Nov. 26, 1963 R. M. ULRICH 3,111,779

ELEVATING GRADER

Filed March 13, 1961 5 Sheets-Sheet 1

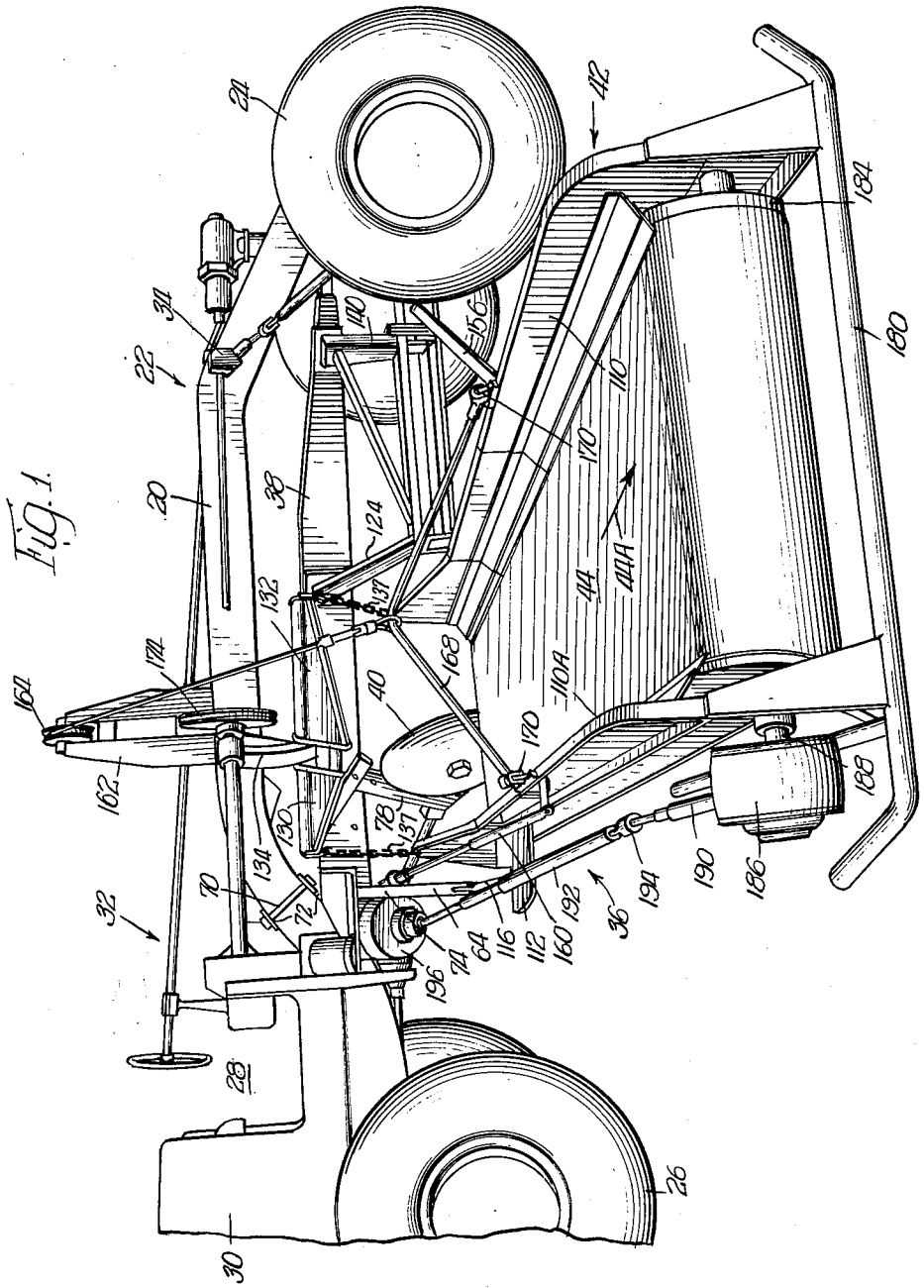


Fig. 1.

INVENTOR.
Raymond M. Ulrich,
BY Brown, Jackson,
Boettcher & Dienner

Nov. 26, 1963 R. M. ULRICH 3,111,779

ELEVATING GRADER

Filed March 13, 1961 5 Sheets-Sheet 2

Fig. 9

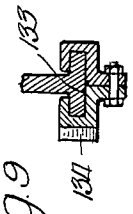


Fig. 2

INVENTOR.
Raymond M. Ulrich,
BY Brown, Jackson,
Boettcher & Dienner
Attys.

