July 16, 1968 R. D. MacDONALD 3,392,464

ROAD WIDENING TRENCHER-LOADER UNIT

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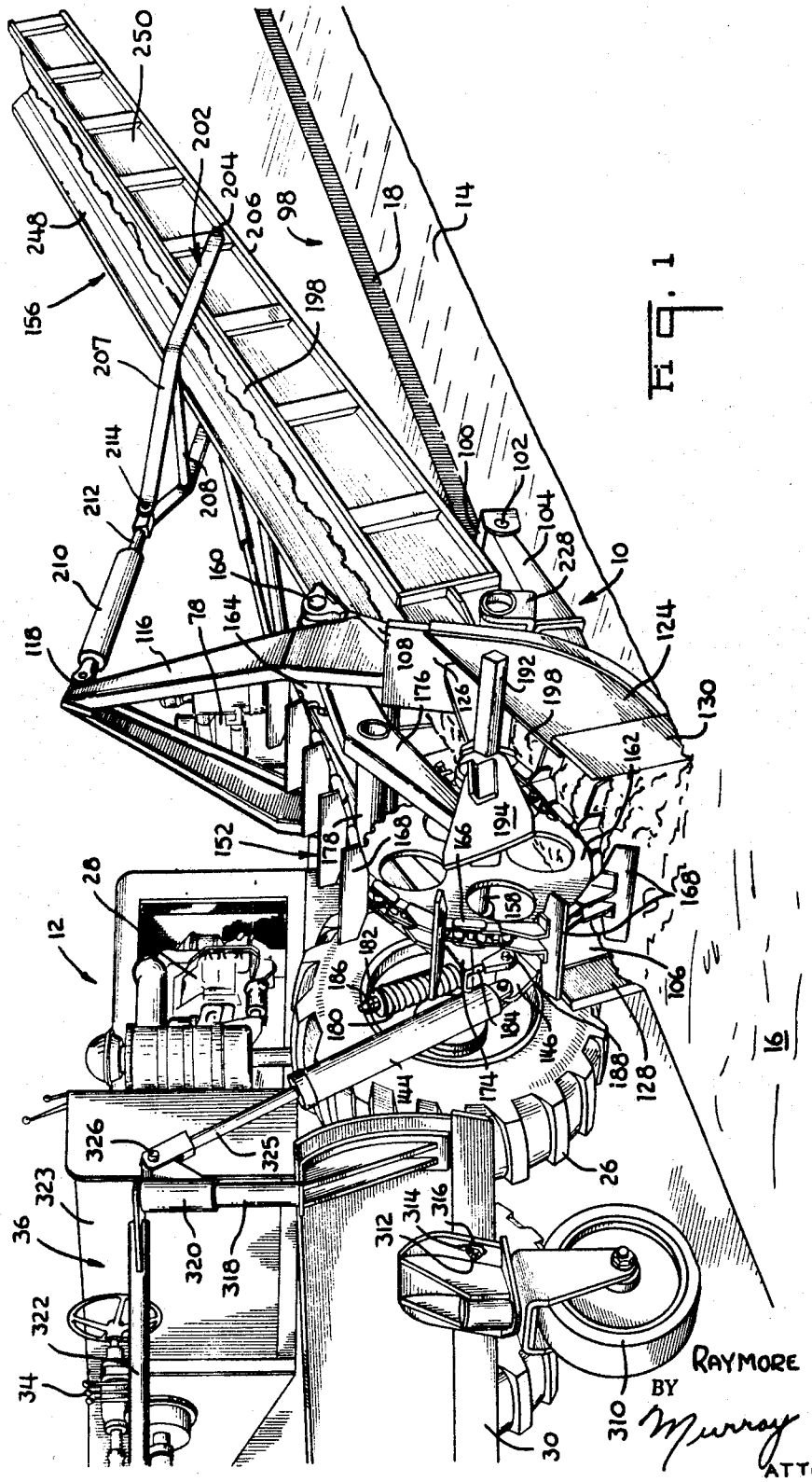



FIG. 1

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ROAD WIDENING TRENCHER-LOADER UNIT

Filed June 25, 1965 5 Sheets-Sheet 2

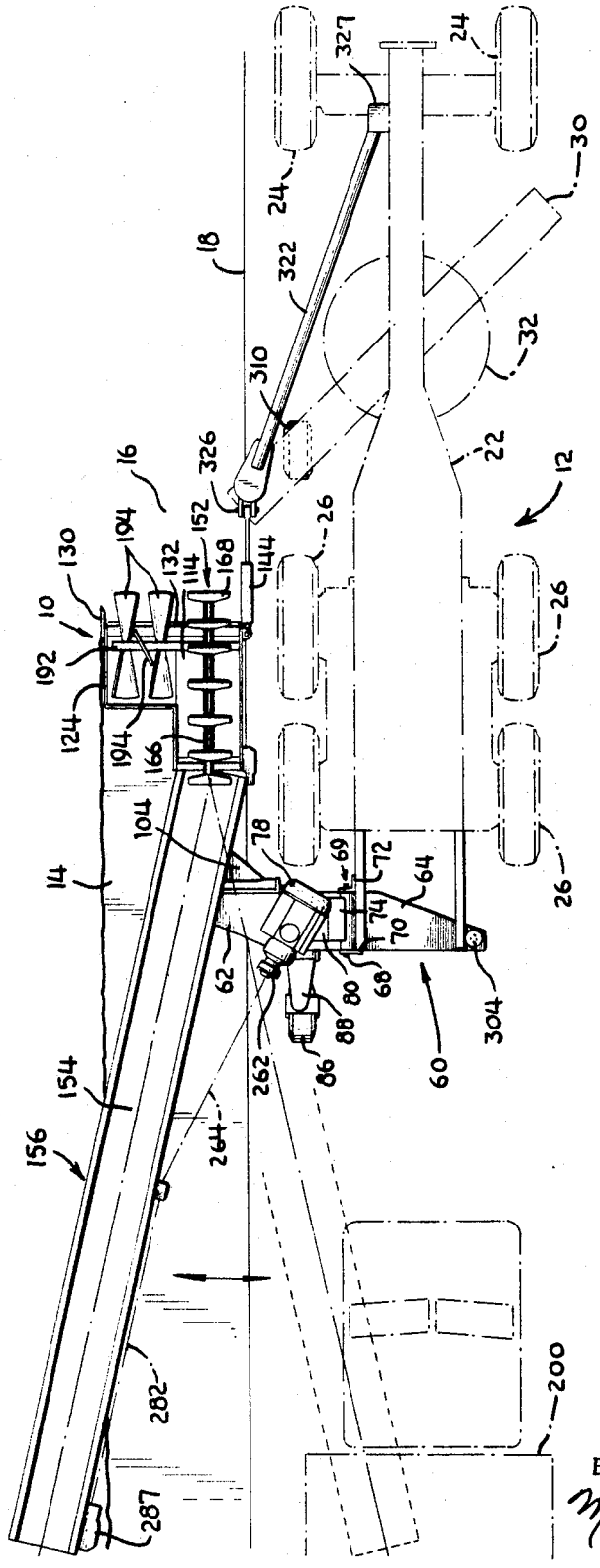



Fig. 2

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ROAD WIDENING TRENCHER-LOADER UNIT

