March 1, 1938. C. A. GUSTAFSON 2,109,793

ROAD MACHINE

Filed April 21, 1932 7 Sheets-Sheet 1

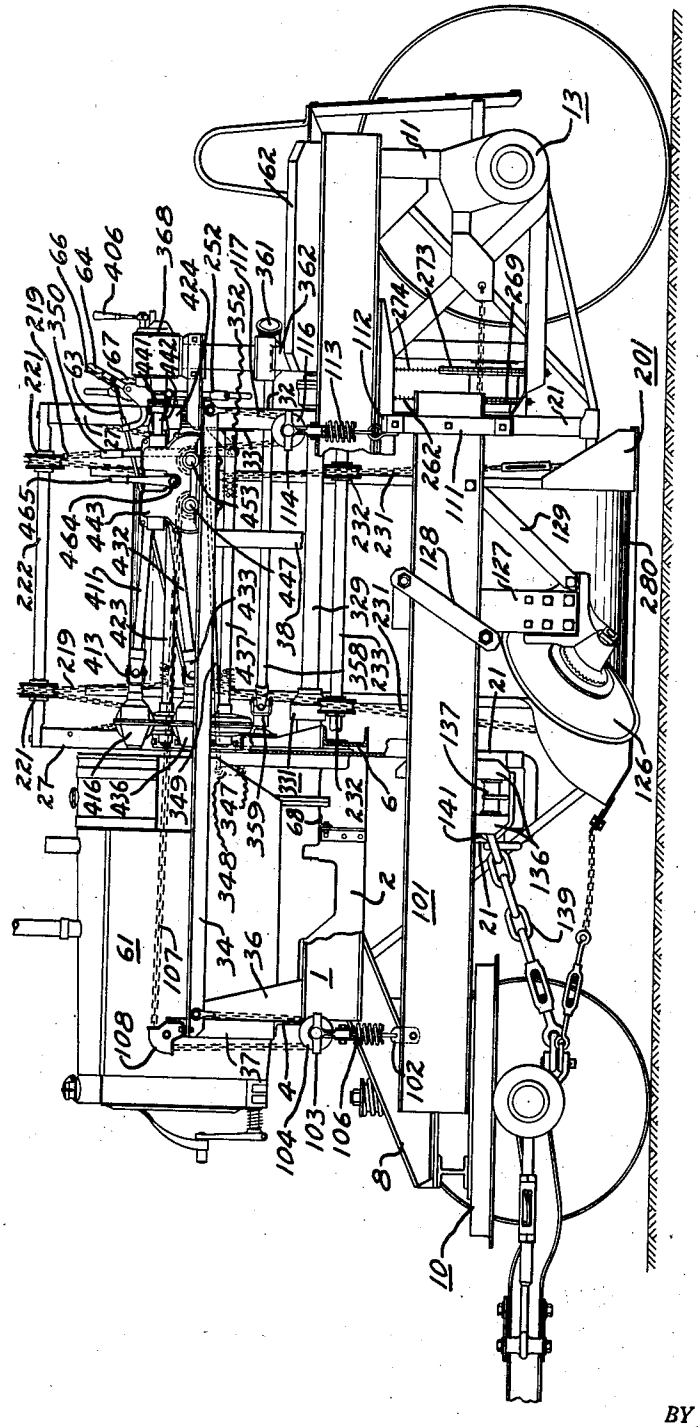


FIG. 1.

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ROAD MACHINE

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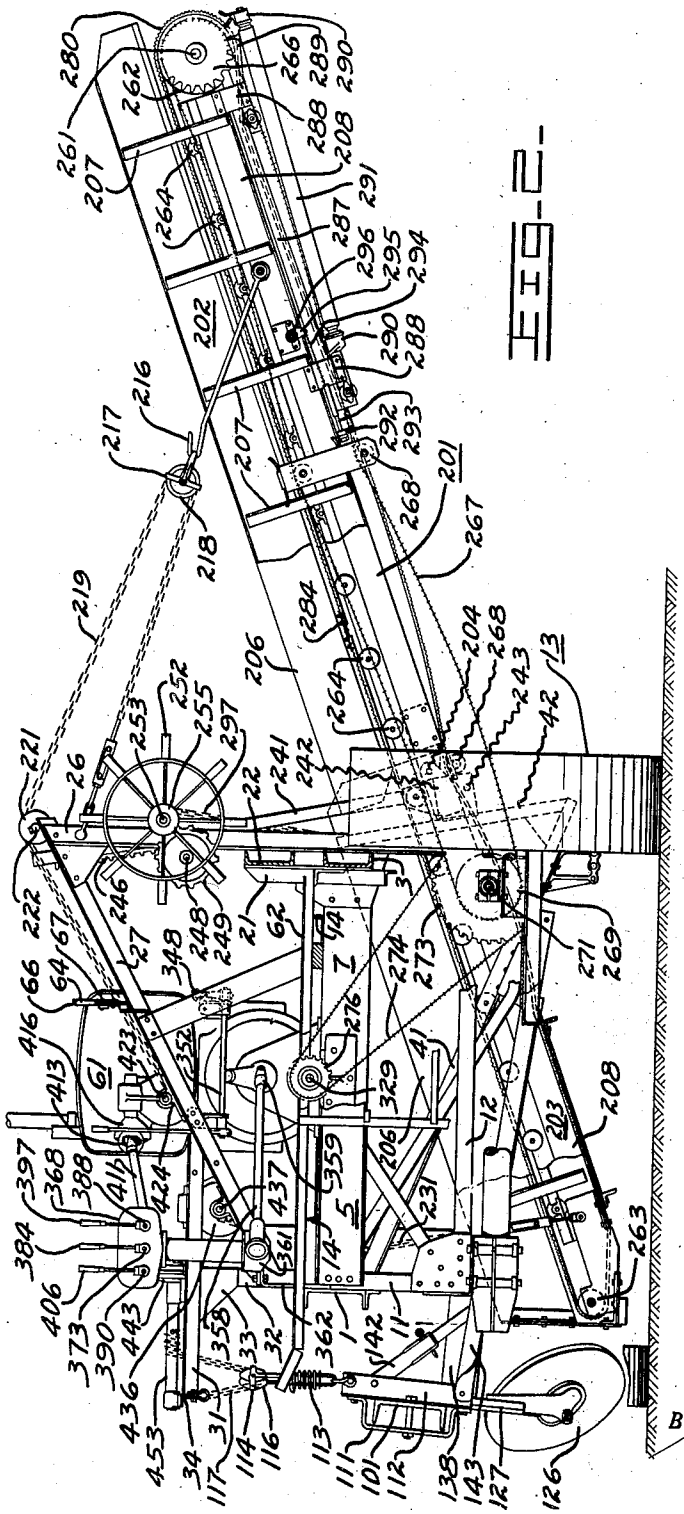