Nov. 26, 1963 R. M. ULRICH 3,111,779

ELEVATING GRADER

Filed March 13, 1961 5 Sheets-Sheet 3

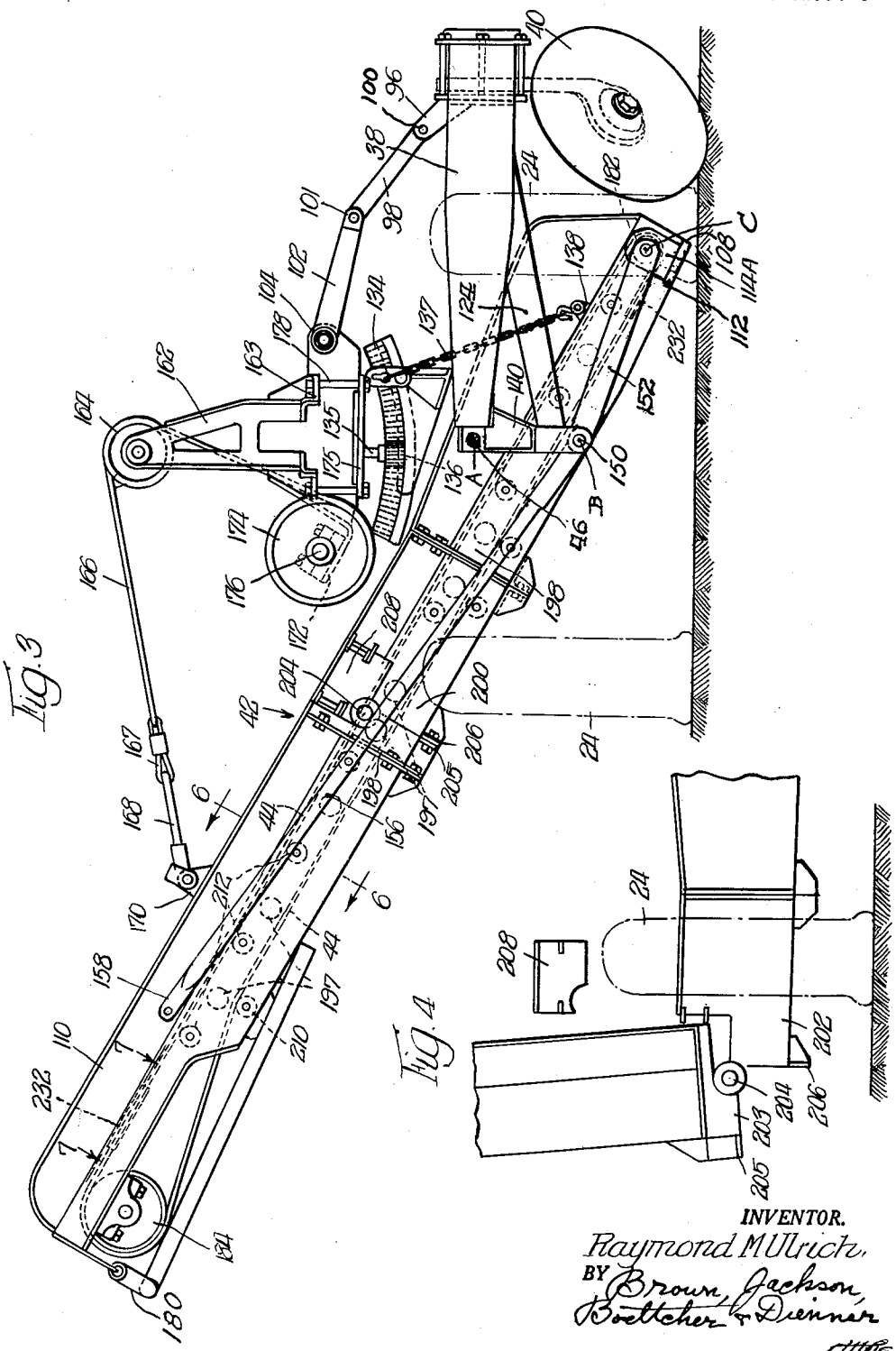


Fig. 3

Fig. 4

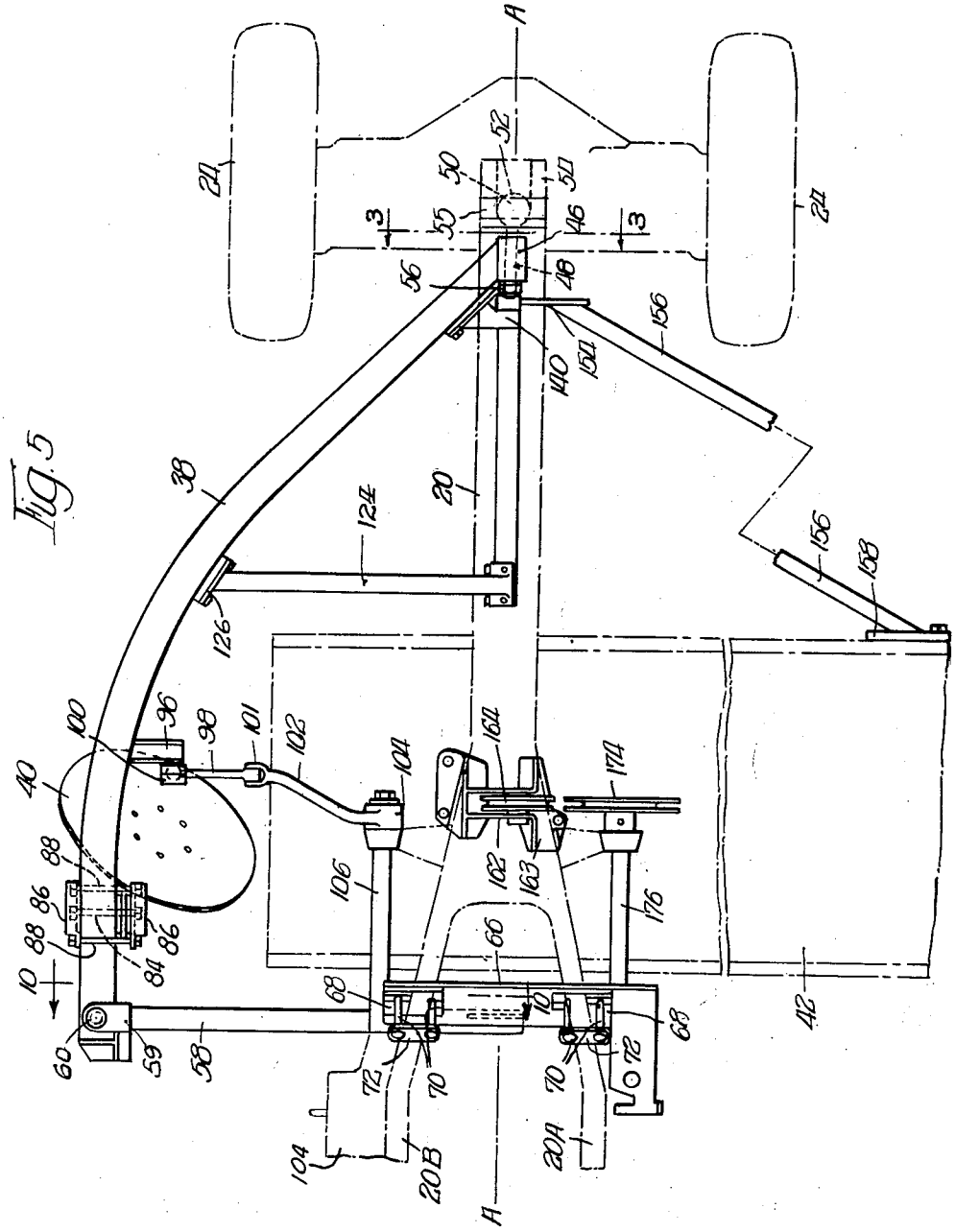
INVENTOR.
Raymond M Ulrich,
BY Brown, Jackson, Boettcher & Dienner
attys

Nov. 26, 1963 R. M. ULRICH 3,111,779

ELEVATING GRADER

Filed March 13, 1961 5 Sheets-Sheet 4

Fig. 5



INVENTOR.
Raymond M. Ulrich,
BY Brown, Jackson,
Boettcher & Dienner
Attys.

Nov. 26, 1963 R. M. ULRICH 3,111,779

ELEVATING GRADER

Filed March 13, 1961 5 Sheets-Sheet 5

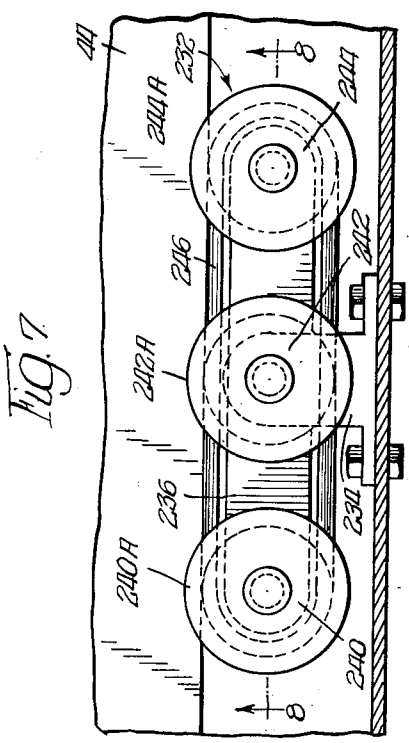


Fig. 7

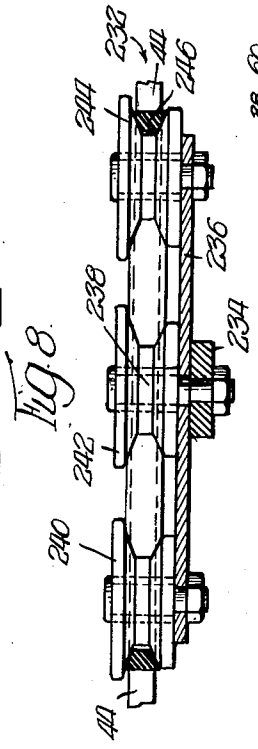


Fig. 8

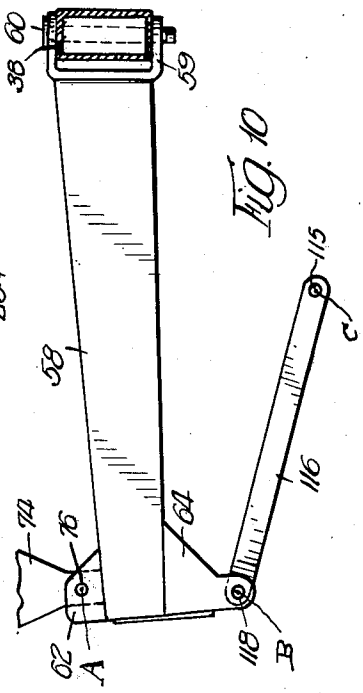


Fig. 10

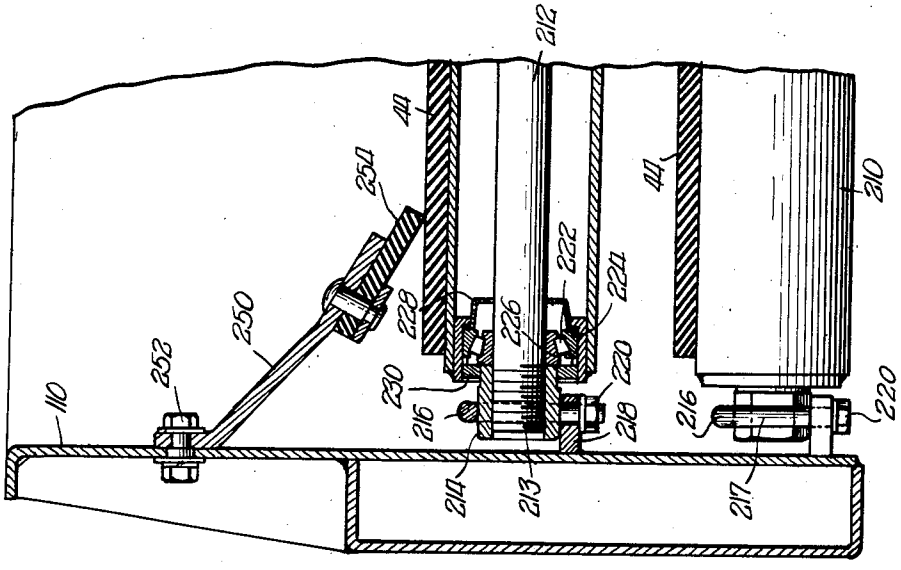


Fig. 6

INVENTOR.
Raymond M. Ulrich.
BY Brown, Jackson, Boettcher & Dienner
Attys.

