either direction. Up and down movement is compensated for at 51. With the frame of the terracing device shifted with respect to the longitudinal axis of the driving tractor, a fixed disc will cut a narrower or wider swath, depending on whether the frame is shifted to the left or the right. A vertical adjustment controlling depth of cut may be made which will be described and the means therefor hereafter.

Conveyors

Turning to the construction of the conveyors, these will not be described in excessively great detail in view of the facts that they are, per se, more or less conventional and conventional conveyor means and mountings therefor are shown in considerable detail in numerous of the references cited above. Referring particularly to FIGS. 1, 2 and 4, and the rearmost conveyor, pairs of opposed, transversely extending (relative to the frame), normally horizontally oriented frames 70 and 71 rotatably carry, on shafts extending therebetween, a plurality of rollers generally designated 72. Rollers 72 are spaced at intervals as required along frames 70 and 71. An endless conveyor belt 73 is engaged over said rollers 72 and driven thereby. Frames 70 and 71 are hinged together for relative angular movement of frames 71 with respect to frame 70 around shaft 74. Shafts 75 and 76 carry the innermost and outermost rollers 72 thereon. Fixed to frames 70 are a pair of dirt deflector plates 77 by clips or straps 78. These extend vertically and transversely of the frame at each lateral extremity of the conveyor belt and confine dirt thrown thereon by the disc opposite thereto.

Power means for the rear conveyor comprise (working inwardly from the outermost connection) gear box 79 having output shaft 79*a* driving outermost roller 72 with input drive shaft 80 coupled to telescoping member 81. The latter is connected through universal joint 82 to telescopingly connected shafts 83 and 84. Shaft 84 is connected through universal joint 85 to shaft 86.

Reference is now made to FIGS. 7 and 8 which show, enlarged, the power transmission means mounted centrally atop the frame between the conveyors. As may be seen in FIG. 8, longitudinal beams 20 and 21 of the frame are joined substantially centrally of the length thereof by transverse horizontal beam 37. Bolted rigidly to beam 37 is gear box 87 which is fixed to and between angle members 88 and 89. The latter are connected by bolts 90 to beam 37. Input power shaft 91 to gear box 87 simultaneously drives output shafts 92 and 93 which have engaging members 94 and 95 connected to the outer ends thereof. Universial joint 96 has input power shaft 97 passing thereto, same being received in bearing 98 forward on the frame under beam 36. From bearing 98, mounted on cross beam member 36, shaft 99 (FIG. 1) connects to universal joint 100 into which power take-off shaft 101 from the tractor connects.

The power connection to the front conveyor is identical in construction to that previously described and thus this description will not be duplicated. All of the like parts are numbered the same as in the rear conveyor power connection from numbers 79 through 86, but primed.

Transmission

Referring back to FIG. 7, pairs of bars 102 and 103 on beams 20 and 21, respectively, have pairs of bearings 104 and 105, respectively, fixed thereto and are connected together at their ends to form platforms carrying the said bearings. The latter receive shafts 86 and 86′ therein with circumferential stops 106 and 107 provided whereby to secure shafts 86 and 86′ in the bearings 104 and 105, respectively, against in and out movement. Engaging members 108 and 109 are fixed to the inward ends of shafts 86 and 86′, respectively, and are adapted to alternatively engage engaging members 94 and 95, respectively, on shafts 92 and 93. Guides 110 and 111 are fixed to beams 20 and 21, respectively, and overlie bars 102 and 103, respectively, having connecting blocks 112 and 113 fixed inwardly thereof between bars 102 and 103. A pair of angle members 114 (forward) and 115 (rearward) underlie the forward and rearward extensions of angle members 88 and 89 on gear box 87. Members 114 and 115 also have fixed thereto connecting lugs 116 which are also welded or otherwise fixedly attached to the outer edges of bars 102 and lugs 117 which are also welded or otherwise fixedly attached to the outer faces of bars 103.