FIG-2-

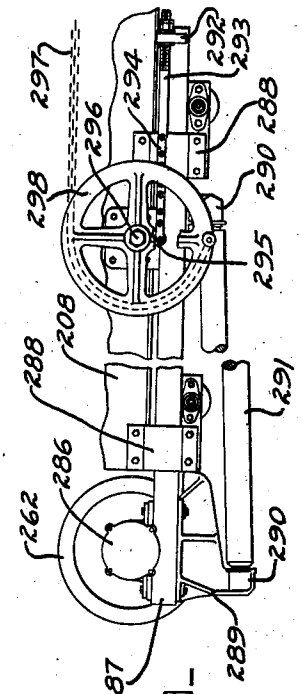


FIG-8-

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ROAD MACHINE

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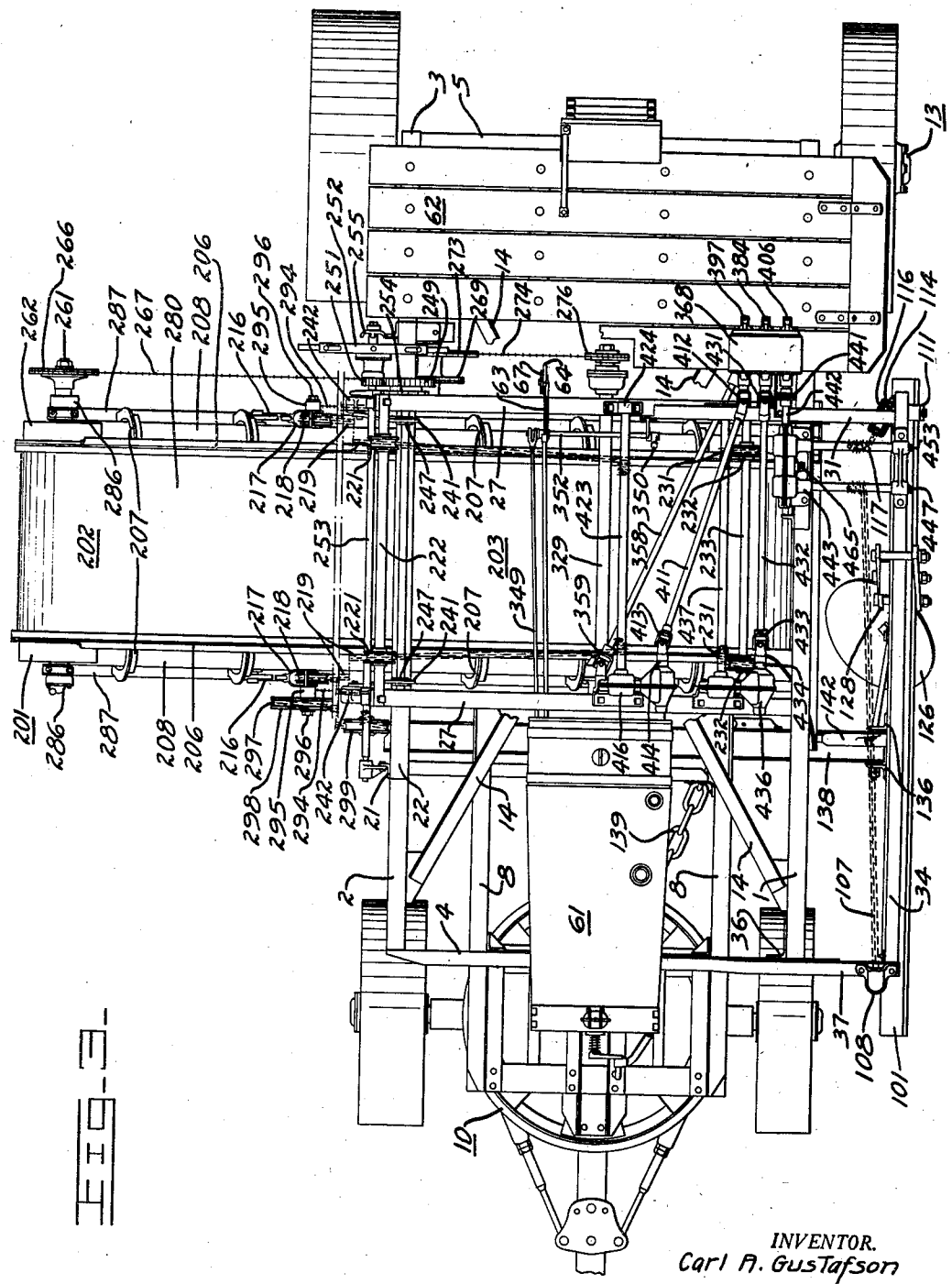


FIG. 3.

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ROAD MACHINE

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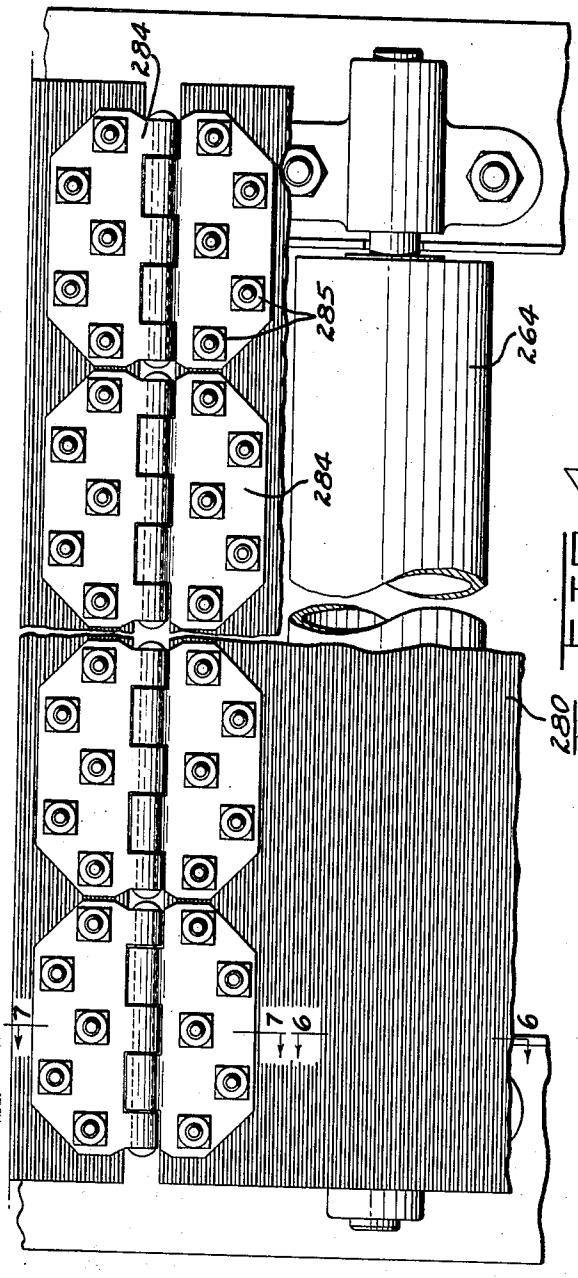


FIG. 4.

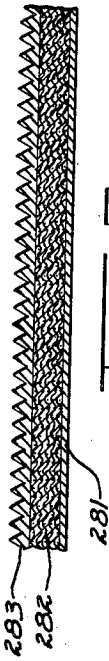


FIG. 6.

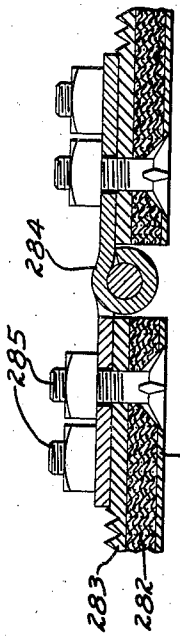
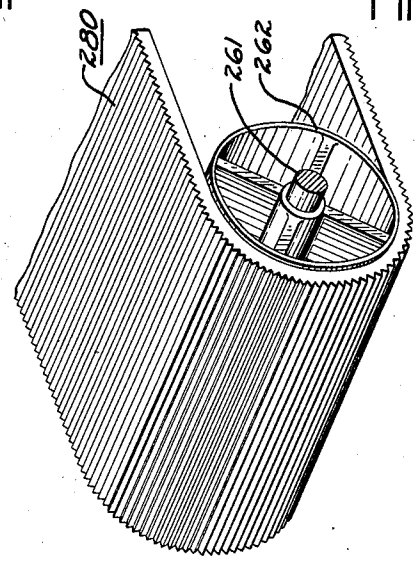


FIG. 7.

FIG. 5.