United States Patent Office

3,111,779
Patented Nov. 26, 1963

3,111,779

ELEVATING GRADER

Raymond M. Ulrich, Roanoke, Ill., assignor to Ulrich Manufacturing Co., Roanoke, Ill., a corporation of Delaware

Filed Mar. 13, 1961, Ser. No. 95,113
20 Claims. (Cl. 37—110)

This invention relates to elevating graders and more particularly to an attachment by which a conventional motor grader may be converted to an elevating grader.

Such attachment devices have been used for a number of years, and briefly comprise an inclinable frame structure on which is supported a lengthwise extending continuous conveyor belt, the lower end of the frame and supported belt being usually suspended or mounted beneath the main frame of the grader and with a disc or other plow device adjacent the lower end of the conveyor belt for feeding earth or other material onto the belt as the grader is moved forwardly. The device is usually mounted as a substitute for the moldboard, circle and other supports which are removed to make room therefor. Such attachment devices have a multiplicity of uses as in loading surplus material onto trucks, i.e., for loading earth, loose gravel, broken macadam or other fill in highway construction, reclaiming or building new ditches along roads and elsewhere and loading the reclaimed material directly onto trucks, casting dirt, as in constructing a levee or other embankment, surface mining, building road shoulders, removing top soil and casting it or loading it into trucks, terracing fields as in combatting erosion, digging canals and countless other loading and/or casting operations where a large quantity operation is desired to be conducted in a swift, economical efficient manner.

One of the difficulties in many of these prior art structures was the inconvenience and difficulty in mounting and/or dismounting the elevating grader attachment. Another problem was that of obtaining an adequate support for the conveyor frame which may have a length of 28 feet and sometimes even longer. Also, there was the problem of stabilizing the lower end of the conveyor so that it would remain in proper alignment with the plow disc or other feed means. In this connection, a major problem has been the danger of the disc striking the conveyor belt, which is usually made of rubber or reinforced fabric, and cutting or otherwise damaging it.

Therefore, a principal object of the present invention is to provide an elevating grader attachment which will remove the source of these difficulties and/or at least minimize their effect.

Thus a first and important feature and/or object of the present invention is to provide means achieving a mechanical coordination between the plow beam which supports the disc and the lower end of the conveyor frame, making it impossible to damage the conveyor belt by reason of the disc striking it. Thus, in accordance with the present invention, it is proposed that the end of the frame or carrier for the carrier belt be supported by the plow beam in a way such that as said beam is moved to raise or lower the disc, the end of the conveyor will travel therewith. This, of course, means that the disc may be advantageously located very close to the lower

terminus of the conveyor belt, and maintain a preset or adjusted position related thereto.

Still another feature and/or object of the invention is to provide bracing and rigidity in the mounting of the lower end of the conveyor with respect to the plow beam, on which it is proposed to mount not only the plow disc but also the conveyor.

Another feature of the invention is the novel means and arrangement by which the plow beam may be mounted and dismounted from the main frame of the motor grader or tractor. Thus, it is contemplated that the beam and supporting structure for the plow disc and conveyor will be joined as a unit which can be attached to the main frame of the tractor or motor grader by means of a ball and socket connection at one end of the beam and a pin connection at its other end.

Still another feature of the invention is the novel means employed for raising and lowering the two ends of the conveyor and also the plow disc by using the controls conventionally provided in a motor grader or tractor equipped with a moldboard and circle support therefor. Thus, in one form of the motor grader to which the invention is adapted as an attachment, the left blade lift control is used to raise and lower the plow disc, while the right blade lift control is used to regulate the height of the upper end of the conveyor. The lower end of the conveyor is connected to the pinion and sector gear which shifts the circle and blade sidewise. The only added control is for the power take off which runs the conveyor belt.

Other features of the invention include a novel and improved construction of conveyor, including a novel roller assembly for supporting the continuous conveyor belt; also novel means for confining its travel, as well as novel frame structure embodying sections which may be conveniently inserted or removed in order to adjust the length of the elevator to the desired length and also adapting it so that it may be hinged intermediate its ends so as to minimize the width of the grader when traveling along a public highway or through narrow passages,

Many other objects of the invention as well as features and/or advantages thereof will be at once apparent or will become so from a reading of the detailed description of a preferred embodiment which follows, and when considered with the figures in the accompanying sheets of drawing.

However, in connection with said description and views of a preferred embodiment of the invention, it is to be understood that the same is not to be taken in a limiting sense, but only as illustrative of the invention, since many modifications and/or substitution of parts and/or arrangements beyond those shown and described will suggest themselves and are intended to be included, although not always definitely referred to in said description. The scope of the invention and what is believed to be new and patentable is defined by the appended claims and which claims are furthermore to be given a breadth consistent with the teaching of the invention as herein disclosed and only as limited by the prior art.

Now first referring to the several views of the drawing wherein like parts are identified by like reference numerals:

FIGURE 1 is a perspective view of the invention, the same being shown in side elevation attached to a conven-

tional motor driven road grader, portions of the cab, rear wheels and motor of the road grader being cut away, as not essential to an understanding of the invention;

FIGURE 2 is a side elevation view of the plow disc and the mounting means therefor, as well as for the conveyor, the motor grader on which the attachment is mounted being shown in dotted lines;

FIGURE 3 is a side elevational view of the attachment taken approximately along lines 3—3 of FIGURES 2 and 5, looking in the direction indicated by the arrows, to show the parts of the attachment in their normal operating positions, but with structural details of the tractor or motor grader omitted for better clarity and understanding of the essential structure of the attachment, the conveyor being shown in an inclined position as it would be in a working position, in contrast with FIGURE 1, where the conveyor is shown lying on the ground in the position it would be located for mounting to the tractor main frame;

FIGURE 4 is a fragmented view of the conveyor showing how the main length of the conveyor may be swung about a hinged section thereof to assume a substantially vertical position to minimize the width the attachment takes in traveling;

FIGURE 5 is a top plan of the attachment with the main frame and forward wheels of the tractor shown by dotted lines;

FIGURE 6 is a sectional view taken through the conveyor on the transverse section plane 6—6 in FIGURE 3 and looking in the direction indicated by the arrows;

FIGURE 7 is a fragmented plan view taken at lines 7—7 of FIGURE 3 to show the conveyor belt confining or guide means;

FIGURE 8 is a sectional view taken along lines 8—8 of FIGURE 7 to show the construction thereof;

FIGURE 9 is a sectional view taken through the gear sector of FIGURE 3 to show keying thereof;

FIGURE 10 is a view taken along lines 10—10 of FIGURE 5 illustrating the means of pivotally connecting the rear end of the plow supporting beam to the tractor frame.

Referring more specifically to the several views which comprise the drawings, and first, to FIGURE 1, the attachment comprising the present invention is there shown mounted on the main frame 20 of a tractor 22 which is conventionally identified in this art as a motor grader, and which terms are herein interchangeably used. The main frame 20 of such tractors is conventionally arched upwardly to provide clearance for the moldboard and supporting circle which are supported therebeneath between the forward wheels 24 and rear wheels 26 thereof. Commonly, such tractors are provided with a cab or driver's position indicated generally at 28, where the operator sits and the various controls are provided. To the rear of the cab is the engine 30 which is drivingly connected at least to the rear wheels 26. Appropriate power steering means, indicated generally at 32, may also be provided and the forward wheels 24 may be adapted to be slanted to accommodate the particular incline or slope of the terrain over which the tractor is being operated. For example, slanting of the forward wheels is particularly advantageous when working on a road shoulder or in a ditch. Appropriate mechanism for so inclining the wheels is indicated generally by reference numeral 34.

Within the cab of the conventional motor grader are found the usual levers and other mechanisms for controlling the forward and reverse movements of the tractor as well as controls for lifting mechanism which will raise either or both the left and right hand sides of the moldboard blade through the conventional circle, as well as shifting the circle and blade sidewise. These controls will be referred to later in the description of the invention with an indication as to how they are adapted to operate the raising and lowering of the disc plow and upper and lower ends of the conveyor, which comprise the attachment representing the present invention.