A lug 118 is attached to the right front (in the view of FIG. 7) edge of angle member 114 and pivotally mounts through bolts 119 the rear end of handle 120. The latter also has a pivotal engagement through bolt 121 with rod or extension 122 on frame member 21. Also positioned intermediate the ends of handle 120 is an aligning bracket 123, while at the front end thereof is grip 120*a*. Bracket 123 is mounted on cross member 36.

In operation of the transmission, movement of grip 120*a* to the left in the view of FIG. 1 moves members 114 and 115 (and, therefore also, bars 102 and 103) to the right in FIGS. 7, 8 and 1, whereby to engage shaft member 108 with shaft member 94 and simultaneously disengage shaft member 109 from shaft member 95. This movement is permitted by sliding telescoping rods 83

and 84 and 83' and 84'. Movement of grip 102 to the right (not shown) has the opposite action. This transmission mechanism and action permits driving of the rearmost conveyor when the grip is to the left in the view of FIG. 1 and driving of the front conveyor when the grip is to the right in the view of FIG. 1. An intermediate position of the grip disengages the power drive from either conveyor.

Conveyor positioning means

The means for elevating and lowering the outer ends of the front conveyor comprise outer Y-arms 124 having brace 125 therebetween with the outer ends 124*a* of member 124 pivotally connected to shaft 126 which is pivotally received between the frames of the front conveyor. Arms 124 are pivotally connected at their inner ends by bolt 127 to arm 128. This latter is L-shaped and has an inner end 128*a* comprising one leg of the L pivotally mounted on vertical brace 129 by shaft 130. Vertical brace 129 has a transverse horizontal base 129*a* fixed to beams 20 and 21. The inner and lower end of arm 128*a* is pivotally attached as at 131*a* to the piston arm 131 of hydraulic cylinder 132. Cylinder 132 is mounted at its other end on bracket 133 fixed to the inner side of elongate beam 20. Outward movement of piston 131 of hydraulic cylinder 132 raises arm 128 at its outer end, whereby to raise arms 124 and the outer end of the conveyor. Retraction of piston 131 has the opposite effects.

The rear conveyor raising means must be separately described as this conveyor is the longer of the two and has a slightly different lever arrangement. Thus, describing the means in the inverse order (from the inner members outward) from the last described like means, transverse brace 124 communicates across and between longitudinal members 20 and 21 and is connected to the lower end of vertically extending brace 135. Elongate L-shaped arm 136 having downwardly extending inner arm portion 136*a* is pivotally attached as at 137 to brace 135. Arm 136*a* is pinned as at 138 to the outer end of piston 139 of hydraulic cylinder 140 which is connected to brace 141 on the inside surface of beam 21. The outer end of member 136 is tied pivotally by pin 142 to outwardly bowed arms 143 which, in their outermost parallel extremities 143*a* (FIG. 2) are connected to short pivot arms 144 and 145 through pins 146. The latter arms are connected to plates 71 by pins or bolts 146 and 147. This latter conveyor end lift assembly operates essentially the same as that assembly described for the front conveyor in that outward movement of piston arm 139 raises the outward end of member 136 and thus the outer end of the conveyor, etc.

Referring to FIGS. 1 and 3, therein may be seen the front conveyor. Pairs of opposed, transversely extending (relative to the frame), normally horizontally oriented frames 148 and normally upwardly angled frames 149 rotatably carry, on shafts extending therebetween, a plurality of rollers generally designated 150. Rollers 150 are spaced at intervals as required along frames 148 and 149. An endless conveyor belt 151 is engaged over said rollers 150 and driven thereby. Frames 148 and 149 are hinged together for relative angular movement of outer frames 149 with respect to inner frames 148 around shaft 152. Shafts 153 and 154 carry the innermost and outermost rollers 150 thereon. Fixed to frames 148 by clips or straps 156 are a pair of dirt deflector plates 155. These latter extend vertically and transversely of the frame at each lateral extremity of the conveyor belt 151 and confine dirt thrown thereon by the disc opposite thereto.