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ROAD MACHINE

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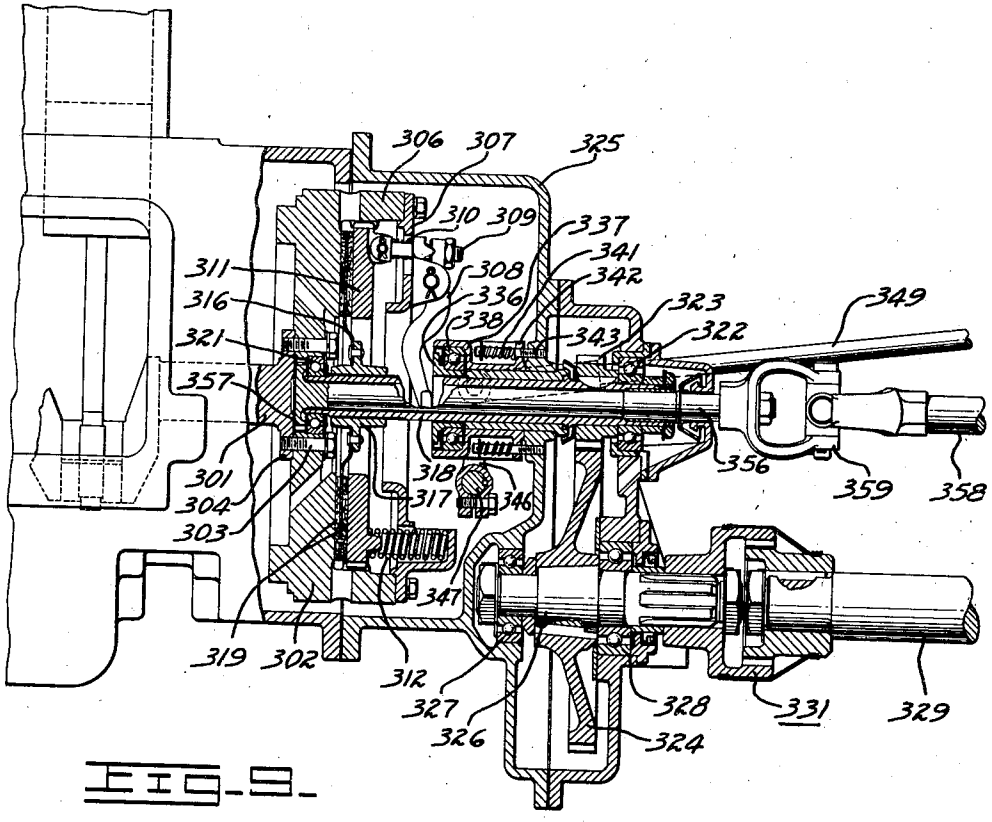


Fig. 9.

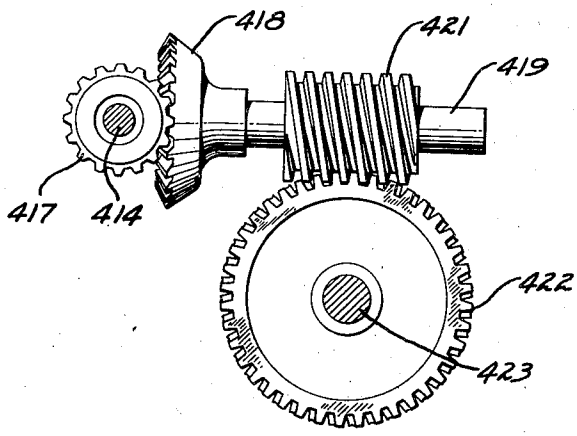


Fig. 15.

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ROAD MACHINE

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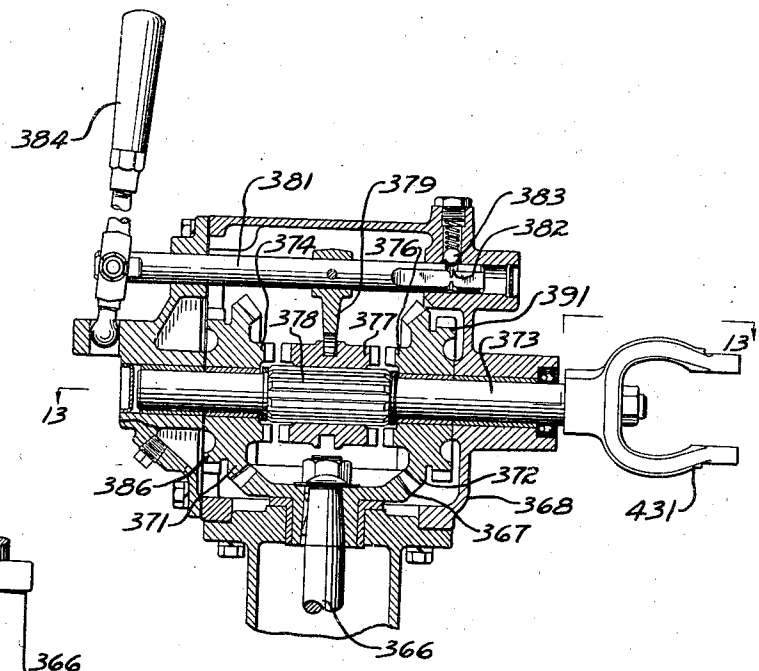


Fig-10-

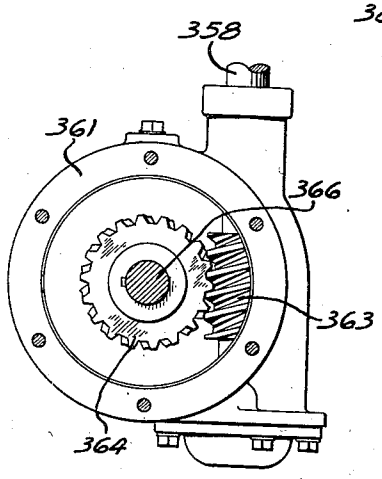


Fig-12-

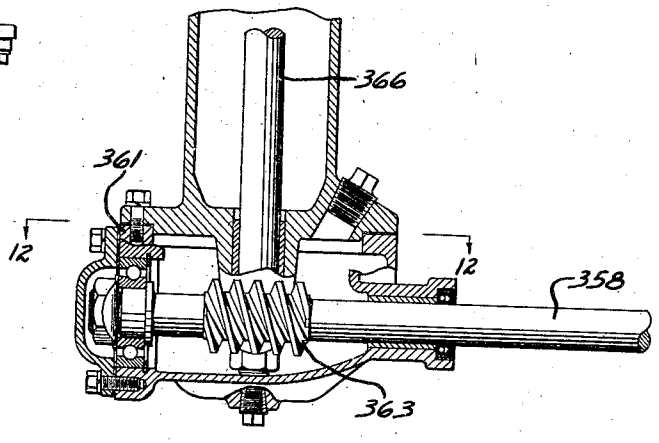


Fig-11-

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ROAD MACHINE

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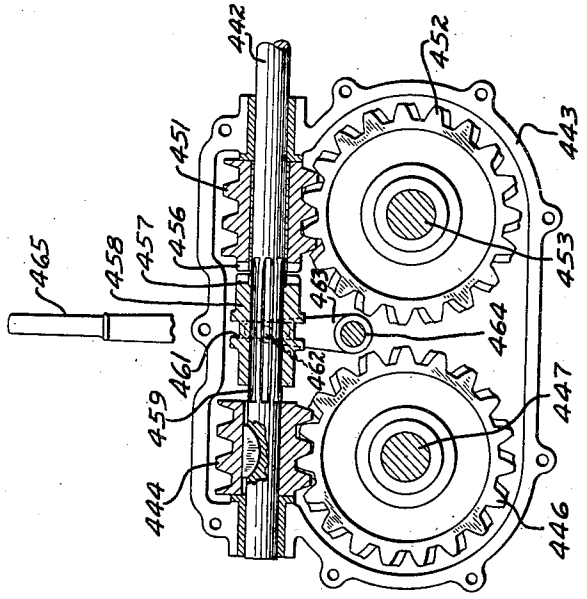