Now referring more specifically to the attachment by means of which a conventional motor grader, such as described, can be adapted as an elevating grader, in FIGURE 1 the attachment is represented generally by reference numeral 36 and includes a plow beam 38 pivotally connectable to the tractor frame as hereinafter described so that it can be moved about an axis represented by A—A in FIGURE 5, which is essentially the longitudinal axis of the tractor or motor grader itself. Suspended from said beam 38 is a plow indicated at 40, which may be of any suitable shape, although preferably it is circular in outline and of convex-concave shape and is usually of hardened steel with sharpened edges. Plow disc 40 is aligned and so angled that the forward movement of the tractor induces it to plow and direct earth or other loose material onto the lower end of an inclinable conveyor indicated generally at 42, the conveyor being provided with a continuously moving belt 44 which carries the material upwardly as indicated by arrow 44A and casts it to the side of the moving tractor 22 into a window pile or levee or into the body of a truck moving with the tractor.

Referring now to FIGURE 5, it will be seen that the forward end of the plow beam 38 has a cylindrical bearing portion 46 through which extends the stem 48 of a ball-headed connecting bolt 50, the head of said bolt being received within a complementary shaped cavity 52 provided in end portion 54 of the main frame 20 of the tractor body and completed by detachable retainer 55 which is standard construction in conventional motor graders for supporting the forward end of the circle supporting frame. The outer end of said stem 48 is threaded to receive a locking nut 56. Through the aforesaid construction, beam 38 may be hinged about stem 48 as an axle while also having a universal movement derived from the described ball and socket connection. As illustrated best in FIGURE 5, plow beam 38 arches outwardly from bearing portion 46 to provide a support to which plow disc 40 may be attached, which is outside the width of the tractor. Therefore, the plowing action of the disc parallels but is also outside the line of travel of the tires so that there is minimum inerference. The opposite or rear end of the beam 38 is not directly connected to the tractor frame, although this might be accomplished by making beam 38 of essentially U-shape. Desirably, however, a supporting strut 58 is provided having a bifurcated end 59 which is pivoted to the rear end of beam 38 by pivot pin means 60 to obtain a limited pivotal action about a vertical axis. Strut 58 is in turn pivotally connected at its opposite end to the frame 20 for movement about horizontal axis A—A along which bearing portion 46 of beam 38 also turns in its swinging about stem 48 of bolt 50. The use of the hinged strut 58 contributes to the ease in mounting the beam 38 to the tractor as does also the ball-and-socket connection of its forward end to the frame.

Referring now to FIGURE 10, the manner by which strut 58 is hinged to frame 20 will now be described. As shown in said FIGURE 10, the inboard end of strut 58 is provided with an upwardly extending ear 62 as well as a downwardly extending ear 64. As indicated in FIGURE 5, the frame 20 of the tractor is conventionally divided in the region of the cab into bifurcations 20A and 20B, which provide a more adequate support for the weight of the engine 30. Therefore, to provide a support to which the inboard end of strut 58 may be hinged, a plate 66 spans said bifurcations 20A, 20B of the tractor frame. Welded to the ends of this plate are a pair of slotted members 68 rigidly locked to the bifurcations 20A, 20B by means of bolts 70 passed through said slots and about the frame bifurcations, appropriately apertured fastening plates 72 being provided on the top and bottom sides of the bifurcations through which the legs of said bolts pass. Intermediate said slotted members is welded a de-

pending lug 74 to which strut 58 is pivotally joined by pin 76 which passes through a suitably provided opening in said lug. It will be understood that both pin 76 and stem 48 of the ball-headed bolt are horizontally disposed so as to lie along the aforesaid axis A—A which also represents the longitudinal axis of the tractor. In mounting the beam 38 on the tractor, it will be appreciated that the aforesaid construction is particularly advantageous since the forward end of the beam may be first connected by bolt 50 which provides a ball-and-socket universal connection about which the beam may be maneuvered in order to bring the inboard end of strut 58 into alignment with lug 74 to permit its pinning thereto, as does also the pivotal connection 60 of the outboard end of the strut 58 to the rearward end of the beam 38.

Referring now to FIGURE 2, plow disc 40 is supported on beam 38 by means of a bracket 78. It will be noted in FIGURE 2 that beam 38 is apertured to provide a series of horizontally arranged openings 80 and that bracket 78 also has a series of vertically arranged openings 82. This permits the disc to be mounted not only at different distances from the beam 38, but also at different locations lengthwise thereof so that it may be effectively centered, or at some related distance off-center with respect to the adjacent edge of the conveyor 42. Bracket 78 may be secured to the beam in a thus selected position by means of a bolt 84 passed through an aligned pair of openings 80 and 82, and a pair of locking plates 86 disposed on the opposite sides of the bracket 78 and beam 38. Preferably, the locking plates 86 are diagonally directed as indicated in FIGURE 2, so that connecting bolts 88 may be also passed through suitable openings in the ends of plates 86 and to lie on opposite sides of the bracket 78 in corners defined by the side surfaces of beam 38 and bracket 78, as illustrated, and which three point mounting considerably increases the lateral rigidity of the connection. Setting of the plow disc will vary greatly in different types of materials. In general, the disc is moved forwardly along the beam 38 and the pitch of the disc flattened when working with loose material. Conversely, when working in heavy material, the disc bracket 78 is moved rearwardly along beam 38 and the pitch of the disc is increased. Pitch of the disc is regulated by means of brace 90, which is shown in FIGURE 2 as provided with apertures 91 placed along its length at predetermined intervals. Brace 90 is suitably pivoted at one end to disc supporting bracket 78 as at 92 and is also connected by means of a shear pin or bolt 93 to a depending lug 94 provided on beam 38. Upon failure of shear pin 93, at predetermined overload, bracket 78 swings back around bolt 84 as a pivot. The interval between these two connections determines the angle of pitch of the plow disc 40. Through the aforedescribed mounting of the disc 40, it will be recognized that not only are a variety of adjustments possible, but also the plow disc 40 can be very stably mounted on the beam 38 in its selected setting.

The depth of cut of the disc 40 is controlled by adjusting beam 38 upwardly or downwardly about the aforementioned axis A—A. To support beam 38 at a height at which the disc will provide the necessary depth of cut, a projection 96 is provided on beam 38 to which link 98 is connected by a ball-and-socket connection indicated at 100 (FIGURE 5). The opposite end of link 98 in turn is hingedly connected at 101 to the bifurcated end of a second link 102 which is connected at 104 so as to be turned by rotation of shaft 106. Shaft 106, in turn, is coupled through a suitable clutch arrangement to the drive mechanism of the tractor, and which clutch is operated from the cab by the driver of the tractor. It should be understood that in a conventional motor grader equipped with a circle supported moldboard, shaft 106, and its operating clutch mechanisms as well as links 102 and 98 are attached to one side of the circle and serve to accommodate raising and lowering of the left side of the moldboard. It will be appreciated therefore that one of the features of applicant's invention is that the attachment he proposes can be operated by the controls normally present in a motor grader of the general character illustrated. It should further be understood that if the grader is equipped with hydraulic devices for raising and lowering the moldboard, rather than the aforedescribed purely mechanical means, one of such hydraulic devices can also be utilized for raising and lowering beam 38 by attaching the piston arm of the hydraulic cylinder through suitable linkages to the beam 38 and so accomplish the same result.

Turning now to the conveyor 44, one of the features of the present invention is that the conveyor is so mounted on the plow beam 38 as to permit adjustments in height of either the lower or upper ends of the conveyor without disturbing the initial spacing or setting of the plow disc with respect to the lower end of the conveyor. Conversely, the invention provides a coordination between the lower end of the conveyor and the plow disc such that as beam 38 is raised or lowered to affect the depth of cut of the plow disc 40, the said initial spacing between the disc and conveyor or end does not materially change. This has the obvious advantage that the end of the conveyor can be placed within three or four inches of the plow disc 40 where it will be most effective to receive and elevate the material plowed thereon by disc 40 without risking injury to the rubber belt 44 of the conveyor, either during swinging of the beam 38 in adjusting the plow disc depth or if the tractor were shaken as when proceeding over rough or uneven terrain. At the same time, the invention provides an exceedingly stable support for the conveyor and particularly for the lower end thereof.

Referring therefore to FIGURES 1 and 2, the lower end of the conveyor 42 is shown provided with a lip member 108 located forwardly of the lower terminus of the belt 44, and which member serves to join the forward ends of the two sidewalls 110 and 110A of the conveyor into a unitary structure, and also provides a measure of protection to the belt in that it prevents the belt from directly engaging the ground surface should the end of the conveyor be so directed. The two ends of the lip member 108 are shown extending outwardly beyond the sides 110 and 110A of the conveyor and so provide flange-like extensions 112 on which are welded upstanding ears 114 and 114A provided with apertures aligned to lie along a horizontal axis defined by dot-dash lines C—C of FIGURE 2 which passes through the center line of the bottom belt roller or cylinder 182 (FIGURE 3), to be later described.