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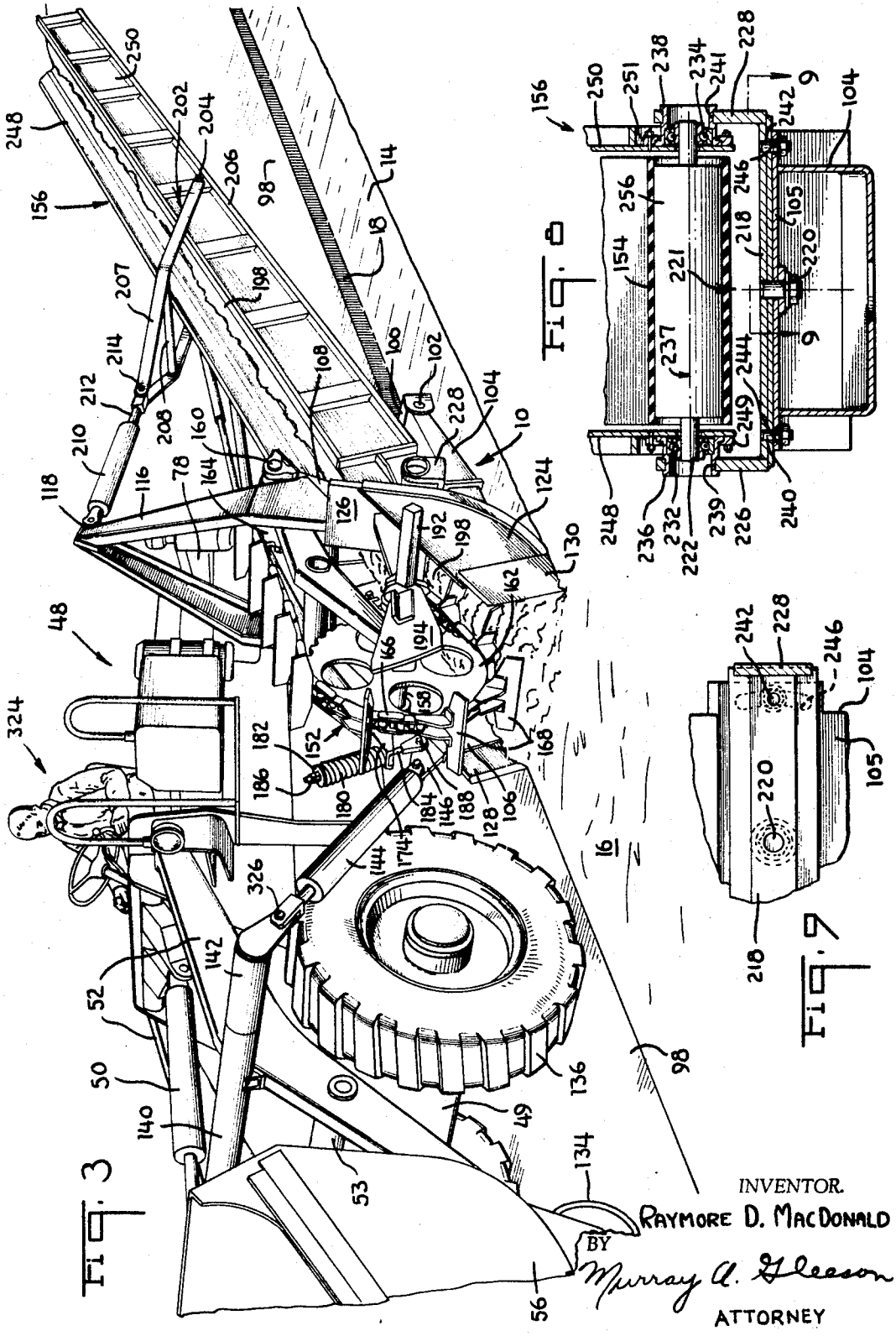


Fig. 3



Fig. 8



Fig. 9

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ROAD WIDENING TRENCHER-LOADER UNIT

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Fig. 4

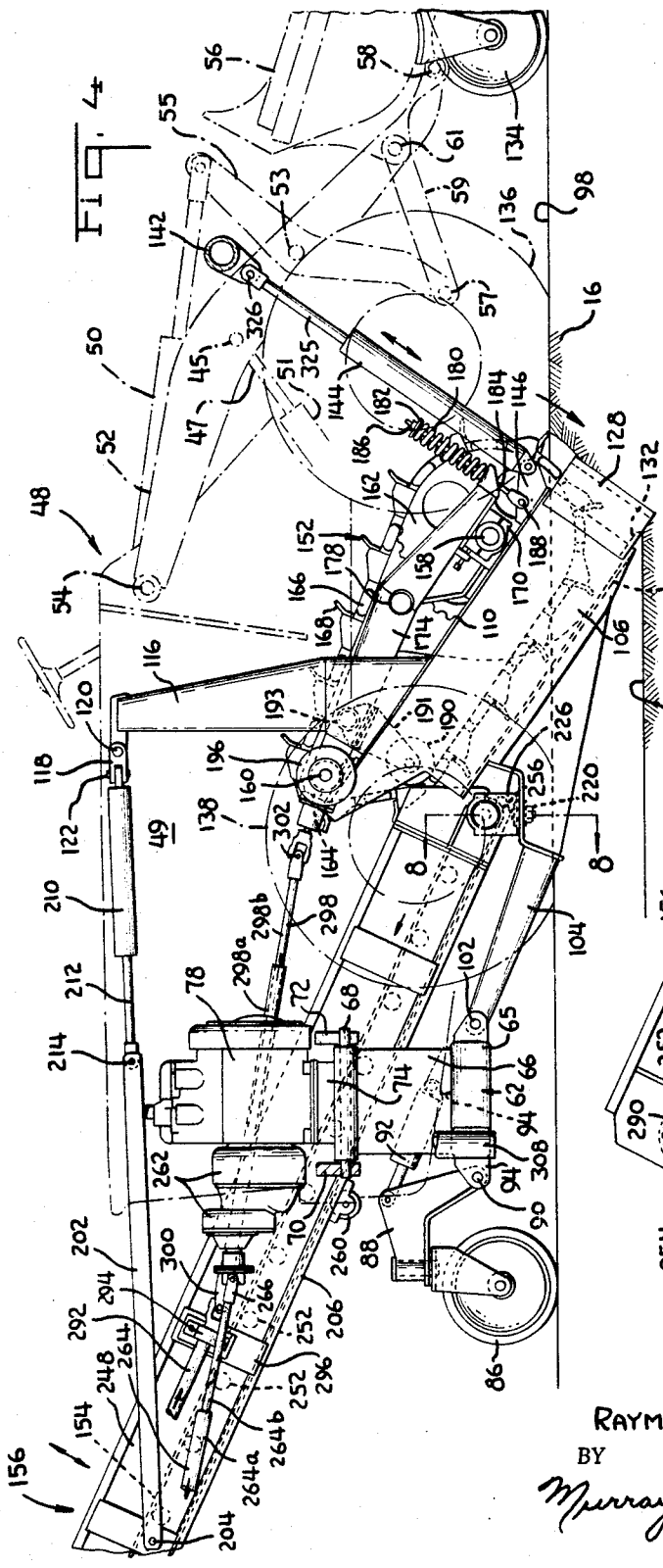
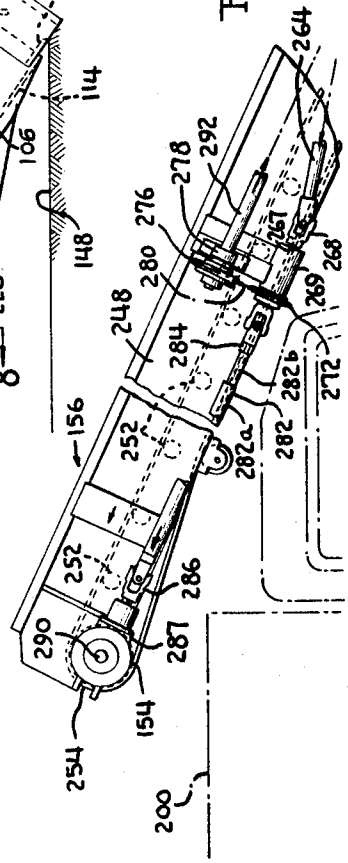