The front conveyor system or conveyor frames 148 thereof are suspended from the main frame by two sets of chains. The first set of chains is designated 157 and each chain thereof communicates from the lower end and connection of strap 156 next the receiving end of said conveyor 151 and is received at its upper end on shaft 158 which is rotatably mounted in bearings 159. Bearings 159 are fixed to the top surface of longitudinal beam 20. A handle 160 is connected to one end of shaft 158 and ratchet 161 is also fixed on shaft 158. Rotation of shaft 158 by handle 160 permits raising and lowering of the receiving end of the conveyor to any desired height, ratchet 161 permitting fixing of this height at the desired level. The other side of conveyor frames 148 is supported by a set of chains generally designated 162. The upper ends of chains 162 are fixed to protrusions, one welded to the forwardly and downwardly inclined member 24, the other on beam 21. The lower ends of chains 162 are connected to the outer ends of shaft 152.

Rearmost conveyor 73 and its assembly or the frames 70 thereof are supported in like manner by two sets of chains. The first set of chains is designated 163 and connects from the lower ends of straps 78 on the receiving end of conveyor 73 to shaft 164 received in bearings 165 mounted on the top surface of beam 21. Handle 166 and ratchet 167 are also mounted on shaft 164. The second set of chains is numbered 168 and extends from upper connections on the outer side of beam 20 to connections on frames 70. Such vertical support chains permit the adjustment of height of the rearward conveyor frames 70 in the same manner as frames 148 of the forward conveyor with rotation of handle 166 rotating shaft 164 and winding and unwinding therearound chains 163 to raise or lower the receiving end of conveyor 73.

Suitable additional chain connections are provided from frames 148 and 70 to main frame members or extensions thereof whereby to prevent forward and rearward swinging or movement of the front and rear conveyor assemblies on their chain suspensions. Only one of these chains may be seen in the views, namely, chain 169 in the lower left center of FIG. 1 which connects axle 30 with rear frame 70 of conveyor 73 and prevents forward swinging thereof. Thus, there is a chain connection from one of the forwardly and downwardly inclined beams 23 or 24 to the front frame 148 of the front conveyor whereby to prevent rearward swinging of the front conveyor assembly. There are beam members provided extending downwardly beneath the beam 37 (FIG. 8) which are not seen in the various views to which chain connections are made to the rear frame 148 of front conveyor 151 and to the front conveyor frame 70 of rear conveyor 73. The former prevents forward swinging of the front conveyor assembly, while the latter connection prevents rearward swinging of the rear conveyor assembly.

Lateral swinging or sway of either the front conveyor assembly 151 or the rear conveyor assembly 73 is prevented to some extent in each case by the outer conveyor lift attachments controlled by hydraulic cylinder 132 in the case of the front conveyor and hydraulic cylinder 140 in the case of the rear conveyor. Additional brace arms may be provided communicating between the conveyor lower frames 70 and 148 and the main frame or members depending therefrom or from the transverse beams therefrom. Such help control both up and down and lateral motion of the conveyor assemblies and one such may be seen in FIG. 3 at 170 and another such at 171 in FIG. 2 connected to vertical member 172 depending from transverse beam 22.

Disc plows are provided mounted on the frame, one adjacent each receiving end of a conveyor. The discs are mounted by such structure and such manner that (1) they may be moved from earth disengaging position (the front disc in the views) to earth engaging position (the rear disc in the views) and (2) their depth of cut may be varied when in earth engaging position. The frame for mounting the disc for the front conveyor will now be described. This is best visible in FIGS. 1 and 3.

An elongate forward arm 173 is received at its inward end in ball and socket joint 174 and at its outward end is connected to beam 175. An elongate downwardly ex-

tending member **176** has disc plow **177** attached at an angle thereto by any suitable connection structure and by welding or other method. Disc plow **177** is angled with respect to the longitudinal axis of the main frame and may be seen in FIG. 3 in the earth disengaging position. For conservation of drawing space, its opposed conveyor **151** is not in raised position, but would ordinarily be. An elongate rear bar **178** is connected at its outward end to the rear end of beam **175** and is pivotally connected at its inward end to a vertical member (not seen) extending downwardly from beam **37**. Thus, arms **173** and **178** are pivotally mounted at their inward ends for up and down movement of the outward ends thereof with respect to the frame connections.