Referring now to FIGURE 10, it will be remembered that plow beam supporting strut 58 is also provided with a depending ear 64. To this ear a link 116 is hinged by a suitable connecting pin 118. The lower end of link 116 is connected by a pin 115 between ears 114 on the one side of the conveyor 42. On the opposite side of conveyor 42 link 120 (FIGURE 2) corresponding to link 116 is provided having its lower end hinged to ears 114A by a pin 117, its opposite end being disposed between the bifurcations of end 122 of a strut 124 and hingedly connected thereto by a pin 128, strut 124 having its opposite end rigidly fastened to beam 38 as by fastening plate 126. Referring still to FIGURE 2, pins 115 and 117 by which the ends of links 116 and 120 are connected to the lower end of the conveyor 42 define a horizontal pivotal axis C—C parallel to axis A—A about which plow beam 38 is hingedly mounted to the tractor frame 20. Furthermore, the opposite ends of the links 116 and 120 are connected to struts 58 and 124 of the plow beam so as to swing about a second axis B—B which is also parallel to axis A—A and furthermore defines therewith a vertical plane which is normally to one side of axis C—C.

In order to support and/or locate the pivotally mounted lower end of the conveyor at a desired height, means are provided in the form of a pair of wings 130, 132

(FIGURE 2) suitably bolted on opposite sides of a sector gear 134 which is keyed about way 133 (FIGURE 9) provided in the casting of the main frame 20 of the tractor or motor grader. Sector gear 134 is adapted to be driven in its arcuate path about way 133 by pinion gear 136 (FIGURE 3) which is secured to shaft 135 and the rotation of which is controlled from the cab of the tractor through a suitable clutching arrangement. Again, sector gear 134 and pinion gear 136 are standard parts of the mechanism of many motor graders and normally are connected to turn the circle on which the moldboard is supported thereby to allow shifting of the circle and moldboard sidewise. In the present invention, the moldboard and its supporting circle are removed, wherefore movement of the sector gear 134 along way 133 may be utilized to adjust the height of the lower end of the conveyor 42 by suspending the same by chains 137 connected to the ends of the wings 130, 132 attached to the sector gear, as aforementioned, the ends of said chains being attached to the sidewalls of the conveyor as by lugs 138 disposed intermediate the pivotal connections of the links 116 and 120 which hinge about axes B—B and C—C. Therefore, rotating movement imparted to shaft 135 may be translated through pinion 136 to sector 134 causing the wings 130, 132 which move therewith to raise or lower end of the conveyor. Links 116 and 120 by reason of their pivotal connections to the ends of the conveyor and supporting struts 58 and 124 accommodate said raising and lowering, but without disturbing the pre-set spacing of lip 108 of the conveyor with respect to the adjacent edge of the plow disc 40 (see FIG. 3).

To stabilize the conveyor against side sway and particularly its lower end which is subject to the loading action of the plow disc 40, appropriate bracing is provided. This is best shown in FIGURES 1 and 2 as comprising a depending strut 140 welded to beam 38 immediately behind bearing portion 46, and which strut 140 depends in spaced relation with strut 124. The lower ends of the two struts 124 and 140 are connected by a horizontal brace 142 (FIGURE 2). Further bracing may also be obtained by means of a diagonal brace 144. Depending strut 140 also has a pair of ears 146 having apertures aligned with the apertures in the ears of strut 124 which receive pin 128 so as to lie along axis B—B. Actually, link 120 previously referred to is but one side of a right triangular member which also includes a horizontal piece 148 and a diagonal brace 152 constituting the hypotenuse of the triangle. Horizontal piece 148 lies along axis B—B between the apertured ears of struts 124 and 140, pin 128 being threadedly connected into one end thereof and a second pin 150 being threadedly connected in the other end thereof. Pins 150 and 128 therefor together serve to pivotally support an axis B—B a triangular link represented by link 120, piece 148 and brace 152, affording a structure of considerable strength and rigidity to support the conveyor on beam 38 and resist torsion and sway of the lower end of the conveyor as in the loading operation and at other times.

Because of the length of the conveyor which may be as much as 31 feet, a stabilizing arm 156 is also provided. Referring to FIGURES 3 and 5, one end of stabilizing rod 156 is also hingedly connected to depending strut 140 as by pin 150, said stabilizing rod 156 extending diagonally to a further attachment plate 158 bolted to sidewall 110 of the conveyor 42 near the top or upper end of the conveyor. As sections are added between the upper and lower sections of the conveyor as hereinafter described to increase the length of the conveyor, plate 158 will be rebolted to the conveyor such that the same angle of the stabilizing rod is held.

In order to support the upper end of the conveyor, suitable means are provided, as will now be described with particular reference to FIGURES 1 and 3.

Suitably mounted on the frame 20 of the grader body is a mounting bracket or stanchion 162 as by bolts 178 which pass through apertured flanges 163 of the stanchion, along the sides of the frame 20 and through aligned apertures in straddling plate 175, nuts on the threaded ends of said bolts being tightened to hold the stanchion 162 rigid. Stanchion 162 serves to rotatably support a sheave 164 about which extends a cable 166 secured at one end to a tie rod 168 by an appropriate fastener element 167, the tie rod 168 having its opposed ends pivotally secured to lugs 170 mounted on the edges of the conveyor sidewalls 110, 110A and the upper end thereof. In place of fastener element 167 a sheave may be substituted and the cable passed around said sheave and anchored at the stanchion 162 to a point below sheave 164, to lessen tension on the cable. The opposite end of said cable 166 is suitably fastened as by means 172 to a second sheave 174 mounted on shaft 176 so as to turn with rotation of the shaft 176, said shaft being suitably clutched to the drive mechanism of the grader and operable through appropriate means in the cab. Again, shaft 176 and the controls therefor, like shaft 106 and its controls, are conventional equipment provided on such graders. Shaft 176 is normally found linked to the circle which supports the moldboard and is used to lift the right side of the circle and thereby the right side of the moldboard. Again, rather than the described mechanical arrangement involving rotation of shaft 176, the raising and lowering of the upper end of the conveyor might be accomplished by hydraulic means. In such case the piston might be connected directly to the conveyor or through suitable linkages. The reciprocation of the pinion rotating shaft 176 might also be suitably geared as to operate sheave 174 and thereby wind and unwind a cable such as 166. In the aforedescribed arrangements, it will be recognized that the cable 166 serves as means which may be operated to raise and/or lower the upper end of the conveyor as well as retaining the conveyor at a desired height. It also will be appreciated that in setting the angle of the conveyor 42, both the mechanisms acting on the upper end and on the lower end of the conveyor, will necessarily be operated.

Now turning to the conveyor 42 itself, as previously described, it comprises a frame embodying two spaced sidewalls 110 and 110A, joined at their lower end by a lip forming member 108 and at their upper ends by a guard rail 180. Cylinders 182 and 184 are rotatably mounted on said sidewalls 110 and 110A adjacent the lower and upper ends, respectively, of said conveyor 42, and about which the conveyor belt 44 extends. Conveyor belt 44 is preferably formed of a rugged rubber composition and is suitably cleated to better hold the earth or other material loaded thereon by disc 40. The direction of travel of the belt 44 is indicated by the arrows 44A (FIGURE 1) and is accomplished through suitable gearing provided in a gear box 186 which drivingly connects shaft 188 of cylinder 184 to telescoping shafts 190 and 192, said shafts 190 and 192 being connected together at 194 by a telescopic drive connection, and telescoping shaft 192 in turn being drivingly connected to drive gearing 196 to accomplish rotation thereof, power therefor being obtained through suitable clutching to the drive mechanism of the tractor. Suitable means for engaging and disengaging the clutch are provided in the cab for the convenience of the operator of the tractor.

The two sidewalls 110 and 110A of the conveyor can be formed as single units, but are preferably formed in short sections joined together by transversely extending tie members 197 and having flanged end portions 198 so that they may be conveniently bolted together to obtain any length of conveyor desired. The two end sections, however, need be flanged only at their inboard ends. Since it is often necessary to move a grader through narrow passages or along public streets where the length of the conveyor added to the width of the grader would make movement of the grader either impossible or at least hazardous and affecting public safety, it is highly desirable that the conveyor be hinged intermediate its ends so that a substantial portion of the length of the conveyor

may be disposed vertically. This may be conveniently accomplished by utilizing a conveyor section wherein the sidewalls comprise two parts hinged together. Such a section is indicated at **200** in FIGURES 3 and 4 and comprises parts **202** and **203** hinged together as at **204**, each said part comprising a pair of spaced sidewalls joined together by tie members **197**. Said parts **202** and **203** are further provided with adjoining flanges **205** and **206**, which flanges are formed with openings so that the two parts may be bolted together to prevent accidental hinging when the conveyor is being worked in its extended position. In order to accommodate the hinging action, a piece **208** of each sidewall of part **202** is made removable, said pieces also normally being bolted in place to provide a continuous wall on either side of the conveyor belt. Although in FIGURE 4 hinge **204** is shown located on the outboard side of the wheels **24**, it will be appreciated that, through suitable adjustment of the elevating controls for the upper and lower ends of the conveyor, it would also be possible to locate said hinge to the inboard side of the wheels and so further narrow the overall width of the grader.