FIG-14-

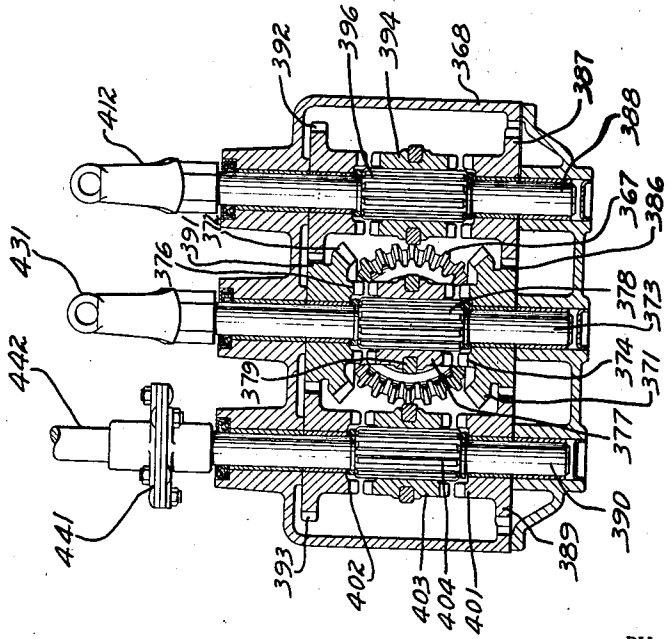


FIG-13-

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Patented Mar. 1, 1938

2,109,793

UNITED STATES PATENT OFFICE

2,109,793

ROAD MACHINE

Carl A. Gustafson, Minneapolis, Minn., assignor to Caterpillar Tractor Co., San Leandro, Calif., a corporation of California

Application April 21, 1932, Serial No. 606,643

24 Claims. (Cl. 37—110)

Introduction

This invention relates to graders, and more particularly to graders having elevating carriers. Machines of this type are adapted for use in earth moving jobs such as filling dump wagons, excavating ditches, casting in road grades directly from the ditch to the grade, building levees, etc., and such machines comprise generally a supporting frame in which is mounted a plow and an elevating carrier for elevating and discharging earth which is cast thereupon by the plow. It is necessary in such work that the carrier be raised or lowered to change the delivery of the earth to the wagon or to the grade and to provide proper delivery of the earth thereupon from the plow. In such machines the plow must also be adjusted to vary its cutting angle and to change the depth of the cut.

The grader is usually drawn by a tractor and in order to keep the grader in constant efficient operation as the train moves steadily along the attendant stationed on the grader must be able to adjust quickly the positions of the plow and the carrier and to control the power drive of the carrier. In short, the efficiency of the grader as an earth-handling machine depends largely on the speed and precision of the controls for the working mechanism. For example, it is often desirable that the adjustments of the plow and the carrier be made simultaneously, or that both ends of the carrier be adjusted at the same time. Such simultaneous adjustment is not possible with the hand operated controls found in machines heretofore known, due to the fact that the heavy plow frame and the heavy carrier cannot be adjusted with ease, and also to the fact that such hand controls are so separated as to preclude simultaneous operation thereof. In such known machines most of the operator's attention is required for the effort of making the adjustment rather than observation of the part being adjusted to ascertain when it has reached the proper positon. Hand operated controls also have the disadvantage of making any adjustment slow and in the increased effort required from the operator for adjustment during operation of the machine.

The present invention overcomes these disadvantages by providing power operated control whereby a quick and positive adjustment of the plow and the carrier is assured, the operator is relieved of the work required to make the adjustment so that his attention can be directed to securing proper adjustment of the plow and of the carrier, and adjustments can be made simultaneously and without stopping the carrier.

In the present invention the power unit is installed on the grader, thereby giving the operator control of the speed of the carrier belt and the speed with which adjustments are made. While this feature is advantageous, it is not necessary as the power controls and the carrier can be operated by a power take-off from the traction vehicle.

Another disadvantage present in elevating carriers heretofore known is that in handling loose, bulky or slippery material the carrier could not be raised to as steep an angle as is sometimes desirable, due to the back-slipping of the material which is being elevated, which also limited the capacity of the machine. These disadvantages are eliminated in the machine embodying the instant invention by providing a carrier belt which prevents slippage of material with respect thereto.

Another advantage present in applicant's improved elevating grader is that the belt adjusting mechanism is easy to operate, is capable of operation while the carrier belt is elevating material, and provides a finer adjustment for varying the tension on the belt.

Statement of Invention

It is an object of the invention to provide machine controls in an elevating grader which are positive in their operation and which respond quickly to manipulation thereof.

Another object of the invention is the provision of power operated control means for elevating graders.

Another object of the invention is to provide controls for power operated adjusting means in an elevating grader which are grouped near the operator's station.

Another object of the invention is the provision of power operated control means for adjusting an adjustable elevating carrier.

Another object of the invention is the provision of manually operable control means for connecting carrier adjusting means to a source of power.

Another object of the invention is the provision of manually operable control means operable by a single manual stroke to connect a plurality of carrier adjusting means to a source of power.

Another object of the invention is the provision of power operated means for adjusting a plow.

Another object of the invention is the provision of manually operated means for connect-

ing plow adjusting means to a source of power.

Another object of the invention is the provision of power operated means for adjusting a plow and means for varying the effect of said adjusting means.

Another object of the invention is to provide an improved carrier belt for elevating graders.

Another object of the invention is to provide means for preventing slippage of the material carried by a conveyer belt.

Another object of the invention is the provision of improved means for adjusting the tension on an endless carrier belt which is capable of operation while the carrier belt is in use and which is easy to adjust.

Other objects will appear as the description of the machine progresses.

Description of Figures

Fig. 1 is a left side elevation of the grader with certain parts broken away.

Fig. 2 is a rear elevation of the grader with certain parts broken away.

Fig. 3 is a plan view of the grader with certain parts broken away.

Fig. 4 is a plan view of a portion of the carrier belt showing the belt splice.

Fig. 5 is a perspective view of a portion of the carrier belt.

Fig. 6 is a section taken on the line 6—6 in Fig. 4.

Fig. 7 is a section taken on the line 7—7 in Fig. 4.

Fig. 8 (sheet 2) is an enlarged partial front view of the upper carrier showing a portion of the carrier belt tightening means.

Fig. 9 is an enlarged section through the flywheel clutch assembly.

Fig. 10 is an enlarged vertical section through the control gear box.

Fig. 11 is an enlarged vertical section showing a portion of the drive transmitting train for the control gear box.

Fig. 12 is a view taken on the line 12—12 in Fig. 11.

Fig. 13 is a view taken on the line 13—13 in Fig. 10.

Fig. 14 is a vertical section through the auxiliary plow control gear box.

Fig. 15 is a detail view of certain drive transmitting assemblies.

Description of Machine

Frame (Series 1 to 99 reference numerals)

The frame of the machine comprises a longitudinal channel 1, forming the left side frame member as viewed from the rear of the machine (Figs. 1–3), channels 2 and 3, forming in part the right side frame member, front cross channel 4 secured to the front ends of channels 1 and 2, and rear cross channel 5 secured to the rear ends of channels 1 and 3. The inner ends of channels 2 and 3 are rigidly connected in a manner to be hereinafter described. Central cross channels 6 (Fig. 1) and 7 (Fig. 2) are connected at their left ends to longitudinal channel 1 and at their right ends to the inner ends of channels 2 and 3, respectively.

The front end of the frame is supported by forward extensions 8 (Figs. 1 and 3) which are secured to channels 4 and 6 and bent downwardly at their forward ends to rest on front wheel and axle assembly 10, indicated generally in Figs. 1 and 3. The left rear end of the frame is provided with angle 11, secured at its upper end to channels 1 and 5, and at its lower end to cross angle 12. A similar upright angle (not shown) is provided at the junction of channels 3 and 5. Cross angle 12 is secured to the rear wheel and axle assembly 13 indicated generally in Figs. 1–3. No detailed description of the wheel and axle assemblies will be given herein as they form no part of the instant invention.

The frame is braced by four diagonal angles 14 having their outer ends secured to the side frame channels, their inner ends gusseted together, and being secured intermediate their ends to forward extensions 8 and cross channels 6 and 7.

Upright angles 21 (Figs. 2 and 3) are secured to the inner ends of channels 2 and 3, and channel 22 secured to said angles serves to complete the right longitudinal frame member of the machine.

A pair of upright angles 26, forming posts, are secured to channels 2 and 22 and channels 3 and 22, respectively, and said posts serve to support certain adjusting mechanisms which are described hereinafter. Inclined angles 27 are secured at their upper ends to posts 26 and at their lower ends to cross channels 6 and 7, respectively, by suitable brackets. Suitable bracing members are provided to support said angles 27 intermediate their lengths.