Fig. 5



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ROAD WIDENING TRENCHER-LOADER UNIT

Filed June 25, 1965 5 Sheets-Sheet 5

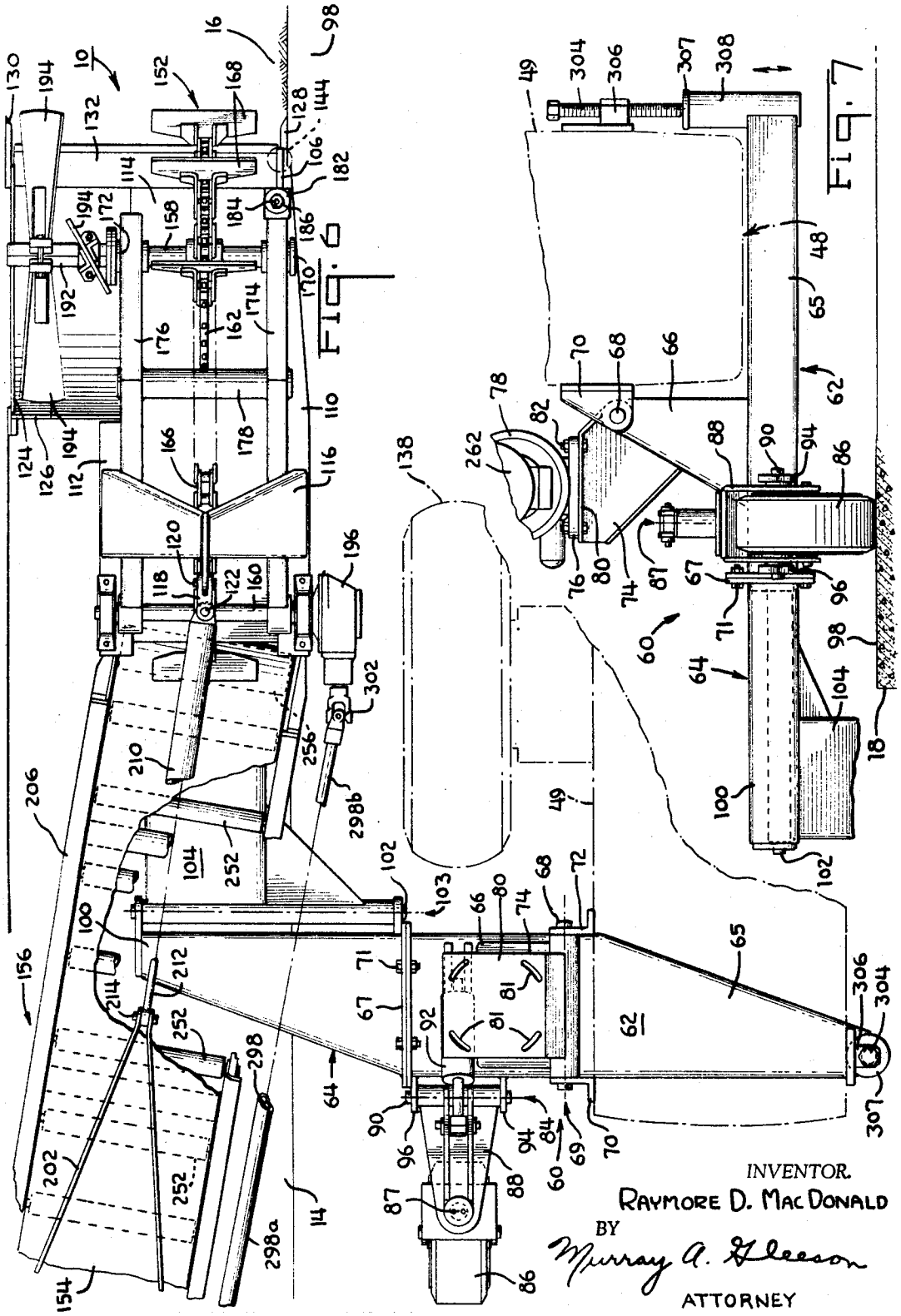


Fig. 7

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United States Patent Office 3,392,464
Patented July 16, 1968



3,392,464

# ROAD WIDENING TRENCHER-LOADER UNIT

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Filed June 25, 1965, Ser. No. 466,945
8 Claims. (Cl. 37—101)

## ABSTRACT OF THE DISCLOSURE

An improved road windening trencher-loader unit having a cutter frame assembly pivotably attached to a main supporting frame for movement about a horizontal axis and the elevating conveyor assembly pivotably and rotatably attached to the cutter frame assembly for up, down and side to side movement independently of the cutter frame assembly. A single power source is provided along with an extensible linkage to enable the power source to drive the elevating conveyor assembly and a feeder-conveyor carried by the cutter frame assembly.

The present invention pertains generally to a trencher-loader apparatus comprising an attachment unit that may be mounted on a conventional, self-propelled road building or maintenance machine for use in road windening operations.

More particularly, this invention relates to shoulder grading, road windening, trencher-loader apparatus which can prepare the subgrade for an additional or new strip of pavement, it being independently powered and readily adaptable to use as an attachment unit for conventional road building and maintenance machines such as motor graders, front end loaders, and the like.

Accordingly, it is a primary object of the present invention to provide a trencher-loader apparatus especially adapted to dig a trench along the edge of an existing pavement or roadway.