One of the features of the conveyor comprising a part of the present invention is the manner of mounting the rollers which are placed at selected intervals and in each section along the length of the conveyor to support the belt in both the upper course of its travel between the end cylinders **182** and **184** and in its return or lower course.

Referring to FIGURE 6, these belt supporting rollers **210** are shown rotatably mounted on shafts **212** having portions which extend outwardly of the cylinder. To accommodate smooth turning of the rollers **210** about their mounting shafts **212**, roller bearings **222** are provided about each end of the shafts and are supported between a bearing cone **224** and a bearing cup **226**, a closure member being provided at **228** and a seal at **230**. To complete the assembly, one of the protruding ends of the shaft **212** is threaded as at **213** so that a nut **214** may be threadedly connected thereto. Although a nut might also be threadedly connected to the opposite end of shafts **212**, it has been found sufficient to provide a nut having a press-fit with the other end of the shaft, since access to the bearings and proper tightening thereof may be conveniently accomplished if at least one nut is removable. However, in accordance with the invention, both nuts are formed of a hexagonal or other non-circular shape so that a flat surface thereof may be rested on projections **218** suitably welded on the inside of conveyor sidewalls **210** and **210A**, U-bolts **216** being provided each having its bight portion resting on a top, preferably flat, surface of the nut and its two legs **217** extending downwardly along the sides of the nuts which may be notched to receive the legs of the bolt and having threaded ends which extend through slotted apertures (in cross-wise of the conveyor) in projection **218** on either side of the nut, the U-bolts being thus secured in place by nuts **220** threadedly connected to said threaded ends. Such a mounting arrangement is not only simple to manufacture, but provides a positive locking of the rollers shaft to the conveyor sidewalls and yet is conveniently removable in the field if found necessary.

In order to properly guide the travel of conveyor belt **44** about cylinders **182** and **184**, means are provided at **232** (FIGURE 3) just ahead of the respective cylinders **182** and **184**, the belt being considered as moving counterclockwise in said FIGURE 3.

Referring to FIGURES 7 and 8, the construction of these guide members is there shown as comprising a main bearing plate **236** pivotally mounted to swing about a central bolt **238** by means of which the plate is secured to a supporting lug or projection **234** welded at appropriate locations on the inside surface of conveyor sidewalls **210** and **210A**. Said plate **236** is shown supporting three aligned sheaves **240**, **242** and **244**, each of which are freely rotatable about their mountings and about which sheaves is mounted a V-belt or band **246**. As illustrated in FIGURE 7, the guide devices are so mounted that the inboard side of the V-belt **246** establishes line contact with the edge of the conveyor belt **44** as it passes thereby in preparation to moving about cylinder **182** or **184** as the case may be. Each of said sheaves **240**, **242**, and **244** is further provided with a lip portion indicated at **240A**, **242A** and **244A** which lap the adjacent edge of the conveyor belt **44**. It will be appreciated that such guide means **232** are provided on each side of the conveyor belt **44** immediately ahead of the two end cylinders **180** and **184** and because they are free to swing about a pivot disposed normal to the direction of travel of the belt **44**, as defined by bolt **238**, the V-belt **246** limit sidewise shift of the conveyor belt **44**, so that there is no danger of the conveyor belt **44** running off the cylinders **184** and **182** in their progress thereabout. Preferably, suitable closure flanges indicated at **250** are bolted to the sidewalls **110** and **110A** of the conveyor as by bolts **252** and extend lengthwise of the conveyor belt **44** so as to prevent dirt from entering the space left between the edge of the belt **44** and walls **110**, **110A**, as the case may be. Preferably, the closure flaps **250** will also have a rubber lip portion **254** fastened along their free edge to directly engage the moving belt **44**.

From the above description, it will be recognized that not only is the invention readily adapted to conventional motor graders, but that its structure provides a most stable as well as efficient operation of elevating grader and accomplishes all of the objects and advantages and features recited therefor and in an exceedingly practical manner.

It will, furthermore, be understood that the invention, rather than constituting an attachment to replace the circle and moldboard of a motorized road grader, might be constructed as a separate unit having its own frame, wheels and engine, and so adapted to be driven under its own power or pulled behind a tractor or other power driven vehicle.

Thus having described my invention, I claim:

1. In an elevating grader, the combination of a beam pivotally connectable to a tractor frame about a first axis extending longitudinally of said frame, a plow suspended from said beam, a conveyor including rollers at opposite ends thereof and an endless belt extending about said rollers, said conveyor having one end portion disposed below said beam and means pivotally mounting said end portion to said beam for movement about a horizontal axis spaced parallel to and below said first axis about which the beam is pivotally mountable, said horizontal axis essentially coinciding with the axis of the roller at said end of the conveyor, means for supporting said conveyor in an inclined position, and means for adjusting the beam about said first axis to raise and lower the plow, the lower end of the conveyor moving with said adjustment of the beam so as to maintain a predetermined alignment and spacing of the plow with respect to the said lower end of the conveyor.

2. In an elevating grader, the combination of a beam for supporting a plow, means for pivotally connecting its ends to a tractor frame so as to be adjustable about a first axis extending longitudinally of said frame, a conveyor having an end portion disposed below said axis and adjacent said plow, rigid means pivotally mounted to said beam for movement about a horizontal axis spaced below and parallel to said first axis about which the beam is pivotally mountable to the tractor frame, said end portion of the conveyor being pivotally connected to said rigid means for movement about a third axis parallel to said first and second axes, means connected to adjacent the two ends of the conveyor by which ends thereof may be raised and lowered, and further means connected to the beam by operation of which it may be adjusted about its pivotal connection to raise and lower the plow, the lower end of the conveyor by reason of its said connection with the beam moving with the adjustment of the beam so as to maintain a predetermined alignment and spacing of the

plow with respect to the said lower end of the conveyor, said plow being adjustable on said beam to a desired positional alignment and pitch with respect to the adjacent conveyor end portion.

3. In an elevating grader, the combination of a beam having axially aligned bearing portions by which it may be pivotally connected to a tractor frame to permit adjustment of the beam about a first axis extending longitudinally of the frame, said beam having a supporting portion offset from its said bearing portions for supporting a plow disc, an inclinable conveyor extending transversely of said first axis, a pair of links one on each side of the lower end of said conveyor, said links having an end pivotally connected to the lower end of the conveyor for hinged movement about a second axis offset from and parallel to said first axis, and means hingedly connecting the opposite ends of said links to the beam for pivotal movement about a common axis disposed below and parallel to said first axis about which the beam is adjustable, a first connecting means joined to the lower end of said conveyor intermediate said offset and common axes, and a second connecting means joined to the upper end of the conveyor, said connecting means being adapted for connection to operating means in the grader to permit variation of the inclination of said conveyor.

4. In an elevating grader, the combination of a beam having axially aligned bearing portions for pivotal connection to a tractor frame to permit adjustment of the beam about a first axis extending longitudinally of the frame, said beam having a supporting portion offset from its said bearing portions, a plow disc suspended therefrom, an inclinable conveyor extending transversely beneath said axis so that its lower end is adjacent the plow disc, a pair of links, one on each side of the lower end of said conveyor, said links each having an end pivotally connected to the lower end of the conveyor for hinged movement about a second axis offset from and parallel to said first axis, a pair of supporting struts on said beam to move with the pivoting of said beam about said first axis, the opposite ends of said links being pivotally connected to said struts about a common axis disposed below and parallel to said first axis, and means joined to adjacent the upper and lower ends of said conveyor which are operable to permit variation of the inclination of said conveyor.

5. In an elevating grader having a longitudinal frame, a beam having one end removably connected by a ball-and-socket joint to beneath the frame adjacent one end thereof, said beam arching outwardly from said connection to one side of the frame, a supporting strut, vertical pivot means connecting one end of said supporting strut to the other end of the beam, horizontal pivot means connecting the other end of the strut to the frame, the axis of said horizontal pivot means intersecting the center of the ball-and-socket joint by which the first end of the beam is connected to the frame, an inclinable belt-type conveyor supported beneath said frame and extending transversely thereof with its upper end on the side of the frame opposite that where the beam is located, a plow disc mounted on said beam intermediate its ends, the lower end of said conveyor being pivotally supported by means including said strut such that said end moves with adjustment of the beam about the axis of said horizontal pivot means to maintain a fixed spacing from said plow disc, means on said beam which permit adjusting the spaced alignment of the plow disc with the lower end of the conveyor, and means on the frame connectable to the beam for adjusting said beam about its pivotal connection with the tractor frame to alter the height of the disc plow.