An elongate shaft **179** underlies conveyor receiving and lifting shaft **158** and is rotatably mounted in brackets **180** (FIG. 3) fixed to the side face of beam **20**. Shaft **179** carries on the ends thereof arms **181** to which are attached at the outer ends thereof chains **182**. One chain **182** is attached at its lower end to forward beam member **173** and the other to brace member **183** communicating between beam **175** and arm **178**. A hydraulic cylinder **184** has its lower end fixed to bracket **185** which is connected to downwardly extending beam **186** fixed to the underside of beam **23**. Cylinder **184** has its piston rod **184***a* connected to the outer end of forward arm **181**. When piston rod **184***a* is extended as in FIG. 3 and FIG. 1, the frame carrying disc **177** is elevated with respect to the over-all frame whereby to move disc **177** out of ground engaging position.

A bracket **187** is fixed to the outer surface of outer beam **175** of the front disc frame and carries hydraulic cylinder **188** connected thereto having piston arm **189**. Piston arm **189** is connected at its outer end to L-shaped lever arm **190** which is pivoted at its vertex at **191** on an extension of beam **175** and has lower arm **192** connected thereto. Arm **192** carries axle **193** thereon mounting tire **194**. Extension of piston arm **189** raises tire **194** while retraction of same lowers the tire. This permits adjustment of the depth of cut of disc **177**.

The elements of suspension of rear disc **196** are the same as previously described in all operating and functional characteristics and thus will be briefly characterized re. FIGS. 1 and 2 for identification purposes. Rear arm **197** is pivotally received at its inward end on vertical beam **33** (FIG. 2) and is connected at its outer end to beam **198** which is itself connected at its forward end to front arm **199**. The inward end of front arm **199** is connected pivotally to a vertical beam member (not seen) from beam **37** or, alternatively, to any depending member (not seen) from longitudinal beam **21**. Vertical member **200** is connected to the outer rear face of disc **196** by suitable means and at its upper end to beam **198**. Shaft **201** (FIG. 2) is received in brackets **202** mounted on the side of beam **21** and has arms **203** thereon. Hydraulic cylinder **204** mounted on bracket **204***a* has the piston rod **205** thereof connected to one arm **203**. Chains **206** are connected to arms **203** and at their lower ends to arms **197** and **199** so extension of piston **205** raises arms **203** and the disc.

Hydraulic cylinder **207** (FIG. 4) is mounted at one end thereof on bracket **208** and has piston **209** connected pivotally to L-shaped arm **210**. The latter is pivotally mounted at **211** on beam **198** and has lower arm **212** connected substantially at right angles thereto. Arm **212** has axle **213** mounted thereon carrying tire **214**. FIG. 4 shows disc **196** in ground engaging position at the least cutting depth. Extension of piston arm **209** will operate to raise tire **214** whereby to permit disc **196** to cut the earth more deeply.

Summary

There has thus been described the entire assembly of apparatus of the terracing device. Briefly summarized, this apparatus comprises the basic horizontal frame having the rear downwardly extended members mounting the rear wheels and the forwardly joined downwardly inclined front beams. The hitch has been described in this manner of connection to both the front end of the frame and the tractor and its manner of adjustment to angle the frame with respect to the line of movement of the tractor. Thus, if arm **42** of cylinder **40** (FIG. 5) is extended, the terracing device is positioned so that the front disc will cut a greater swath, while the rear disc will cut a lesser swath. If piston arm **42** is retracted in FIG. 5, the main frame would be canted with respect to the tractor line of motion so the reverse effect would be obtained, namely, the front disc would cut a lesser swath, while the rear disc would cut a greater swath.