Another object is to provide a trencher-loader unit that is independently powered, and constructed and arranged so as to be adjustably operatively associated with, or connected sidewardly of, road forming equipment, and effective to remove, load, and feed excess earth material rearwardly thereof.

Yet another object is to provide a trencher-loader unit having a shaped, leading, cutting box or scoop which is adjustable to vary its position and width, thereby enabling it to gather and contain the trenched material and direct it to a collecting zone.

A further object is to provide a trencher-loader unit having a feeding assembly effective to continuously chop, cut and remove trenched and collected material from a collecting zone and transfer it to a disposing zone.

A still further object is to provide a trencher-loader unit having a conveying assembly for continuously discharging trenched and collected material from a disposing zone to off-road, shoulder, back-fill areas or, alternatively at the selection of the operator, to on-road truck loading.

An additional object is to provide a trencher-loader unit having a conveying assembly that is tiltable up and down independently of the excavating assembly, enabling the conveying assembly to be adjusted vertically without changing the depth adjustment of the excavating assembly.

Another object is to provide a trencher-loader unit having a conveying assembly that is swingable from side to side about an axis near the front end thereof, enabling the conveyor to be swung off the road for shoulder filling or on the road for truck filling.

Furthermore, it is an object of this invention to provide a trencher-loader unit having rotatable structure such as a gauge wheel which can rigidly support a cutting box



with respect to a road surface while being effective to gauge and adjust the depth of the excavation at a predetermined level below the road surface.

A still further object is to provide a trencher-loader unit having an adjustable structure for adjusting the slope, or yaw attitude, of a cutting box with respect to the plane of a road surface.

A still further object of this invention is to provide a trencher-loader unit having a controllable load wheel particularly adapted to be disposed in load bearing relationship with a pavement or road surface at the rear of the unit, and effective to relieve a primary motorized vehicle to which it is connected of loads imposed on the vehicle by the weight of the unit, the load wheel being adjustable to compensate for the weight of the unit throughout a range of tilted positions.

These and other objects and advantages of the present invention will become readily apparent from a study of the following specification when taken with the appended drawings in which like reference characters indicate similar parts throughout the several views, which together show, illustrate, describe and disclose a preferred embodiment or modification of the invention, and what is now considered to be the best mode of practicing the principles thereof. Other embodiments or modifications may be suggested to those having the benefit of the teachings herein, and such other embodiments or modifications are intended to be reserved especially as they fall within the spirit and scope of the subjoined claims.

In the accompanying drawings:

FIGURE 1 is a fragmentary perspective view showing a left side portion of a conventional motor grader, and illustrating a trencher-loader unit constructed in accordance with the present invention operatively associated with it;

FIG. 2 is a plan view of the trencher-loader unit of FIG. 1, showing in broken lines a different position of a conveyor assembly, and again showing the excavating device or apparatus operatively associated with the motor grader (shown in phantom);

FIG. 3 is a fragmentary perspective view showing a left side portion of a conventional front end loader, and illustrating a trencher-loader unit constructed in accordance with the present invention operatively associated with it;

FIG. 4 is a fragmentary side view of the trencher-loader unit of FIG. 3, with a fragmentary side view of the front end loader superimposed on it in phantom;

FIG. 5 is a fragmentary side view of the rear end portion of the conveyor assembly of the trencher-loader unit of FIG. 4, drawn to a like scale, and showing in phantom a portion of a following truck adapted to be loaded by the conveyor;

FIG. 6 is a substantially enlarged, fragmentary plan view of the trencher-loader unit of FIG. 3 with parts broken away to illustrate certain components and with a rear portion of the front end loader being shown in phantom;

FIG. 7 is a substantially enlarged fragmentary rear elevational view of the load wheel and associated component parts of the trencher-loader unit of FIG. 3 with certain connecting portions of the front end loader being shown in phantom;

FIG. 8 is a fragmentary, enlarged, cross-sectional view of a component of the trencher-loader unit as viewed along line **8—8** of FIG. 4; and

FIG. 9 is a fragmentary top view taken substantially along the line **9—9** of FIG. 8.

With reference now to the drawings, and particularly to FIGS. 1 and 2, a preferred form of the invention comprises an independently powered trencher-loader unit **10** particularly adapted for use as an attachment to a prime

mover for road building equipment; for example, a self-propelled motor grader **12**. Accordingly, the trencher-loader unit **10** will be able to excavate a trench **14** in the earth or other road shoulder material **16** immediately adjacent the edge **18** of a roadway **98**.

The motor grader **12** may be of any suitable and conventional construction enabling the trencher-loader unit **10** to be attached to it. While a motor grader in and of itself is well known to those persons skilled in the art to which the present invention pertains, a short description of the motor grader **12** will be set forth for a complete understanding of this invention.

As shown in FIGS. 1 and 2, the motor grader **12** has a suitable frame **22** supported at its front end on front steering wheels **24**, and at its rear end on rear driving wheels **26**, the latter being generally but not necessarily disposed in tandem pairs. A power source comprising an internal combustion engine **28** powers the rear driving wheels **26**, and also certain accessories such as the oil pump of the hydraulic control system. In the case of a six-wheel-drive motor grader, the engine **28** will also drive the front steering wheels **24**. A conventional scraper blade **30** is disposed under the frame **22**, between the front wheels **24** and the rear wheels **26**, and is operatively associated with or mounted upon the frame **22** so as to be capable of a wide variety of positioning adjustments.

The blade **30** is mounted upon a "circle" **32** rotatable about an upright axis. This enables the scraper blade to be rotated with respect to and underneath the frame **22**. The horizontal rotation of the blade **30** about the axis of the circle **32** generally is performed by an engine drive through a suitable gear reduction assembly, in a well known manner. The blade **30** and the circle **32** also are capable of a lateral or side-shifting adjustment, this adjustment generally being performed by hydraulic rams or mechanical linkages. This may be done in any suitable manner, enabling either end of the scraper blade **30** to be extended outwardly of the frame **22** to a greater or lesser extent. Additionally, the circle **32** can be tilted about a fore and aft axis. In this manner, either side of the circle can be tilted upwardly or downwardly, enabling the corresponding end of the scraper blade **30** to be tilted upwardly or downwardly. Moreover, the entire assembly of the circle **32** and the blade **30** can be raised and lowered to vary the cutting depth of the blade, by the operation of well known hydraulic rams or mechanical linkages.

The lifting, tilting, and side-shifting blade positioning adjustments, just described, may be effected by control levers **34** at an operator's position **36** on the motor grader **12**.