6. In an elevating grader, a conveyor comprising an inclinable frame embodying a pair of spaced sidewalls, said sidewalls each supporting on their inboard sides aligned pairs of projections each having a pair of spaced openings, a shaft supported roller between each pair of projections, bearings in the ends of said rollers each supported between an inward-located tapered bearing receptacle and an outer bearing receptacle slidingly received on said shaft thereof, the ends of said shaft extending outwardly of said slidable bearing receptacle and the ends of the rollers, plural flat-sided members connected about the ends of said shafts to retain the bearings and said receptacles in place, at least one of said plural flat-sided members being threadedly connected to said shaft to accommodate tightening of the bearing between respective pairs of receptacles, said plural flat-sided members having a flat surface resting on said projections intermediate the openings therein, and U-shaped connecting means extending about said plural flat-sided members and having their two legs extended through the apertures in said projections, and means detachably secured to the ends of the legs in said openings so as to secure the shafts of said rollers to respective pairs of said projections and prevent loosening of said bearing receptacles in the relation to which they are adjusted by the threaded connection of the plural flat-sided member on the end of the shaft.

7. In an elevating grader, an inclinable conveyor comprising a pair of spaced sidewall members, a cylinder rotatably mounted between said sidewall members at each end thereof, one of said cylinders being operably connectable to drive means for rotating the cylinder, a continuous belt about said cylinders to be driven by rotation of said one cylinder, and guide means mounted on said walls to establish yieldable line contact with the two edges of the belt immediately ahead of its travel about the two cylinders, said guide means each comprising a member mounted to one side of the edge of the conveyor belt and free to swing about an axis normal to the direction of travel of the conveyor belt, a line of rotatable sheaves mounted on said member lengthwise of the travel of the conveyor belt, and a continuous band about said sheaves which maintains line engagement with the edge of the conveyor belt lengthwise thereof.

8. In an elevating grader, an inclinable conveyor comprising a pair of spaced sidewall members, a cylinder rotatably mounted between said sidewall members at each end thereof, one of said cylinders being operably connectable to drive means for rotating the cylinder, a continuous belt about said cylinders to be driven by rotation of said one cylinder, and guide means mounted on said walls which establish yieldable line contact with the opposed edges of the belt immediately ahead of its travel about the two cylinders, said guide means each comprising a member mounted to one side of the edge of the conveyor belt and free to swing about an axis normal to the direction of travel of the conveyor belt, a line of rotatable sheaves mounted on said member lengthwise of the travel of the conveyor belt, and a continuous band about said sheaves, to engage the edge of the conveyor belt, said sheaves including a lip portion which laps the adjacent edge of the conveyor belt.

9. In an elevating grader, the combination of a tractor having an arched longitudinal frame and wheels at either end of said frame, a plow adjustably mounted on said frame to one side thereof, an inclinable conveyor having its lower end supported beneath said arched frame and in alignment with said plow, the upper end of said conveyor extending upwardly to the opposite side of the frame, said conveyor comprising a plurality of sections each including a pair of spaced sidewalls, said sections further having tie members intermediate their longitudinal edges joining each said sidewalls thereof together and rotatable upper and lower rollers supported between said sidewalls, the sidewalls of each said sections having flanged ends which abut and are provided with aligned apertures through which bolts are located to detachably join said sections, the end sections of said conveyor each including a rotatable cylinder, and a continuous belt extending about said cylinders, the upper course of which passes above the tie members and is being supported by the upper rollers

of the individual sections and the lower course of the belt passing below the tie members and being supported by the lower rollers of each section, one of said sections having each of its sidewalls in two parts hingedly connected together, whereby to allow the upper portion of the conveyor to be disposed in a vertical position and adjacent the frame of the tractor, and said two parts of said one section including means by which two parts are optionally rigidly connected to prevent their pivoting about the hinge connection in the normal use of the conveyor.

10. In an elevating grader, the combination of a tractor having an arched longitudinal frame and wheels at either end of said frame, a plow adjustably mounted on said frame to one side thereof, an inclinable conveyor having its lower end supported beneath said arched frame and in alignment with said plow, the upper end of said conveyor extending upwardly to the opposite side of the frame, said conveyor comprising a plurality of sections each including a pair of spaced sidewalls, each having tie members joining said sidewalls together in spaced relation and supporting rotatable upper and lower rollers between said sidewalls, the sidewalls of each said sections having flanged ends which abut and are provided with aligned apertures through which bolts extend to detachably join said sections, the end sections of said conveyor each including a rotatable cylinder, and a continuous belt extending about said cylinders and having its upper and lower courses supported by the respective upper and lower rollers of the individual sections, one of said sections having each of its sidewalls in two parts hingedly connected together, and a removable section in one of said two parts of each sidewall of the section above the hinge connection to permit the two parts to pivot about said hinged connection whereby to allow the upper portion of the conveyor to be disposed in a vertical position and adjacent the frame of the tractor, and said two parts of said one section including adjoining flanged parts which abut and through which bolts are extended to prevent said parts of the one section from pivoting about its hinge connection in the normal use of the conveyor.

11. For use in extending the length of the conveyor of an elevating grader and to permit positioning of the upper portion of such a conveyor in a vertical position with the lower portion mounted beneath the frame of the tractor, a section comprising a pair of spaced sidewalls, each sidewall being similarly divided into two parts and which are hinged together about a common axis intermediate the two ends thereof, each said part having at least one tie member joining said part to the corresponding part of the other sidewall and rotatable rollers supported between at least one pair of parts of said sidewalls, the two parts of said sidewalls having flanged ends provided with apertures through which bolts may be located to detachably join said section to further sections in such a conveyor, and one of said parts of each sidewall of said section having a removable portion immediately above the hinge connection which permits the two parts to pivot about said hinged connection toward each other, and said two parts of the two sidewalls of said section further including adjoining flanged parts which abut in one position of their adjustment about said hinged connection, said flanged parts having apertures through which bolts may be extended to prevent said parts of the section from pivoting about the hinge connection in the normal use of the conveyor.

12. In an elevating grader having a longitudinal frame, a sector gear slidably supported on said frame intermediate its ends for movement in a curved path transversely of the frame, a beam pivotally connected to beneath the frame to permit adjustment thereof about a horizontal axis extending longitudinally of the frame, an intermediate portion of said beam being disposed outwardly of said pivotal connections, an inclinable belt-type conveyor located beneath said frame and extending transversely thereof with its upper end on the side of the frame opposite that where the beam is located, a plow disc adjustably mounted on said intermediate portion of the beam and in spaced alignment with the lower end of the conveyor, a first supporting strut on one side of the conveyor, a first link along said side of the lower end of the conveyor having one end pivotally connected to said strut and its other end pivotally connected to the lower end of the conveyor, said pivotal connections being about spaced parallel axes, a pair of spaced depending struts fixed to the beam on the opposite side of the conveyor, brace means connecting the lower ends of said two depending struts, and a right-triangular member having one leg paralleling said brace and pivotally connected to the ends of said two depending struts for movement about the axis of the pivotal connection of the first link to its supporting strut, a second leg of said right triangular member fixed to the first leg and having its opposite end pivotally connected to the forward end of the conveyor for movement about an axis corresponding to the axis of the pivotal connection of the first link to said lower conveyor, a pair of wings mounted on said sector gear having means on the ends thereof connected to the two sides of the conveyor at locations intermediate said axes about which the conveyor is pivotally linked to the beam whereby movement of the sector gear will serve to raise and lower the lower end of the conveyor about its pivotal connections.