Horizontal angle 31 (Figs. 2 and 3) is secured at its right end to rear angle 27, and is supported intermediate its ends by post 32 rising from side channel 1 (Figs. 1 and 2). Gusset 33 serves to brace post 32 and angle 31. The outer end of angle 31 is secured to longitudinal angle 34 which is supported at its forward end by angle 37 which is supported by post 36 secured to channels 1 and 4. Bent angle 37 (Figs. 1 and 3) is secured at its lower end to channel 4 and forms a support for a portion of the plow adjusting mechanism as described hereinafter. Angle 34 is supported intermediate its ends by post 38 (Fig. 1).

A pair of inclined angles 41 (Fig. 2) are secured at their upper ends to channel 1 and channels 6 and 7, respectively, and near their lower ends to posts 26. A pair of inclined angles 42 are secured at their lower ends to the respective ends of angles 41 and at their upper ends to posts 26 as shown in Fig. 2. Said angles 42 serve as guides for the carrier center lifting mechanism as described hereinafter.

Motor 61 (Figs. 1–3) is supported near its ends by cross channels 4 and 6 and near its center by angle 68 secured to channels 1 and 2. Said motor 61 may be of any conventional type. The throttle control for motor 61 comprises rod 63 (Figs. 1 and 3) attached to control handle 64 (Figs. 1–3), the adjustment of which is maintained by a pawl having operating handle 66 and engaging fixed ratchet 67.

Platform 62, secured to channels 1 and 3 at the rear of the machine, provides an operator's station from which operation of the grader is controlled, as is more fully described hereinafter.

Plow assembly (Series 100 to 199 reference numerals)

The plow frame comprises channel 101 (Figs. 1–3) which carries plow 126 in a manner to be hereinafter described, and is adjustably supported from the frame of the grader. Channel 101 is provided with strap 102 at its forward end to which clevis 103 carrying sheave 104 is attached by hanger and spring assembly 106. Chain 107 fixed at one end to angle 34 runs over sheave 104

and a sheave 108 secured to bent angle 37 (Figs. 1 and 3) and the other end of said chain is secured to shaft 447 to be more fully described hereinafter.

The rear end of channel 101 is held between yoke 111 and clamp 112, which are bolted to each other and to channel 101 (Figs. 1 and 2). Clamp 112 is supported by hanger and spring assembly 113 from clevis 114 carrying sheave 116. Chain 117 secured at one end to angle 34 passes over sheave 116, and is secured at its other end to shaft 453.

From the foregoing description it is seen that plow frame channel 101 is adjustably supported at its front and rear ends so that it may be raised or lowered bodily with respect to the ground or its inclination may be changed with respect thereto by selective rotation of shafts 447 and 453.

Plow 126 is mounted on plow standard 127 which is secured to channel 101 by clamp 128, being braced with respect thereto by brace 129 (Fig. 1).

A draft connection is provided from front wheel and axle assembly 10 to channel 101 and plow 126. Angles 136 (Figs. 1 and 3) are secured to channel 101 intermediate its ends and journaled in said angles is a pivot 137 (Fig. 1) on which I-beam 138, (Figs. 2 and 3), comprising a plow drawbar, is pivoted, said I-beam 138 being releasably secured to the grader frame at its other end. Adjustable connection 142 serves to hold I-beam 138 in the proper angular relation with channel 101. Chain 139 (Figs. 1 and 3) is secured to the front axle and to clevis 141 which is pivoted to I-beam 138, thereby providing a draft connection from the front axle to the plow frame. The rear end of channel 101 is adjustable with respect to the line of draft by means of bar 143 (Fig. 2) secured at one end to clamp 112 and at the other end to a frame member (not shown).

Carrier assembly (Series 200 to 299 reference numerals)

Carrier 201 comprises upper carrier or section 202 and lower carrier or section 203 pivotally joined at 204; each of said sections is provided with sideboards 206 to guide the material being elevated, said sideboards 206 being supported by brackets 207 from side frame members 208 connected by suitable braces.

Means are provided for adjusting upper carrier 202 to vary the height at which the elevated material is discharged. A pair of hooks 216 (Figs. 2 and 3) are secured to side members 208 of upper section 202 and engage clevises 217 in which sheaves 218 are mounted. Chains 219 each having one end secured to respective posts 26 pass over said sheaves 218, and sheaves 221 loosely mounted on shaft 222 which is secured to inclined angles 27. Said chains 219 have their other ends secured to shaft 423, which is rotated in a manner hereinafter described to wind or unwind said chains 219, thereby raising or lowering upper carrier or section 202.

Means are provided for adjusting lower carrier or section 203 to vary the position of said section with respect to the ground and to vary the inclination at which material is elevated. A pair of chains 231 (Figs. 1 and 3) have their lower ends secured to side members 208 of lower section 203 and passover idler sheaves 232 loosely mounted on shaft 233, said shaft being supported by cross channels 6 and 7. Said chains 231 have their upper ends secured to shaft 437 suitably supported on inclined angles 27 as described hereinafter. Shaft 437 is rotated by means to be described hereinafter to wind or unwind chains 231, thereby raising or lowering section 203.

Means are provided for adjusting the carrier center to maintain equal inclinations of upper section 202 and lower section 203. A pair of bars 241 (Figs. 2 and 3) are secured at their lower ends to boxes 242 which receive transverse carrier supporting rod 243 which extends beneath lower section 203 immediately below pivotal connection 204 of said sections. Boxes 242 are provided with flanged extensions which engage angles 42 to guide movement of said boxes. Bars 241 are provided at their upper ends with racks 246 (Fig. 2) which mesh with, and are guided by, flanged pinions 247 fast on shaft 248, suitably journaled in bearings mounted on posts 26. Shaft 248 is provided at its rear end with gear 249 (Figs. 2 and 3) which meshes with pinion 251 integral with hand-wheel 252 slidably and rotatably mounted on transverse shaft 253, also journaled in suitable bearings on posts 26 and 21. Upon rotation of shaft 248 by hand-wheel 252, bars 241 are raised or lowered, thereby adjusting said carrier center. Ratchet wheel 254 (Fig. 3) cooperates with a suitable pawl (not shown) to maintain the adjustment of the carrier center in a well-known manner.

Means are provided for driving an endless carrier belt hereinafter described so that material cast thereon by plow 126 at the lower end of the carrier will be elevated and discharged at the upper end thereof. Shaft 261 (Figs. 2 and 3) adjustably mounted in frame members 208 of upper section 202 carries drum 262 which drives said carrier belt. Roller 263 (Fig. 2) is journaled in the lower ends of said frame members 208 of lower section 203, and intermediate drum 262 and roller 263 a plurality of idler rollers 264 are provided to support the upper stretch of said carrier belt. Drum 262 and shaft 261 are driven by chain 267 (indicated diagrammatically in Figs. 1–3) which engages sprocket wheel 266 fast on shaft 261. Said chain 267 passes over idler sprockets 268 and engages and is driven by sprocket wheel 269 fast on shaft 271 (Fig. 2) journaled in a suitable housing mounted on a frame bracket. Sprocket wheel 273 also fast on shaft 271 is engaged and driven by chain 274 (also indicated diagrammatically) which engages sprocket wheel 276 fast on shaft 329. Said shaft 329 and the drive therefor from motor 61 are more specifically described hereinafter.

As pointed out hereinbefore, inclined carriers of the type provided in elevating graders are limited in capacity by the character of material being elevated, loose, bulky or slippery material being inclined to slip back. Thus, not only is the angle of inclination of the carrier limited but the entire capacity of the grader is limited when any slippage of the material occurs. In applicant's improved elevating grader these difficulties are overcome and the permissible angle of inclination of the carrier is increased for all types of material conveyed, and the capacity of the machine as a whole is increased by the provision of a new and advantageous belt construction which is particularly adapted for use in elevating graders.