The trencher-loader unit **10** is illustrated in FIGS. 3 through 9 as an attachment for a conventional self-propelled front end loader **48**. The front end loader comprises, generally, a 4-wheel, powered vehicle having a main frame **49** and a forwardly extending pair of shovel or bucket arms **52** interconnected by a horizontal brace **53**. As shown in FIG. 4, the arms **52** are pivoted for up and down tilting movement about horizontal pins **54** on the main frame. A double-ended lever **55** (FIG. 4) is pivoted (by pivot means not shown) about the brace **53** and is connected at its lower end **57** through a link **59** to a pivot pin **61** on the back of a bucket **56**, the latter being pivoted at the forward end of the arms **52** about a horizontal axis defined by pins **58**. Normally, in the practice of the present invention, the cylinder **50** will be adjusted to hold the bucket **56** against its backward tilted limit to provide a stable carriage for the gauge wheel means **134**.

The arms **52** may be lifted and lowered under the control of an operator by actuation of hydraulic jack means **51** having a piston rod **47** pivotally connected to the arms at a horizontal axis **45**.

The bucket **56** in FIGS. 3–9, and the motor-grader scraper blade **30** in FIGS. 1–2, have in common the function of supporting the gauge wheel **134** or **310** which runs along the pavement and determines the operating depth of the trencher-loader unit. This will be described in greater detail.

With particular reference now to FIGS. 6 and 7, the trencher-loader unit **10** comprises a main support assembly **60** having a hollow main supporting frame **62**. This, in plan view, is substantially diamond-shaped. It underhangs the rear portion of the front-end loader **48**.

Frame **62** consists of two major portions: a horizontal flat portion **64** comprising an outer frame **100** and an inner frame **65**, bolted together at flange connection **67** by bolts **71**, and a central upstanding portion **66**. Frame **62** is of suitable thickness to provide structural integrity, and to provide oil storage and cooling capacity for the hydraulic system. The portion **66**, generally triangular shaped in FIG. 7, is preferably cast or welded integral with portion **64**. The main supporting frame **62** is pivotally mounted on the side of the vehicle frame **49** by a long pin **68**, extending through the frame upper portion **66**, along an axis **69** lengthwise of the vehicle, and pivoted between brackets **70**, **72** which are fixed, as by welding, to the left rear side of vehicle frame **49**.

A bracket **74** (FIG. 7) is secured to the central upstanding portion **66** of the main supporting frame **62**. Bracket **74** carries a top plate **80** to which the baseplate **76** of engine **78** is fastened as by bolts **82**.

A load bearing wheel **86** (FIGS. 6 and 7) trails the supporting frame **62**, preferably of the caster type, effective to support the rear portion of the trencher-loader unit **10**. It is pivotable about an offset, upright, caster axis **87** on a supporting bracket **88** which, in turn, is tiltable up and down about a horizontal transverse axis **84** through a pin **90**. The up and down movement of the bracket **88** may be accomplished in any suitable manner, as, for example, by an elevating hydraulic power cylinder **92**. The pin **90** is supported between a pair of brackets **94** and **96** fixed on the back side of frame **62** in any suitable manner, as by welding. A fuel tank (not shown) for the engine **28** may be carried by the main supporting frame **62**.

By adjusting the pressure fluid within the hydraulic cylinder **92**, the weight of the trencher-loader unit **10** may be taken from the prime mover (**12** or **48**) and applied to the roadway directly through the load bearing wheel **86**. This enables the prime mover to maintain a level condition while operating on a roadway **98**.

A horizontal transverse axis **103** defined by a pin **102**, is disposed along the leading edge of the outer end portion **100** of the horizontal flat portion **64**, where it juts out beyond the left rear wheel of the prime mover **12** or **48**. This horizontal transverse axis **103** is the pivot point for the back end of a cutter frame assembly **104** which comprises side plates **106** and **108** having upper flanged portions **110** and **112**, respectively, and an inclined, chute-like, bottom floor **114**. The cutter frame assembly **104** further includes an upstanding mast or A-shaped frame **116** supported upon and suitably operatively associated with the flanged portions **110** and **112** of the side plates **106** and **108**, as best shown in FIGS. 3, 4 and 6. The A-shaped frame **116** terminates at its upper apex in a dual pivot universal joint or universal clevis **118** which enables motion to occur about a plurality of axes, that is, a generally horizontal transverse axis through a pin **120**, and a generally vertical axis through a pin **122**.

It is desirable that the width of the cutter frame assembly **104** be adjustable, enabling the trencher-loader unit **10** to dig trenches of different widths. To this end, a forward side plate **124** of the cutter frame assembly **104** is offset from the side plate **108** by a curved rear plate **126**, which can readily be replaced with narrower or wider curved plates, enabling the overall width of the cutter box to be varied. Removable side cutting edges comprising beveled blades **128** and **130**, and a bottom beveled blade **132** are respectively operatively associated in any suitable manner with the side plates **106** and **124**, and the bottom floor **114**, enabling them to be readily removed

for sharpening, replacement, and the like. They constitute a U-shaped cutter box defining the shape and size of the trench.

The depth of the bottom cutting blade **132** is gauged from the roadway pavement **98** by a gauge wheel-linkage arrangement operatively associated with a gauge wheel **310** or **134** in the FIG. 1 or 3 embodiments respectively.

With particular reference now to FIGS. 3 and 4, a gauge wheel **134**, preferably a solid rubber tire on a steel wheel, similar to the rear load bearing wheel **86**, is mounted on the underside of the bucket **56**. The gauge wheel **134** is preferably longitudinally aligned with loader wheels **136** and **138** adjacent the pavement edge.

As shown in FIG. 3, a brace or stiffening bar **140** is secured across the bucket arms **52**, and has a stabilizing strut extension **142** beyond the left side of the front end loader. A power cylinder **144** comprises a power-adjustable link between a bracket **146** fastened to the side plate **106**, and the extension **142**. The cylinder **144** can be adjusted to vary the depth of the bottom cutting blade **132** relative to the gauge wheel **134**. This sets the depth of the trench.

One of the significant aspects of this particular assembly for gauging the depth of a trench **14** is that the cutter frame assembly **104** can be lifted completely out of contact with the ground **16**. This is especially useful when passing an intersecting highway, or a driveway, or any other location where it is desired that the trencher-loader unit **10** be disposed in an inoperative position, but yet can be replaced in exactly the same cutting position, at the requisite depth, by simply lifting and lowering bucket **56** by activation of cylinder **51**, see FIGURE 4.

A floating, spring-loaded feeder conveyor assembly **152** digs, feeds, removes and drags trenched earth material **198** upwardly along the inclined bottom floor **114**. It is positioned within and over the U-shaped cutter frame assembly **104**. The feeder conveyor assembly **152** extends upwardly, over and beyond the receiving end of an endless conveyor belt **154** of an elevating conveyor assembly **156**, and comprises an endless chain **166** with a plurality of flights, digging members or scraper blades **168**; and auger paddles **194**. The feeding conveyor assembly includes: a forward, driven shaft **158**; a rear, driving shaft **160**; and sprocket wheels **162** and **164**, respectively, mounted thereupon. The chain linkage **166** is trained about the sprockets. The scraper blades **168** are preferably equally spaced along the outside of the chain linkage **166**.