13. In an elevating grader having a longitudinal frame, a sector gear slidably supported on said frame intermediate its ends for movement in a curved path transversely of the frame, a beam pivotally connected to beneath the frame to permit adjustment thereof about a horizontal axis extending longitudinally of the frame, an intermediate portion of said beam being disposed outwardly of said pivotal connections, an inclinable belt-type conveyor located beneath said frame and extending transversely thereof with its upper end on the side of the frame opposite that where the beam is located, a plow disc adjustably mounted on said intermediate portion of the beam and in spaced alignment with the lower end of the conveyor, a first supporting strut on one side of the conveyor, a first link along said side of the lower end of the conveyor having one end pivotally connected to said strut and its other end pivotally connected to the lower end of the conveyor, said pivotal connections being about spaced axes parallelling said first axis, a pair of spaced depending struts fixed to the beam on the opposite side of the conveyor, brace means connecting the lower ends of said two depending struts, and a right-triangular member having one leg paralleling said brace and pivotally connected to the ends of said two depending struts for movement about the axis of the pivotal connection of the first link to its supporting strut, a second leg of said right triangular member fixed to the first leg and having its opposite end pivotally connected to the forward end of the conveyor for movement about an axis corresponding to the axis of the pivotal connection of the first link to said lower conveyor, a pair of wings mounted on said sector gear having means on the ends thereof connected to the two sides of the conveyor at locations intermediate said axes about which the conveyor is pivotally linked to the beam whereby movement of the sector gear will serve to raise and lower the lower end of the conveyor about its said pivotal connections, and means on the tractor frame connectable to the beam for adjusting said beam about its pivotal connection with the tractor frame to alter the height of the disc plow, the lower end of the conveyor moving with said adjustment of the beam so as to maintain a predetermined alignment and spacing of the disc with respect to said lower end of the conveyor.

14. In an elevating grader having a vertically arched longitudinal frame, a sector gear slidably supported on said frame intermediate its ends for movement in a curved path transversely of the frame, an attachment therefor which comprises a beam having one end removably connected by a ball-and-socket joint to beneath the frame

adjacent one end thereof, said beam arching outwardly from said connection to one side of the arched frame, a supporting strut, vertical pivot means connecting one end of said supporting strut to the other end of the beam, horizontal pivot means connecting the other end of the strut to the frame, the axis of said horizontal pivot means intersecting the center of the ball-and-socket joint by which the first end of the beam is connected to the frame, an inclinable belt-type conveyor located beneath said frame and extending transversely thereof with its upper end on the side of the frame opposite that where the beam is located, said conveyor including rollers at each end thereof and an endless belt about said rollers, a plow adjustably mounted on said beam intermediate its ends and in spaced alignment with the lower end of the conveyor, a first link along one side of the lower end of the conveyor and a second link along the other side thereof, each link having one end pivotally connected to the lower end of the conveyor about a first horizontal axis which substantially coincides with the axis of the roller at said end about which the belt extends, the other end of said first link being hinged to said supporting strut for movement about a second horizontal axis, a depending strut fixed to the beam on the opposite side of the conveyor, and the second link on the opposite side of the conveyor having its other end pivotally connected to said depending strut, the pivotal connections of the two links lying along two spaced horizontal axes, parallel to each other and to the axis of the horizontal pivot means of the strut which connects the beam to the frame, a pair of wings mounted on said sector gear having means on the ends thereof connected to the two sides of the conveyor at locations intermediate said first and second horizontal axes about which the conveyor is pivotally linked to the beam whereby movement of the sector gear will serve to raise and lower the lower end of the conveyor about its said pivotal connections, and means on the tractor frame connectable to the beam for adjusting said beam about its pivotal connection with the frame to alter the height of the disc plow, the lower end of the conveyor moving with said adjustment of the beam so as to maintain a predetermined alignment and spacing of the disc with respect to said lower end of the conveyor.

15. In an elevating grader having a vertically arched longitudinal frame, a sector gear slidably supported on said frame intermediate its ends for movement in a curved path transversely of the frame and a pair of rotatable shafts extending longitudinally of the frame, an attachment therefor which comprises a beam having one end removably connected by a ball-and-socket joint to beneath the frame adjacent one end thereof, said beam arching outwardly from said connection to one side of the arched frame, a supporting strut to the other end of the beam, horizontal pivot means connecting the other end of the strut to the frame, the axis of said horizontal pivot means intersecting the center of the ball-and-socket joint and defining an axis about which the beam is adjustable relative to the frame, an inclinable belt-type conveyor located beneath said frame and extending transversely thereof with its upper end on the side of the frame opposite that where the beam is located, a plow disc adjustably mounted on said beam intermediate its ends and in spaced alignment with the lower end of the conveyor, a first link along one side of the lower end of the conveyor having one end pivotally connected to the lower end of the conveyor about a first horizontal axis, the other end of said first link being hinged to said supporting strut for movement about a second horizontal axis, a pair of depending struts fixed to the beam on the opposite side of the conveyor, one of said depending struts depending from the beam adjacent its ball-and-socket connection to the frame, the other depending strut being spaced from said first depending strut and angling forwardly from the beam, brace means connecting the lower ends of said two depending struts, and a right-triangular member having one leg paralleling said brace and pivotally connected to the end of said two depending struts for hinged movement about said second horizontal axis, a second leg of said right triangular member fixed to the first leg and having its opposite end pivotally connected to the forward end of the conveyor for hinged movement about said first horizontal axis, a pair of wings mountable on said sector gear having means on the ends thereof connected to the two sides of the conveyor at locations intermediate said first and second horizontal axes about which the conveyor is pivotally linked to the beam whereby movement of the sector gear will serve to raise and lower the lower end of the conveyor about its said pivotal connections, sheave means mountable on the tractor frame and a cable extending thereover having one connected to the upper end of the conveyor and its other secureable to said shaft whereby rotation of said shaft will serve by winding or unwinding the cable to adjust the height of the conveyor's upper end, and means connecting the beam to said other rotatable shaft of its frame whereby rotation of said shaft will serve to pivot said beam about its pivotal connection with the frame to adjust the height of the disc plow, the lower end of the conveyor moving with said adjustment of the beam so as to maintain a predetermined alignment and spacing of the disc with respect to said lower end of the conveyor.

16. In an attachment according to claim 15 wherein guide means are mounted on the sidewalls of the convyeor which establish yieldable line contact lengthwise of the opposed edges of the belt to confine the path of travel of the conveyor belt.

17. In an attachment according to claim 15 wherein the conveyor is diveded into sections each including spaced sidewalls supporting rollers therebetween over which the conveyor belt courses, said sections having adjacent apertured flanged ends which abut and are bolted together by bolts extending through aligned apertures thereof.

18. In an attachment according to claim 15 wherein the conveyor is divided into sections each including spaced sidewalls supporting rollers therebetween over which the conveyor belt courses, said sections having adjacent flanged ends bolted together, and one of said sections comprising two parts hingedly connected together to permit positioning the outer portion of the conveyor in a vertical position, and releasable means for locking said hinged parts of said one section against such hinging action.

19. In an elevating grader, the combination of a beam pivotally connectable to a frame so as to be adjustable about a first axis extending longitudinally of the frame, a plow suspended from said beam, an inclined conveyor extending transversely of said first axis and having its lower end portion disposed adjacent said plow, said conveyor including a roller supported at each of its upper and lower ends and an endless belt extending over and between said rollers, linking means securing said lower end of the conveyor to said beam, said linking means being pivotally connected to said beam for hinging movement about a second axis disposed parallel to and spaced from said first axis about which the beam is adjustable, said linking means being also pivotally connected to said conveyor for hinging movement about a third axis spaced from said first and second axes and parallel thereto, said third axis coinciding with the axis of the roller carried by the lower end of the conveyor, a first connecting means joined to adjacent the lower end of the conveyor intermediate said second and third spaced pivotal axes of the link means, and a second connecting means joined to the upper end of the conveyor, said connecting means being adapted for connection to operating means of the grader to permit varying the inclination of the conveyor.

20. In an elevating grader, the combination according to claim 19 wherein the linking means further includes rigidifying structure to prevent lateral sway of the lower end of the conveyor.

(References on following page)

References Cited in the file of this patent

UNITED STATES PATENTS

260,356	Barry	July 4, 1882
758,148	Powlinson	Apr. 26, 1904
870,134	Sargent	Nov. 5, 1907
958,331	Smith	May 17, 1910
1,767,992	Lilly	June 24, 1930
1,924,055	Wallace	Aug. 22, 1933
2,109,793	Gustafson	Mar. 1, 1938
2,362,168	Stokes	Nov. 7, 1944
2,469,483	Strong	May 10, 1949
2,619,223	Rawlinson	Nov. 25, 1952
2,756,521	Clark	July 31, 1956

2,791,043	Hancock	May 7, 1957
2,814,889	Reisser	Dec. 3, 1957
2,856,705	Brown	Oct. 21, 1958
2,896,344	Armington	July 28, 1959
2,939,226	Ronk	June 7, 1960

FOREIGN PATENTS

150,611	Australia	Mar. 24, 1953

OTHER REFERENCES

Domor publication, Elevating Grader attachment for "Caterpillar" Motor Graders (Models No. 12 and 112), published by Ulrich Products Corp. Received in Patent Office April 11, 1951.