Belt 280 (Figs. 4–7) comprises an under layer 281 (Figs. 5 and 6) of rubber, a relatively thick intermediate layer 282 consisting of a plurality of sheets of fabric and rubber, and an upper layer 283 of rubber in which transverse corrugations are integrally formed by means of a die. The

above described layers are vulcanized together to form a relatively thick laminated belt. The ends of said belt 280 are spliced together by means of hinges 284 secured to the ends of said belt by bolts 285.

Means are provided for adjusting the carrier belt whereby the tension thereon may be varied at any time by the operator. Shaft 261 which carries drum 262 is journaled in bearings 286 (Figs. 3 and 8) mounted on a pair of slides 287 (Figs. 2, 3 and 8) which are supported on respective side frame members 208 of upper section 202 by guides 288 bolted to said frame members. Each slide 287 is provided at its outer end with bracket 289 having bearing 290 in which one end of roller 291 is journaled, the other end thereof being journaled in similar bearing 290 secured to slide 287 near the inner end thereof. Rollers 291 brace slides 287 and also serve to support carrier 201 when said carrier is lowered against a wagon.

Each slide 287 is provided at its inner end with boss 292 which is engaged by the nut on bolt 293. Chain 294 secured to bolt 293 at one end is fastened at its other end to cam 295 fast on shaft 296. Rotation of shaft 296 in a clockwise direction as viewed in Fig. 8 winds chains 294 about cams 295 thereby pulling slides 287 forwardly carrying drum 262 therewith whereby the tension on belt 280 is increased.

Means are provided to rotate shaft 296 to tighten or loosen belt 280 by adjusting the tension thereon. Chain 297 is fastened at one end to sheave 298 (Fig. 8) on shaft 296 and passes over idler sheave 299 mounted on forward post 26, having its other end secured to shaft 253 (Fig. 3). Shaft 253 is provided at its rear end with clutch element 255 which is adapted to engage a complementary clutch element on hand-wheel 252 when said wheel is shifted rearwardly on shaft 253. Turning of hand-wheel 252 in its rearward position serves to wind or unwind chain 297 about shaft 253 whereby chains 294 are wound or unwound about cams 295 to tighten or loosen carrier belt 280. It will be recalled that hand-wheel 252 also controls the carrier center lift.

This type of belt tightening apparatus is particularly advantageous in that only a minimum portion of the carrier assembly need be moved to make the adjustment, thereby securing easy operation, and in that the adjustment may be readily made while the carrier belt is in use. The construction thereof is also substantially simplified over known forms of belt tighteners.

Power control (Series 300 to 499 reference numerals)

The drive from motor 61 is transmitted through a controllable clutch connection to the carrier belt driving mechanism and continuously to the power control mechanism.

Crank shaft 301 (Fig. 9) of motor 61 is secured at its rear end to flywheel 302 by bolts 303 passing through said flywheel and flange 304 on said crank shaft. Flywheel 302 is provided with a cylindrical flange 306 to which centrally apertured plate 307 is bolted. Lever 308 pivoted on plate 307 extends substantially radially thereof and is provided at its outer end with a fingered aperture adapted to receive bolt 309 which passes through an aperture in plate 307 and is pivoted to plate 311. Spring 310 surrounding bolt 309 tends to hold lever 308 in the position shown in Fig. 9. Three levers 308 are provided but only one of said levers is illustrated in Fig. 9. Plate 311 is provided with teeth which mesh with internal teeth formed on flange 306 of flywheel 302, whereby said plate 311 rotates with said flywheel 302 but is shiftable with respect thereto. A plurality of compression springs 312 are provided which press plate 311 towards said flywheel 302; said springs 312 are seated in plate 307 and engage projections on plate 311. Only one of said springs is shown in Fig. 9.

Plate 316 riveted to hub 317 splined on tubular shaft 318 is provided with clutch faces 319 of suitable composition, said faces 319 being adapted to be engaged by the respective clutching faces of flywheel 302 and plate 311.

From the foregoing description, it is seen that when lever 308 is in the position shown in Fig. 9, springs 312 press plate 311 inwardly whereby clutch faces 319 on plate 316 are gripped between the respective clutching faces of flywheel 302 and plate 311, transmitting the drive therefrom to hub 317 and tubular shaft 318, said shaft 318 being supported by bearing 321 in flywheel 302 and by bearing 322 in housing 325.

Gear 323 keyed on tubular shaft 318 meshes with gear 324 keyed on stub shaft 326, said shaft 326 being supported in housing 325 by bearings 327 and 328. Shaft 329, the drive shaft for the carrier belt drive, is driven from shaft 326 through releasable connection 331.

It is seen, therefore, that the drive for the carrier belt is controlled by movement of plate 311 as determined by movement of levers 308. The inner ends of levers 308 (Fig. 9) are bent and bear against the face of ring 336 surrounding tubular shaft 318 but not engaged therewith. Ring 336 is mounted in cage 337 by bearing 338, being held therein by the end of lever 308. Cage 337 is resiliently held against the wall of housing 325 by compression springs 341 held between flange 342 of said cage 337 and washers on the end of bolts 343, which pass freely through said flange and have threaded engagement with the wall of housing 325. Cage 337 when moved forwardly presses ring 336 against the inner ends of levers 308 whereby said levers are rocked to move plate 311 to the right as viewed in Fig. 9, thereby interrupting the drive for the carrier belt.

Movement of cage 337 is controlled by a pair of arms 346 on shaft 347, and engaging the shoulder on said cage 337. Only one of said arms 346 is seen in Fig. 9. Shaft 347 is journaled in housing 325 and extends therethrough to the right as viewed from the rear of the grader, and arm 348 (Fig. 1) secured thereon is connected by rod 349 with a crank on shaft 352 (Figs. 1 and 3) carrrying clutch control lever 350.

From the foregoing description it is seen that the operator can control the drive for the carrier belt from his station at the rear of the grader.

Means are provided whereby a continuous drive is transmitted from the crank shaft of the motor to the power operated control mechanism. Shaft 356 journaled in tubular shaft 318 (Fig. 9) is provided with gear 357 meshing with internal teeth on flywheel 302. Shaft 356 extends through housing 325 and is connected to shaft 358 by universal connection 359; said shaft 358 enters the base of housing 361 supported by bracket 362 on channel 1 (Figs. 1 and 2). Shaft 358 carries worm 363 (Figs. 11 and 12) which engages worm wheel 364 (Fig. 12) fast on vertical shaft 366.

Bevel gear 367 keyed to shaft 366 at its upper end within gear box housing 368, meshes with bevel gears 371 and 372, rotatably mounted on shaft 373, journaled in housing 368. Thus it is

seen that bevel gears 371—372 are rotated in opposite directions upon rotation of shaft 366 and gear 367. Hubs 374 and 376 of gears 371 and 372, respectively, are formed with clutch teeth adapted to be engaged by complementary clutch teeth on double faced clutch element 377 which engages splined portion 378 of shaft 373.

Clutch element 377 is provided with a peripheral groove engaged by fork 379 secured to rod 381 slidably mounted in housing 368. Rod 381 is provided at its front end with a notch 382 which is engaged by spring pressed ball 383 when said shaft is in its central position, wherein clutch element 377 is disengaged from both gears 371 and 372. Rod 381 is pivoted at its rear end to control lever 384 (Fig. 10), said control lever being conveniently pivoted in housing 368.

Spur gear 386 (Fig. 13) integral with bevel gear 371 meshes with spur gear 387 rotatable on shaft 388, and spur gear 389 rotatable on shaft 390. Spur gear 391 integral with bevel gear 372 meshes with spur gear 392 on shaft 388 and spur gear 393 on shaft 390.

Spur gears 387 and 392 on shaft 388 are provided with clutch teeth adapted to cooperate with double faced clutch element 394 slidable on splined portion 396 of shaft 388, and controlled by lever 397 (Figs. 2 and 3) identical in construction with control lever 384.

Spur gears 389 and 393 on shaft 390 are similarly provided with hubs 401—402 formed with clutch teeth adapted to cooperate with complementary clutch teeth on double faced clutch element 403 slidably engaged with splined portion 404 of shaft 390, said clutch element 403 being controlled by lever 406 (Figs. 2 and 3), identical in construction with levers 384 and 397.

From the foregoing description it is seen that control lever 397 upon forward or rearward movement selectively controls rotation of shaft 388 in either direction. Similarly, lever 384 determines rotation of shaft 373 selectively in either direction, and lever 406 similarly controls shaft 390.

Shaft 388 is connected to shaft 411 (Fig. 3) by universal connection 412 and said shaft 411 is connected by universal connection 413 to shaft 414 journaled in housing 416, mounted on inclined angle 27. Shaft 414 (Fig. 15) carries bevel pinion 417 meshing with bevel gear 418 on shaft 419 also journaled in housing 416. Shaft 419 carries worm 421 engaging worm wheel 422 on shaft 423 (Figs. 3 and 15) said shaft 423 being journaled at its ends in housing 416 and in bearing 424 mounted on respective inclined angles 27. As described hereinbefore, chains 219 wind and unwind about shaft 423 to control raising and lowering of upper carrier or section 202. It is seen, therefore, that movement of control lever 397 controls the adjustment of said upper carrier. It is to be noted that worm 421 and worm wheel 422 transmit the adjusting drive and also serve to maintain the adjustment of upper section 202 in that worm wheel 422 is driven by worm 421 but cannot drive said worm.

Shaft 373 is connected by universal connection 431 to shaft 432 which is connected at its other end by universal connection 433 to shaft 434 journaled in housing 436 mounted on inclined angle 27. Said housing 436 encases a drive assembly identical in construction with that contained in housing 416 heretofore described and illustrated in Fig. 15. Said drive assembly drives shaft 437 to which chains 231 for adjusting lower carrier 203 are secured. It is seen, therefore, that forward or rearward movement of control lever 384 determines raising or lowering of said lower carrier 203.

Shaft 390, controlled by lever 406, is connected by spider connection 441 with shaft 442 journaled in housing 443 (Fig. 14) mounted on angle 34 (Fig. 1). Worm 444 keyed on shaft 442 engages worm wheel 446 fast on shaft 447 journaled in said housing 443. Said shaft 447 extends through said housing 443 to the left as viewed from the rear of the grader and chain 107 for adjusting the front end of plow channel 101 is secured to said shaft 447.

Worm 451 (Fig. 14) rotatably mounted on shaft 442 engages worm wheel 452 fast on shaft 453 journaled in said housing 443 and extending therethrough parallel to said shaft 447. Chain 117 for adjusting the rear end of plow channel 101 is secured to shaft 453. Worm 451 is provided at its front end with clutch teeth 456 adapted to be engaged by complementary clutch teeth 457 on clutch element 458 slidable on splined portion 459 of shaft 442. Clutch element 458 is provided with peripheral groove 461 which receives pins 462 on a pair of integral arms 463 secured to shaft 464 journaled in said housing 443. Only one of said arms 463 is illustrated in Fig. 14. Control lever 465 is secured on shaft 464 outside of housing 443.

From the foregoing description it is seen that with control lever 465 in its rearward position, manipulation of the control lever 406 determines raising or lowering of both ends of plow channel 101 whereby the depth of cut of plow 126 may be varied, or said plow 126 may be disengaged from the earth. If said control lever 465 is moved to its forward position, the drive for shaft 453 is interrupted whereby, upon manipulation of lever 406, only the front end of plow channel 101 is raised or lowered. In this manner the angle of inclination of plow 126 with respect to the earth may be varied.

In the foregoing description a plurality of new and advantageous features have been described, all of which contribute to easier and more efficient operation of the grader. The power operated controls enable the operator to adjust readily and simultaneously the positions of the plow and the carrier, whereby no delay is encountered during operation and the grader is at all times adjusted properly for the most efficient operation. The belt tightening mechanism described herein provides an easier and more sensitive adjustment of the tension on the belt whereby said belt is always operating at the proper tension. Moreover the controls for the above-mentioned adjusting mechanisms as well as the throttle and clutch controls, are all conveniently located at the operator's station so that the operator is in constant command of the grader. The new carrier belt construction disclosed herein contributes to more efficient operation of the grader by preventing back-slipping of the material being elevated whereby a greater quantity of material is delivered and the permissible inclination of the carrier is increased.

While my invention has been described with reference to the preferred embodiment thereof, it is to be understood that my invention is not limited by the specific construction of such embodiment, but is limited only by the scope of the appended claims.

I, therefore, claim as my invention:

1. In an elevating grader, a frame, a carrier having a belt and a driving train therefor, a set

of chains connecting the upper end of said carrier to a shaft mounted on said frame, a second set of chains connecting the lower end of said carrier to a second shaft mounted on said frame, a plow, a set of chains connecting said plow to third and fourth shafts mounted on said frame, a power driven shaft, a clutch connecting said power driven shaft and said driving train, a fifth shaft driven by said power driven shaft, a gear box comprising sets of oppositely disposed intermeshing gears driven by said fifth shaft and having clutch teeth, each opposite pair of gears being rotatably mounted on a stub shaft journaled in said box and having a central splined portion, a double faced clutch element slidable on said splined portion and having driving engagement therewith, a control lever associated with each clutch element adapted to shift said clutch element into clutching engagement with either gear of the associated pair, a driving connection from one said stub shaft to said first shaft, a second driving connection from a second said stub shaft to said second shaft, and a third driving connection from a third said stub shaft to said third and fourth shafts.

2. In an elevating grader, a frame, a carrier having a belt and a driving train therefor, a set of chains connecting the upper end of said carrier to a shaft mounted on said frame, a second set of chains connecting the lower end of said carrier to a second shaft mounted on said frame, a plow, a set of chains connecting said plow to third and fourth shafts mounted on said frame, a power driven shaft, a clutch connecting said power driven shaft and said driving train, a fifth shaft driven by said power driven shaft, a gear box comprising sets of oppositely disposed intermeshing gears driven from said fifth shaft and having clutch teeth, each opposite pair of gears being rotatably mounted on a stub shaft journaled in said box and having a central splined portion, a double faced clutch element slidable on said splined portion and having driving engagement therewith, a control lever associated with each clutch element adapted to shift said clutch element into clutching engagement with either gear of the associated pair, a driving connection from one said stub shaft to said first shaft, a second driving connection from a second said stub shaft to said second shaft, and a third driving connection from a third said stub shaft to said third and fourth shafts, including a gear assembly providing a constant connection to said third shaft and a controllable clutch connection to said fourth shaft.

3. In a machine of the class described, an adjustable tool, a plurality of adjusting means for said tool, means for actuating all of said adjusting means simultaneously including a reversible master clutch operable to establish a power drive to actuate said adjusting means in either one of opposite directions, and a secondary clutch for disabling at least one of said adjusting means.

4. In a machine of the class described, an adjustable tool, a plurality of adjusting means connected to said tool at spaced points, a reversible drive adapted to actuate all of said adjusting means simultaneously in either one of opposite directions, and a clutch mechanism for disabling at least one of said adjusting means.

5. In a machine of the class described, an adjustable tool, a plurality of adjusting means connected to said tool at spaced points, a reversible drive adapted to actuate all of said adjusting means simultaneously in either one of opposite directions, means including a single control lever for disabling all of said adjusting means simultaneously, and additional means for disabling at least one of said adjusting means independent of said first mentioned disabling means.

6. In an elevating grader, an adjustable plow frame, a source of power, a plurality of adjusting means connected to said plow frame at spaced points, means for positively actuating all of said adjusting means simultaneously from said source of power to effect raising or lowering of the entire plow frame uniformly with respect to the ground, and a clutch mechanism for disabling at least one of said adjusting means when it is desired to adjust the angle of the plow frame with respect to the ground.

7. In a device of the class described, a plurality of drive shafts, adjusting means operated by rotation of each drive shaft, a control shaft, constantly meshing gears between said control shaft and one of said drive shafts, a gear journaled about said control shaft, a gear meshing therewith and on another of said drive shafts, means for driving said control shaft, and means for optionally effecting driving connection between said latter two gears.

8. In a device of the class described, a plurality of drive shafts, adjusting means operated by rotation of each drive shaft, a control shaft, constantly meshing gears between said control shaft and one of said drive shafts, a gear journaled about said control shaft, a gear meshing therewith and on another of said drive shafts, means for driving said control shaft, and means including a clutch element slidably mounted on said control shaft for optionally effecting driving connection between said latter two gears.

9. In an elevating grader, a frame, a carrier adjustably mounted on said frame, self-locking means for adjusting one end of said carrier, self-locking means for adjusting the other end of said carrier, a source of power, and selectively operable means including independent reversible driving connections to each of said adjusting means for connecting said adjusting means to said source of power.

10. In an elevating grader, a carrier comprising an upper section and a lower section, a power driven shaft, means including a self-locking connection adapted to be driven by said shaft for adjusting said upper section, means including a self-locking connection adapted to be driven by said shaft for adjusting said lower section, and means including control members and an independent reversible driving connection to each of said adjusting means and operable by a control member for enabling the drive for said upper section and said lower section adjusting means.

11. In an elevating grader, a power driven carrier belt, a source of power, means for driving said carrier belt from said source of power including a rotatable shaft and clutching mechanism interposed between said source of power and said rotatable shaft, power operated means for adjusting the position of said carrier belt, other adjusting means for adjusting the position of mechanism other than said carrier belt, and means for controlling the operation of all of said aforementioned adjusting means, including a second shaft connected for constant rotation with said source of power and a unitary, selective clutch mechanism interposed between said constantly rotatable second shaft and said adjusting means.

12. In an elevating grader, a power driven car-

rier belt, a source of power, means for driving said carrier belt from said source of power including a rotatable shaft and clutching mechanism interposed between said source of power and said rotatable shaft, power operated means for adjusting the position of said carrier belt, other adjusting means for adjusting the position of mechanism other than said carrier belt, means for controlling the operation of all of said aforementioned adjusting means, including a second shaft connected for constant rotation with said source of power and a unitary, selective clutch mechanism interposed between said constantly rotatable second shaft and said adjusting means, and an operator's station, said unitary, selective clutch mechanism being positioned adjacent said operator's station.

13. In an elevating grader, a power driven carrier belt, a source of power, means for driving said carrier belt from said source of power including a rotatable shaft and clutching mechanism interposed between said source of power and said rotatable shaft, power operated means for adjusting the position of said carrier belt, other adjusting means, means for controlling the operation of all of said aforementioned adjusting means, including a second shaft connected for constant rotation with said source of power and a unitary, selective clutch mechanism interposed between said constantly rotatable second shaft and said adjusting means, an operator's station, said unitary, selective clutch mechanism being positioned adjacent said operator's station, said first-mentioned clutching mechanism being positioned remote from said operator's station and adjacent said source of power, and a control lever operatively connected to said clutching mechanism adjacent said source of power and positioned adjacent said operator's station.

14. In an elevating grader, a source of power, power operated movable mechanism adapted for substantially constant operation, power operated adjusting mechanism adapted for non-constant operation, means for operating said movable mechanism including a shaft and clutching means interposed between said shaft and said source of power, and means for operating said adjusting mechanism, including a second shaft connected for constant rotation with said source of power and clutching mechanism interposed between said second shaft and said adjusting mechanism.

15. In a machine of the class described, an adjustable device, a plurality of adjusting means connected to said device, a source of power, means for connecting said adjusting means to said source of power, reversible clutching means operable to establish a power drive to actuate said adjusting means in either one of opposite directions for connecting or disconnecting all of said adjusting means simultaneously, and means interposed between said clutching means and said adjusting means for effecting adjustment of one of said adjusting means alone.

16. In an elevating grader, a plow frame, adjusting means connected to one end of said plow frame, adjusting means connected to an opposite end of said plow frame, a source of power, means for connecting all of said adjusting means to said source of power, clutching means for connecting or disconnecting all of said adjusting means simultaneously, and means for effecting adjustment of one of said adjusting means alone.

17. In an elevating grader; a power driven conveyor; a source of power; means for driving said conveyor from said source of power, including a rotatable shaft, and a releasable connection interposed between said source of power and said rotatable shaft; power operated means for adjusting the position of said conveyor; and means for controlling the operation of said adjusting means, including a control box, reversible drive establishing means in said control box and connected to said adjusting means for selectively operating said adjusting means in opposite directions, and a second shaft interposed between said control box and said source of power, whereby a constantly available drive is provided for said drive establishing means irrespective of the conditioning of said releasable connection.

18. In an elevating grader; a power driven conveyor; a source of power; means for driving said conveyor from said source of power, including a rotatable shaft, and a releasable connection interposed between said source of power and said rotatable shaft; power operated means for adjusting the position of said conveyor; other adjusting means; and unitary selectively operable means for controlling the operation of all of said adjusting means, including a control box, reversible drive establishing means in said control box and connected to said adjusting means for selectively operating said adjusting means in opposite directions, and a second shaft interposed between said control box and said source of power, whereby a constantly available drive is provided for said drive establishing means irrespective of the conditioning of said releasable connection.

19. In an elevating grader; a plurality of adjusting mechanisms for earth working means; a source of power; and means for operating said adjusting mechanisms together or individually including driving means connected with said source of power, and an independently operable and reversible driving connection between said driving means and each of said adjusting mechanisms.

20. In an elevating grader; an adjustable carrier; an adjustable plow; a source of power; adjusting mechanism for said carrier; adjusting mechanism for said plow; and means for operating said adjusting mechanisms together or individually including driving means connected with said source of power, and an independently operable and reversible self-locking driving connection interposed between said driving means and each of said adjusting mechanisms.

21. In an elevating grader; an adjustable carrier; an adjustable plow; a source of power; a plurality of adjusting mechanisms for said carrier; adjusting mechanism for said plow; and means for selectively operating said adjusting mechanisms including driving means connected with said source of power, and a driving connection from said driving means to each of said adjusting mechanisms, each of said driving connections including independently operable reversible drive establishing means whereby any one of said adjusting mechanisms can be operated in either direction independent of the other of said adjusting mechanisms and also including self-locking mechanism for automatically holding the adjusting mechanism in the different positions to which it may have been adjusted.

22. In an elevating grader; an adjustable carrier; an adjustable plow; a source of power; adjusting mechanism for said carrier; adjusting mechanism for said plow; and means for selectively operating said adjusting mechanisms including driving means connected with said source

of power, and a driving connection from said driving means to each of said adjusting mechanisms, each of said driving connections including independently operable reversible drive establishing means whereby any one of said adjusting mechanisms can be operated in either direction independent of the other of said adjusting mechanisms and also including self-locking worm and gear mechanism for automatically holding the adjusting mechanism in the different positions to which it may have been adjusted.

23. In an elevating grader; an adjustable carrier having a belt; an adjustable plow; adjusting mechanism for said carrier; adjusting mechanism for said plow; a source of power for both said adjusting mechanisms and said carrier belt; means including a releasable drive establishing connection for connecting said source of power to said belt to effect driving of said belt; and means for selectively operating said adjusting mechanisms including driving means connected with said source of power irrespective of whether the releasable drive establishing connection to said belt is engaged or disengaged, and a driving connection from said driving means to each of said adjusting mechanisms, each of said driving connections including independently operable reversible drive establishing means whereby any one of said adjusting mechanisms can be operated in either direction independent of the other of said adjusting mechanisms and also including self-locking mechanism for automatically holding the adjusting mechanism in the different positions to which it may have been adjusted.

24. In an elevating grader; a carrier having a belt; a plow; a source of power including an engine and a drive shaft extending from one end of said engine; driving means connected to said belt adapted for substantially constant operation and having a releasable connection with said drive shaft; adjusting means for said carrier; adjusting means for said plow; and means for operating said adjusting means including a driven shaft connected for rotation from said end of the engine irrespective of whether said releasable drive connection is engaged or disengaged, an independently operable reversible driving connection to each of said adjusting means interposed between said driven shaft and said adjusting means, and self-locking means for each of said adjusting means.

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