With particular reference now to FIGS. 4 and 6, the shaft **158** may be rotatably journaled in bearing housings or trunnions **170** and **172** which are fastened to the forward underside of a pair of forwardly extending feeder conveyor arms **174** and **176**. The latter are joined and made rigid by a cross-tube **178** and are pivotally mounted for up and down tilting movement about the rear shaft **160**. The forward end of the feeder conveyor arms **174** and **176**, and the feeder conveyor assembly **152**, are urged downwardly by a suitable biasing means, such as compression spring **180** held between the forward upper side of the feeder arm **174**, and a heavy duty flat washer **182** and nut **186** on the upper end of a rod **184**. The bottom of rod **184** is pivotably mounted to the bracket **146** by a pin **188**, bracket **146** being carried by side plate **106**.

As illustrated in FIG. 4, a chain guide roller **190** is carried by a bracket **191** fastened on the bottom side of a cross tube **193** which extends between the arms **174** and **176**. The roller **190** trains the lower run of the feeder conveyor chain **166** and keeps it parallel with the drag plate **114**. This improves conveyor efficiency by maintaining uniform, close spacing between the plate **114** and the flights **168**. In FIG. 6, an auger shaft **192** (which may be integral with the shaft **158**) comprises an axial extension of the shaft **158**. It overhangs and extends beyond the side plate **124**. The shaft **192** has positioned on it as many diametrically opposed auger paddles **194** as is necessary, depending upon the width of the cutter frame assembly **104** which, as hereinbefore pointed out, is adjustable by selecting the proper width of the rear plate **126** corresponding to the width of trench being made. The auger paddles **194** function to move the excavated material **198** inwardly toward the feeder conveyor scraper blades **168**. Suitable gears (not shown), such as spiroid gears, or right angle beveled gears, are disposed within a gear head or box **196**, and are suitably driven, in a manner hereinafter to be described, so as to power the drive sprocket wheel **164**. It, in turn, drives the other sprocket wheel **162**, and the corresponding shafts **160** and **158**, **192**, through the chain linkage **166**. The gear box **196** is bolted on the flanged portion **110** of the side plate **106**.

As hereinbefore pointed out, the elevating conveyor assembly **156** is mutually cooperatively associated with the feeder conveyor assembly **152**, enabling the feeder conveyor assembly to receive the trenched material **198** which is to be removed, and dispose of it rearwardly to back-fill off-road shoulders, or to load a dump truck **200** on-road as illustrated in phantom in FIGS. 2 and 5. As shown in FIG. 3, the elevating conveyor assembly **156** is supported and maintained at a predetermined inclination by a yoke **202** suitably pivoted on pins **204** on a main conveyor framework **206**, and comprises a fork **207** reinforced by a brace **208**. An adjustable power cylinder **210** is connected at one end, through the universal clevis **118**, to the A-shaped frame **116**. At the other end, it is connected through the center block **214** and piston rod **212** to yoke **202**.

As particularly illustrated in FIGS. 4, 8 and 9, the elevating conveyor assembly **156** is supported at its front end on a clevis or yoke **218**, which, in turn, is pivoted for horizontal swinging movement about the axis **221** of a vertical pin **220** extending from the bottom of the yoke through an aperture in the top plate **105** of the main cutter assembly **104**. The pin is threaded at the bottom end and held in place by the nut and washer shown. This arrangement enables the elevating conveyor **156** to be swung horizontally independently of the feeder conveyor assembly **152**.

It is desirable that the elevating conveyor assembly **156** also be capable of up and down tilting movement independent of the feeder conveyor assembly in any swung position thereof. To that end, the conveyor assembly **156** is pivotably mounted for up and down tilting movement about a generally horizontal axis **237** defined by a pair of bearing retainers **236**, **238** rotatable about that axis. Retainers **236**, **238** are rotatable respectively within the bores **239** and **241** of the upstanding forks **226** and **228** of the clevis **218**. The bearing retainers **236**, **238**, in the shape of grooved, flanged, round tubes, are mounted onto the side plates **248**, **250** of the elevating conveyor assembly by clamp rings **249** and **251**. Thus, as the elevating conveyor is tilted up and down by cylinder **210**, the members **236**, **238** will turn within the bores **239** and **241**.

The retainers **236**, **238** also support bearings **232**, **234** which journal the supporting shaft **222** for the forward, "driven" elevating conveyor roller **256**.

The horizontal swinging of the elevating conveyor assembly **156** is limited by stop pins **240**, **242** which are carried by the yoke **218** and which extend from the bottom thereof into arcuate slots **244**, **246** formed within the upper plate **105** of the cutter frame assembly **104**. These stop pins **240**, **242** are threaded at the bottom ends and are provided with nuts and washers, as shown, to lock the elevating conveyor assembly in any preferred swung position.

An important feature of the trencher-loader unit **10** is that the cutter frame assembly **104** can be adjusted, that is, raised or lowered, to a desired depth relative to the gauge wheel **134**, by the hydraulic cylinder **144**. Another important feature is that the adjustment for the depth of the cutter frame assembly **104** is substantially completely independent of the adjustment for the height of the elevating conveyor assembly **156**. Still further, the conveyor

assembly **156**, in addition to its independent adjustment for height, is laterally swingable independently of and with respect to the cutter frame assembly **104**. An excavating device or apparatus constructed in accordance with the principles of the present invention will therefore be seen to comprise an assemblage of pivot locations enabling the various component elements or parts thereof to be translated along similar or different planes of movement substantially completely independently of one another.

The elevating conveyor assembly **156** has reinforced longitudinal side plates **248** and **250** of generally channeled-shaped configuration, which side plates are suitably disposed in fixed, substantially parallel, or at least spaced-apart, relationship with respect to one another, and may be fabricated of any suitable material, such as steel plate. A plurality of guide and support rollers **252** for the material-carrying run are disposed at substantially equal space intervals between the "driving" pulley **254** at the upper, discharge end, and the "driven" pulley **256** at the lower, receiving end. The endless conveyor belt **154**, preferably of rubber-like material, has its material-carrying run supported on the rollers **252** and its return run supported on a return idler **260**. The rollers and pulleys are supported by and between side plates **248** and **250**. If desired, the belt **154** may be provided with ribs (not shown), of any suitable and conventional configuration, such as V-shaped, for aiding in holding the trenched material **198** on the belt **154**, particularly in those applications where the conveyor assembly is elevated at a steep angle.

The engine **78** provides a convenient, integral, self-contained power source for the mechanical and hydraulic actuated components. A hydraulic system and transmission and gear reduction assembly is generally designated **262**.

As shown in FIGS. 4 and 5, the engine **78** drives a main power shaft **264**, through assembly **262** and U-joint **266**.

The main power shaft **264** extends from the U-joint **266** to the U-joint **268**. The latter drives a short shaft **267** which is journaled in a bearing housing **269** fastened to the conveyor side plate **248**.