There are two separate oppositely directed conveyors which have suspending and bracing means and means for adjusting the height of the receiving ends and the discharging ends thereof, separately. One of the conveyors is preferably longer than the other, namely, here, the rear one. Power means are provided for the conveyors driving the outermost roll thereof with transmission means provided for shifting the power input from one to the other. Means are provided for mounting the discs relative to the receiving end of the conveyors and moving them into and out of digging position, as well as adjusting the depth of the cut of the discs.

In operation, with the rear disc in digging position as shown in the drawings, one pass would be made with dirt being discharged to the left in FIG. 1 from conveyor **73**. The outer end of conveyor **151** would be raised, as in disc **177**. On the return pass, disc **177** would be in digging position with disc **196** raised and the outer end of conveyor **161** lowered to desired discharge angle with the outer end of conveyor **73** raised out of use.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth together with other advantages which are obvious and which are inherent to the structure.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings are to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim:

1. A grading device comprising;

a wheeled frame,

a first endless conveyor having receiving and discharging ends mounted on said frame, disposed transversely thereof and having the discharge end thereof extending outwardly beyond one side of said frame,

a first plow mounted on the other side of said frame from the discharge end of said first conveyor and positionable so as to excavate earth and pass it laterally onto the receiving end of said first conveyor,

frame means mounting said first plow on said frame in such manner as to permit vertical adjustment of said plow into and out of ground engaging relationship,

a second endless conveyor having receiving and discharging end mounted on said frame longitudinally rearwardly of said first conveyor, disposed transversely thereof and having the discharge end thereof extending in an opposite direction from the said first conveyor outwardly beyond the other side of said frame,

a second plow mounted on the other side of the frame from the discharge end of the second conveyor and positionable so as to excavate earth and discharge it onto the receiving end of said second conveyor,

frame means supporting said second plow in such man-

ner as to permit vertical adjustment thereof into and out of ground engaging relationship,

and a power drive connection mounted on said frame between said conveyors adapted to be connected to a tractor power drive and power engaging and disengaging transmission means also mounted on said wheeled frame between said conveyors for separately and sequentially connecting said power drive to one of said first and second conveyors.

2. Connecting means for coupling towed vehicles and towing vehicles comprising, in combination;

a towing vehicle,

a bar,

means connecting said bar to said towing vehicle whereby to rigidly position same in horizontal orientation substantially transverse to the longitudinal axis of the towing vehicle,

a pair of arms pivotally connected at one end thereof to each end of the bar and converging at the other end thereof to join together,

a pair of bearings carried by said arms, one at the rearward juncture thereof and the other intermediate the ends thereof,

a towed vehicle comprising a wheeled frame member made up of a box structure comprising two normally horizontal longitudinal beams joined adjacent the ends thereof by two normally horizontal transverse beams, vertical members connected adjacent the rear end of the box structure mounting a transverse axle having wheels rotatably mounted thereon and a pair of forwardly and downwardly inclined beams joined at the rearward ends thereof to the front of the box structure and at the forward ends thereof to one another,

a shaft received in said arm bearings;

means retaining said shaft in said arm bearings against forward and rearward sliding action,

a T-arm fixed to the rearward end of said shaft and extending at right angles to same,

connecting means pivotally engaging said T-arm at a front end thereof and pivotally engageable at the rear end thereof with said wheeled frame member at the forward juncture of said inclined beams,

and hydraulic means on said frame member connected to said connecting means on one side thereof adapted to shift said wheeled frame member with respect to said towing vehicle.

3. In combination, connecting means for coupling a towing vehicle and a towed vehicle comprising;

a wheeled frame member, said wheeled frame member comprising a box structure made up of two normally horizontal longitudinal beams joined adjacent the ends thereof by two normally horizontal transverse beams, vertical members connected adjacent the rear end of the box structure mounting a transverse axle having wheels rotatably mounted thereon, and a pair of forwardly and downwardly inclined front beams joined at the rearward ends thereof to the front end of the box structure and at the forward ends thereof to one another,

said connecting means comprising a bar mounted rearwardly of said towing vehicle in substantial horizontal orientation and extending substantially transversely of the longitudinal axis of the towing vehicle,

a frame structure pivotally mounted on said bar at the forward end of the frame structure and having bearing elements carried on its rearward end,

an elongate normally horizontally oriented bar circular in section rotatably received by said frame bearing elements,

said bar having a normally vertically oriented cross arm at the rearward end thereof,

a connecting member pivotally mounted at its front end on said normally vertical cross arm and further pivotally mounted and connected at its rearward end to the forward juncture of said front beams of said wheeled frame members,

and hydraulic means communicating between said connecting member and said frame adapted to angle said wheeled frame with respect to said connecting member and towing vehicle.

4. A grading device comprising;

a wheeled frame,

a first endless conveyor having receiving and discharging ends mounted on said frame, disposed transversely thereof and having the discharge end thereof extending outwardly beyond one side of said frame,

a first plow mounted on the other side of said frame from the discharge end of said first conveyor and positionable so as to excavate earth and pass it laterally onto the receiving end of said first conveyor,

frame means mounting said first plow on said frame in such manner as to permit vertical adjustment of said plow into and out of ground engaging relationship,

a second endless conveyor having receiving and discharging ends mounted on said frame longitudinally rearwardly of said first conveyor, disposed transversely thereof and having the discharge end thereof extending in an opposite direction from the said first conveyor outwardly beyond the other side of said frame,

a second plow mounted on the other side of the frame from the discharge end of the second conveyor and positionable so as to excavate earth and discharge it onto the receiving end of said second conveyor,

frame means supporting said second plow in such manner as to permit vertical adjustment thereof into and out of ground engaging relationship,

each of said first and second conveyors extending completely under said frame whereby the receiving end of each conveyor extends under one side of said frame and the discharging end of each said conveyor extends beyond the other side of said frame,

the rearward one of said conveyors substantially longer than the other by a substantial portion of the width of the frame.

5. Connecting means for coupling towed vehicles and towing vehicles comprising, in combination;

a towing vehicle,

shaft means,

means connecting said shaft means to said towing vehicle whereby to rigidly position same in horizontal orientation substantially transverse to the longitudinal axis of the towing vehicle,

a pair of arms pivotally connected at one end thereof adjacent the ends of the shaft and converging at the other end thereof to join together,

bearing means carried by said arms,

a towed vehicle,

a shaft received in said arm bearing means,

means retaining said shaft in said arm bearing means against forward and reaward sliding action,

a T-arm fixed to the rearward end of said shaft and extending at right angles to same,

connecting means pivotally engaging said T-arm at a front end thereof and pivotally engageable at the rear end thereof with said towed vehicle,

and hydraulic means on said towed vehicle connected to said connecting means on one side thereof adapted to shift said towed vehicle with respect to said towing vehicle.

6. A grading device comprising;

a wheeled frame,

a first endless conveyor having receiving and discharging ends mounted on said frame, disposed transversely thereof and having the discharge end thereof extending outwardly beyond one side of said frame,

a first plow mounted on the other side of said frame

from the discharge end of said first conveyor and positionable so as to excavate earth and pass it laterally onto the receiving end of said first conveyor,

frame means mounting said first plow on said frame in such manner as to permit vertical adjustment of said plow into and out of ground engaging relationship,

a second endless conveyor having receiving and discharging ends mounted on said frame longitudinally rearwardly of said first conveyor, disposed transversely thereof and having the discharge end thereof extending in an opposite direction from said first conveyor outwardly beyond the other side of said frame,

a second plow mounted on the other side of the frame from the discharge end of the second conveyor and positionable so as to excavate earth and discharge it onto the receiving end of said second conveyor,

frame means supporting said second plow in such manear as to permit vertical adjustment thereof into and out of ground engaging relationship,

and a power drive connection mounted on said frame adapted to be connected to a tractor power drive and power engaging and disengaging transmission means also mounted on said wheeled frame for separately and sequentially connecting said power drive to one of the first and second conveyors.

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