The shaft **267** carries a power take-off sprocket **272** (for a purpose to be described later) and is connected through U-joint **284**, shaft **282**, and U-joint **286**, into a conveyor drive gear box **287** fastened to side plate **248**. Any suitable gearing arrangement may be used in the box **287** to enable the shaft **282** to rotate the shaft **290** for the drive pulley **254**. Shaft **282** comprises a pair of splined, telescopical sections **282***a* and **282***b*.

Sprocket **272** (FIG. 5) drives a sprocket **276** through a chain **280**. Sprocket **276** drives a forwardly extending shaft **292** which is journaled along the side plate **248** by bearing housing **278** and **294** (FIGS. 5 and 4). Bearing housing **294** is carried upon a brace **296** fastened to the side plate **248**.

As shown in FIG. 4, the forward end of shaft **292** is connected through U-joint **300**, shaft **298**, and U-joint **302** into the gear box **196** already described for the feeder conveyor assembly **152**.

The main power shaft **264** extends between the *fixed* gear box **262** and the bearing housing **269** which *swings and tilts* with the conveyor. Likewise, the feeder conveyor power shaft **298** extends between the *fixed* gear box **196** and the bearing housing **294** which *swings and tilts* with the conveyor. To accommodate this swinging and tilting movement, and to drive at any swung or tilted position of the elevating conveyor, each of these shafts is 2-piece, telescopical, and splined. Shaft **264** comprises two splined sections **264***a* and **264***b*. Shaft **298** similarly comprises the two sections **298***a* and **298***b*. This enables the feeder conveyor to discharge trenched material onto the elevating conveyor at all swung and elevated positions.

Top plate **80** (FIGS. 2, 4 and 6), to which the engine **78** is bolted, preferably has provision to rotatably adjust the position of the engine relative to the drive shaft **264**. Arcuate slots **81**, formed in the plate **80**, permit the engine **78** to be generally aligned with the drive shaft **264** and thereby reducing the strain on U-joints **266** and **268**.

The power train can be summarized as follows: the engine **78** powers the elevating conveyor drive pulley **254**, through shafts **264** and **282**. The power take-off at the sprocket **272** drives the feeder conveyor **152** through the shafts **292** and **298**. Shafts **264** and **298** are splined and extensible to drive at any swung position of the conveyor. Suitable hydraulic pressure generating means, comprising a pump in the assembly **262**, may be powered by the engine **78**.

In FIGS. 4 and 5, the flow of power through shafts **264**, **282**, **292**, and **298** is shown by the direction of the arrows on those shafts. In certain other figures, reference arrows are employed to show direction of movement of the parts themselves.

FIG. 7 shows the slope control and adjustment. This comprises an adjusting jack screw **304** threadedly engaged within a supporting bracket **306** suitably fixed on the right rear side of the main frame **49** of the front end loader **48**. The jack screw **304** is vertically aligned with and bears against a pressure pad **307** on a supporting bracket **308** at the far right edge of the main supporting frame **62**. With this adjustment control, the cutter frame assembly **104** and the U-shaped cutter on its forward end may be tilted sidewise about axis **69** to, for example, compensate for the crown of the roadway **98**. Thus, even with a substantial crown in the road, the trencher-loader unit can produce a uniformly level trench.

With the understanding that gauge wheels **134** and **310** function alike, gauge wheel **310** (FIGS. 1 and 2) will not be described. Preferably it is the caster type and serves the same function as the gauge wheel **134** described in connection with the attachment unit for the front end loader shown in FIGS. 3–9.

Structually, the gauge wheels resemble the load wheel **86**. As shown in FIG. 1, the gauge wheel **310** is mounted upon the scraper blade **30** by a series of bolts **312**, nuts **314** and washers **316**, only one set of which is shown. By releasing the bolts, the gauge wheel **310** can readily be removed to allow the motor grader **12** to be utilized for other work. To stabilize the attachment of unit **10** to the motor grader, an upstanding bracket **318** is fixed, removably as by bolts not shown, to the upper portion of the scraper blade **30**. The bracket **318** has an upstanding extension **320** to which the piston rod **325** of cylinder **144** is connected, as for example on the pin **326**.

To rigidify the stabilizing arrangement just described, a stabilizing strut **322** is fixed to the top of the extension **320** and extends in a generally forward direction (FIG. 2) to a forward anchor on the frame **22**, just above the front wheels **24**, at a point **327**.

The cylinder **144** comprises an adjustable link between the cutter frame **104** and the gauge wheel **310** which rolls on the pavement surface **98**. The adjustment of cylinder **144** determines the depth of cut, that is, the level of the trench below the pavement surface. When passing a driveway or other obstruction which must not be cut through, the operator lifts the scraper blade **30** by means of the normal controls for that purpose on the motor grader. This lifts the gauge wheel, the cylinder **144**, and the cutter frame **104**, taking the latter out of digging contact with the ground until the unit gets past the obstruction at which time trench-cutting can be resumed by lowering the blade **30** until the gauge wheel **310** is again on the pavement surface. Since this is done without changing the adjustment of the cylinder **144**, trenching will be resumed at exactly the same depth as before.

The operation of the trencher-loader unit **10**, whether used on a motor grader, front end loader, or other suit-

able prime mover, is believed readily apparent from the foregoing description. Such a unit, although designed to be used as an attachment to a prime mover, is particularly adapted to be controlled and operated from a control panel (not shown) installed in, or within easy reach of, an operator's position on the prime mover. For example, in FIG. 1, the motor grader **12** has a cab **323**; and in FIG. 3, the front end loader has a cab **324**. The engine **78** of the trencher-loader unit may be started from the prime mover cab and all other control functions for the operation of the trencher-loader unit **10** may be manipulated from the cab.

For example, the depth of the U-shaped cutter box at the front of the cutting frame assembly **104** of FIG. 1 may be adjusted, remotely, by the cylinder **144**. Likewise the inclination of the elevating conveyor **156** can be varied at the operator's will by adjusting the cylinder **210**. And, as previously described, the cutter frame **104** can be taken completely up, out of contact with the shoulder, by lifting either the motor grader blade **30** or the bucket **56** when it is desired to cross over a driveway, intersecting highway, or the like. These adjustments often need to be made quite frequently, therefore it is desirable that they be readily made from the operator's cab.

Other adjustments, which need not be made so frequently, but are more in the nature of set-up for the job, will be to swing the elevating conveyor **156** for truck loading, or for windrowing along the shoulder; the slope control by the adjustment of screw **304**; and setting the width of the trench by use of the requisite width cutter box back plate **126** and corresponding number of auger paddles **194**.

Digging is commenced simply by actuating the controls at the operator's position to tram the prime mover and at the same time engaging the clutch to start the main power shaft **264** to thereby simultaneously actuate the feeding and elevating conveyors, and adjust cylinder **144** for the proper trenching depth.

One important feature of the trencher-loader unit **10** is that it is primarily intended to be an attachment unit and can readily be assembled and disassembled with respect to the motor-grader **12**, the front end loader **48**, or any other similar prime mover, with a minimum amount of time and effort.

Referring to FIGS. 1 and 2, the trencher-loader unit may be disassembled from the motor grader simply by releasing bolts **312** to remove the gauge wheel **310**; releasing the pin **326** to disconnect the cylinder **144**; and releasing the longitudinal pin **68** to disconnect the main frame **62**.

Referring to FIGS. 3 and 6, the trencher-loader unit may be removed from the front end loader by unbolting the gauge wheel **134**; releasing the pin **326** to disconnect the cylinder **144**; and releasing the pin **68**.

In effect, it can be said the apparatus **10** is removably, operatively associated with respect to the prime mover as through the medium of a plurality of pin assemblies, one such assembly being located at each end of the unit **10**.

In some instances it may be desirable to remove the trencher-loader from the prime mover exclusive of the engine **78** and the load bearing wheel **86**. This is accomplished by first blocking up the trencher-loader. The pin **326** is then disconnected to free cylinder **144**. The outer end frame **100** is unbolted from the inner frame **65**. The prime mover is then driven ahead, separating the two sections of the telescopic drive shaft **264**. Drive shaft section **264*b*** remains fastened to the engine unit and section **264*a*** comes free with the trencher-loader.

In summary, the trencher-loader unit of the present invention comprises: a main support assembly **60** pivotable (for slope adjustment) about the longitudinal axis **69** on the prime mover frame **22** or **49**; a cutter frame assembly **104** pivotable up and down on assembly **60** about transverse axis **103**, to vary the trenching depth; a feeder conveyor assembly **152** pivotable on assembly **104**, about a horizontal transverse axis through its rear driving shaft **160**; and an elevating conveyor assembly **156** swingable from side to side on assembly **104**, about an upright axis **221**, and tiltable up and down on yoke **218**, about a horizontal transverse axis **237**.

While the invention has been shown, illustrated, described and disclosed in terms of embodiments or modifications which it has assumed in practice, the scope of the invention should not be deemed to be limited by the precise embodiments or modifications herein shown, illustrated, described or disclosed, such other embodiments or modifications intended to be reserved especially as they fall within the scope and spirit of the claims here appended.

What is claimed is:

**1.** A trencher-loader unit for widening a road bed, comprising:

a cutter frame assembly for defining the width of the trench;

a main supporting frame;

the cutter frame assembly being pivotally mounted on the main supporting frame for up-down tilting movement about a substantially horizontal axis;

a feeder conveyor assembly disposed on the cutter frame assembly;

an elevating conveyor assembly being pivotally mounted on the cutter frame assembly for up and down tilting movement about a second substantially horizontal axis independent of the cutter frame assembly, said elevating conveyor assembly being disposed upon the cutter frame assembly in material-receiving relationship with the feeder conveyor assembly;

a first telescoping splined drive shaft universally connected between a power source and a first sprocket wheel which is rotatably supported by the elevating conveyor assembly;

a first reach shaft disposed on the elevating conveyor assembly between the first sprocket wheel and drive gearing for the elevating conveyor assembly;

a second reach shaft operatively positioned upon the elevating conveyor assembly;

a second sprocket wheel positioned upon one end portion of the second reach shaft in driving relationship with the first sprocket wheel;

a second telescoping splined drive shaft universally connected to the other end portion of the second reach shaft; and

gear means operatively associated with the feeder conveyor assembly enabling the first telescoping splined drive shaft to simultaneously drive both conveyor assemblies at all positions of the elevating conveyor assembly.

**2.** A road widening trencher-loader unit for attachment to a road vehicle for use in cutting a trench along the edge of a roadway as a step in the process of widening the roadway, said trencher unit including, in combination,

a main supporting frame adapted to be removably connected to said road vehicle,

means for cutting said trench including a trough-like cutter frame assembly privotally mounted to said main supporting frame for up and down tilting movement about a first generally horizontal axis,

first conveying means carried by said cutter frame assembly for conveying the trenched material along and rearwardly of said cutter frame,

second conveying means for receipt and transport of the trenched material upon discharge from said cutter assembly,

means for attaching said second conveying means to said cutter frame assembly for rotation about a substantially upright axis and for up and down tilting

about a second generally horizontal axis to thereby enable independent adjustment of said second conveying means relative to said cutter frame assembly,

a bracket pivotally mounted to said main supporting frame,

a load bearing wheel carried by said bracket, and

means secured between said bracket and said main supporting frame for pivoting said load bearing wheel into and out of load supporting engagement with the roadway.

3. A road widening trencher-loader unit for attachment to a road vehicle for use in cutting a trench along the edge of a roadway as a step in the process of widening the roadway, said trencher-loader unit including, in combination,

a main supporting frame assembly adapted to be removably connected to said road vehicle in a position extending laterally outwardly of said road vehicle,

means for cutting said trench carried by said main supporting frame assembly in a position laterally spaced from said road vehicle, said trench cutting means including a trough-like cutter frame assembly mounted for pivotal movements with said main supporting frame assembly about a first generally horizontal axis,

means for digging and conveying the trenched material along and rearwardly of said cutter frame assembly, and

second conveying means for receipt and transport of the trenched material upon discharge from said cutter frame assembly,

said second conveying means being pivotally mounted for movement about a second generally horizontal axis directly on the main supporting frame assembly,

said second conveying means being further mounted for pivotal movement about a generally vertical axis on the main supporting frame assembly to thereby provide independent adjustment of said second conveying means relative to said cutter frame assembly.

4. The structure of claim 2 further characterized by and including

a drive motor carried by said main supporting frame assembly and

means establishing a driving connection between, firstly, said drive motor and said means for digging and conveying the trenched material along and rearwardly of said cutter frame assembly, and between secondly, said drive motor and said second conveying means throughout all relative positions thereof.

5. The structure of claim 3 further characterized by and including,

a bracket pivotally mounted to said main supporting frame assembly,

a load bearing wheel carried by said bracket, and

means secured between said bracket and said main supporting frame assembly for pivoting said load bearing wheel into and out of load supporting engagement with the roadway.

6. The structure of claim 3 further characterized in that the second conveying means is so mounted on the main supporting frame assembly that the axes about which said second conveying means is pivotally mounted substantially intersect one another.

7. The structure of claim 3 further including

means for varying the depth of cut of the cutter frame assembly,

and depth of cut variation means being operatively connected to the cutter frame assembly and having connecting means connected to lifting means associated with the road vehicle whereby the cutter frame assembly may be elevated above, and returned to, an established trench cutting position without operating the depth of cut variation means.

8. The structure of claim 7 further characterized in that

the means for varying the depth of cut of the cutter frame assembly includes an adjustable link which is pivotally connected to the cutter frame assembly.

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# UNITED STATES PATENT OFFICE

# CERTIFICATE OF CORRECTION

Patent No. 3,392,464 July 16, 1968

Raymore D. MacDonald

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 8, line 35, after "is" insert -- of --. Column 11, line 41, claim reference numeral "2" should read -- 3 --. Column 12, line 20, "and" should read -- said --.

Signed and sealed this 30th day of December 1969.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents