United States Patent

Brown

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[45] **Sept. 26, 1972**

[54] **FINE GRADING DEVICE FOR RUBBER TIRE ROAD GRADER**

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[52] **U.S. Cl.** **172/4.5,** 172/72, 172/785, 37/108

[51] **Int. Cl.** **E02f 3/76,** A01b 49/02, E02f 3/12

[58] **Field of Search**.....172/785, 779, 72, 71, 4.5, 172/784; 37/108

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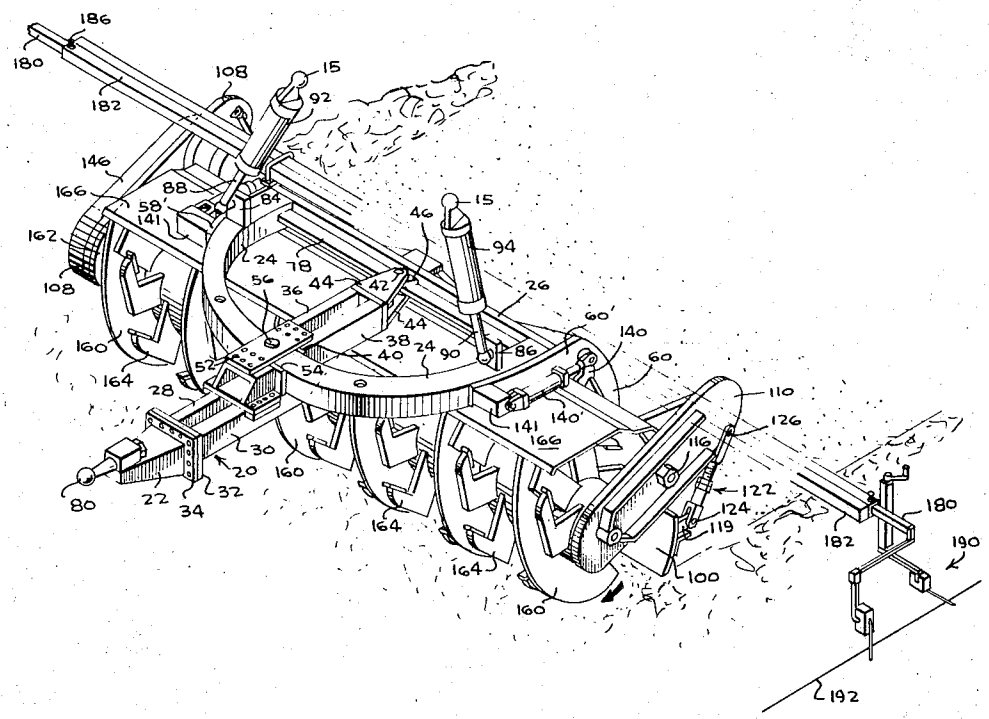
[57] **ABSTRACT**

A grading blade and parallel rotary auger are supported on an auxiliary frame transversely with respect to a grader vehicle from which the frame is supported with the auger being connected to the blade for unitary pivotal movement about a pivot point on the frame between the front of the blade and the rear of the auger in general vertical alignment with the cutting edge of the blade so that the height of the auger can be pivotally adjusted by hydraulic cylinder means with respect to the cutting edge of the blade for differing soil conditions by pivoting the auger and blade with there being a negligible vertical displacement of the cutting edge of the blade; an automatically operable control means actuates hydraulic cylinders supporting the auxiliary frame from the vehicle in response to signals from a guide line extending along the path of movement of the vehicle for maintaining the cutting edge of the blade at a given elevation with respect to the guide line regardless of the height of the auger with respect to the cutting edge of the blade as adjusted by the operator for differing soil conditions.

14 Claims, 7 Drawing Figures



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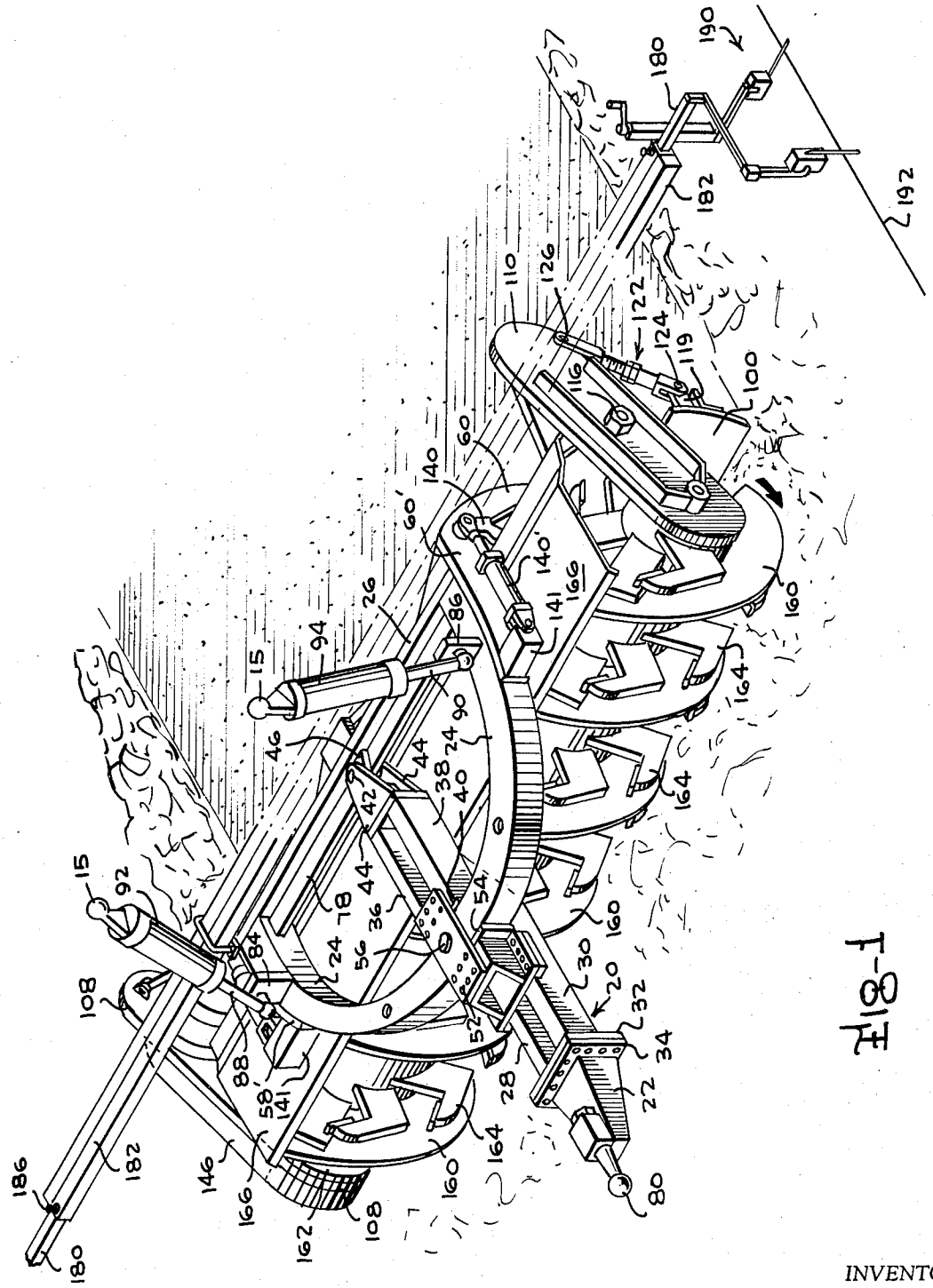

FIG. 1

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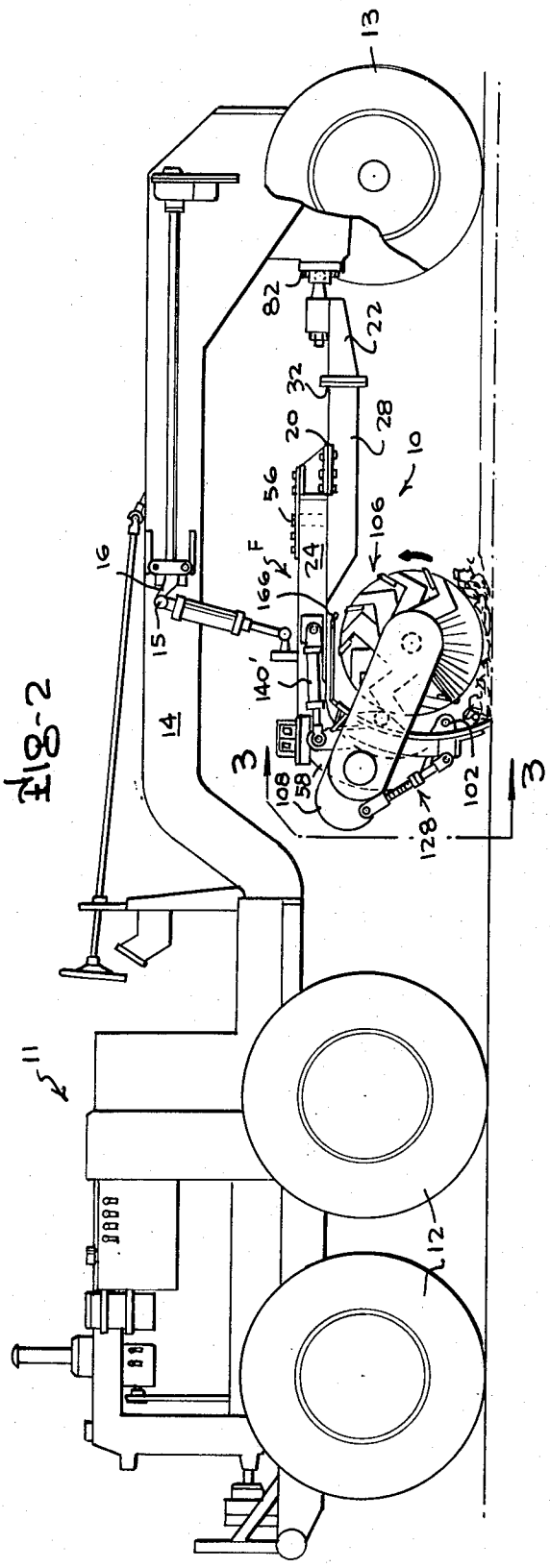

FIG-2

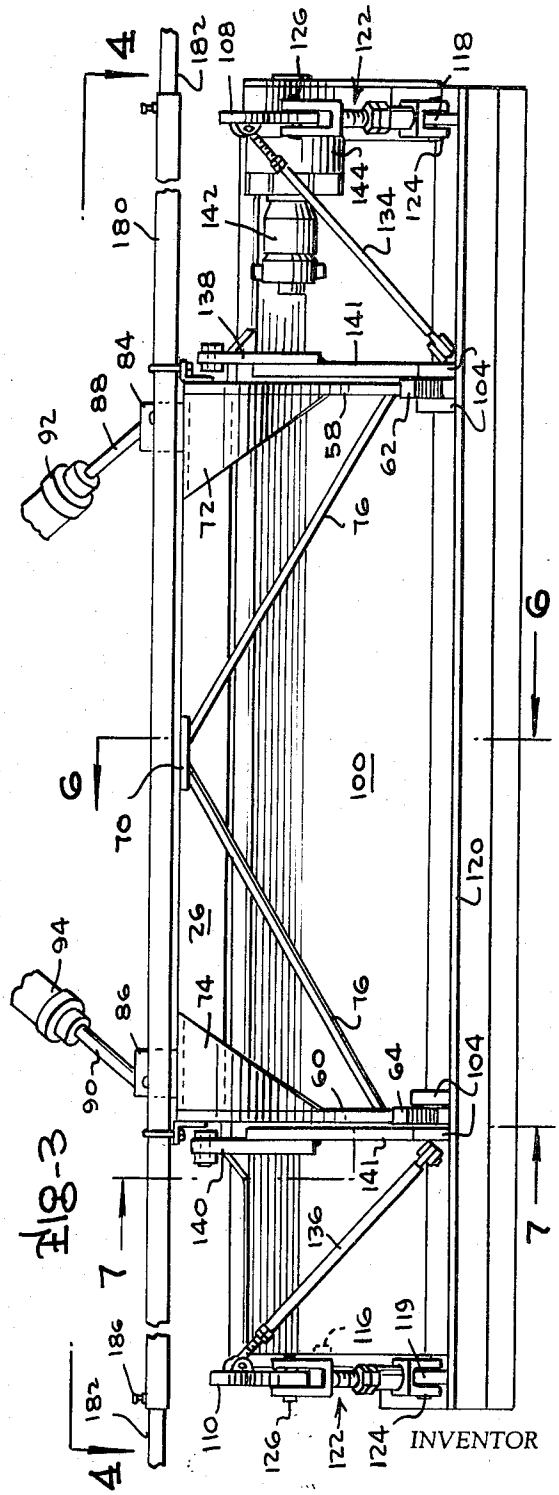

FIG-3

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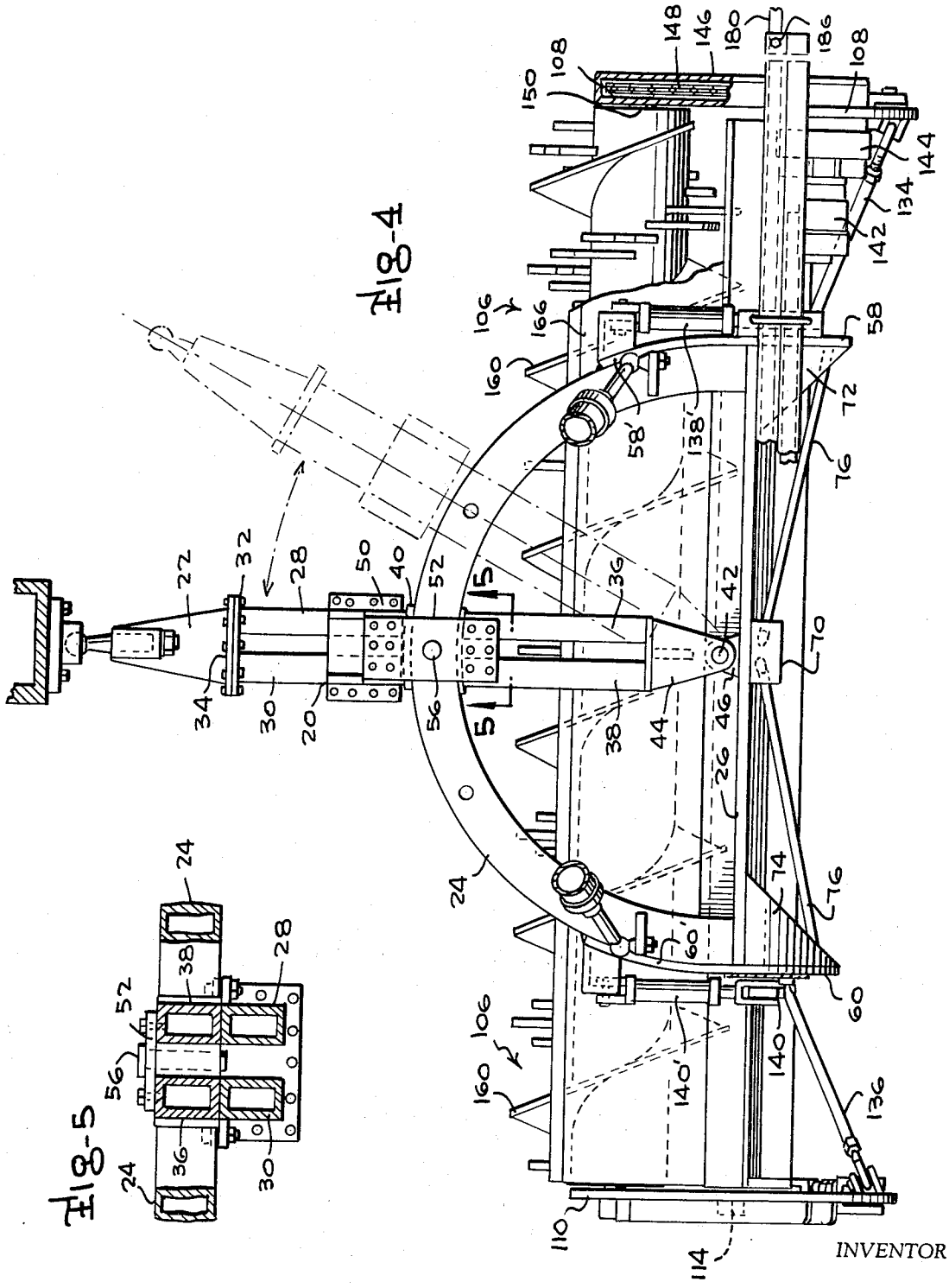

FIG 8-4

FIG 8-5

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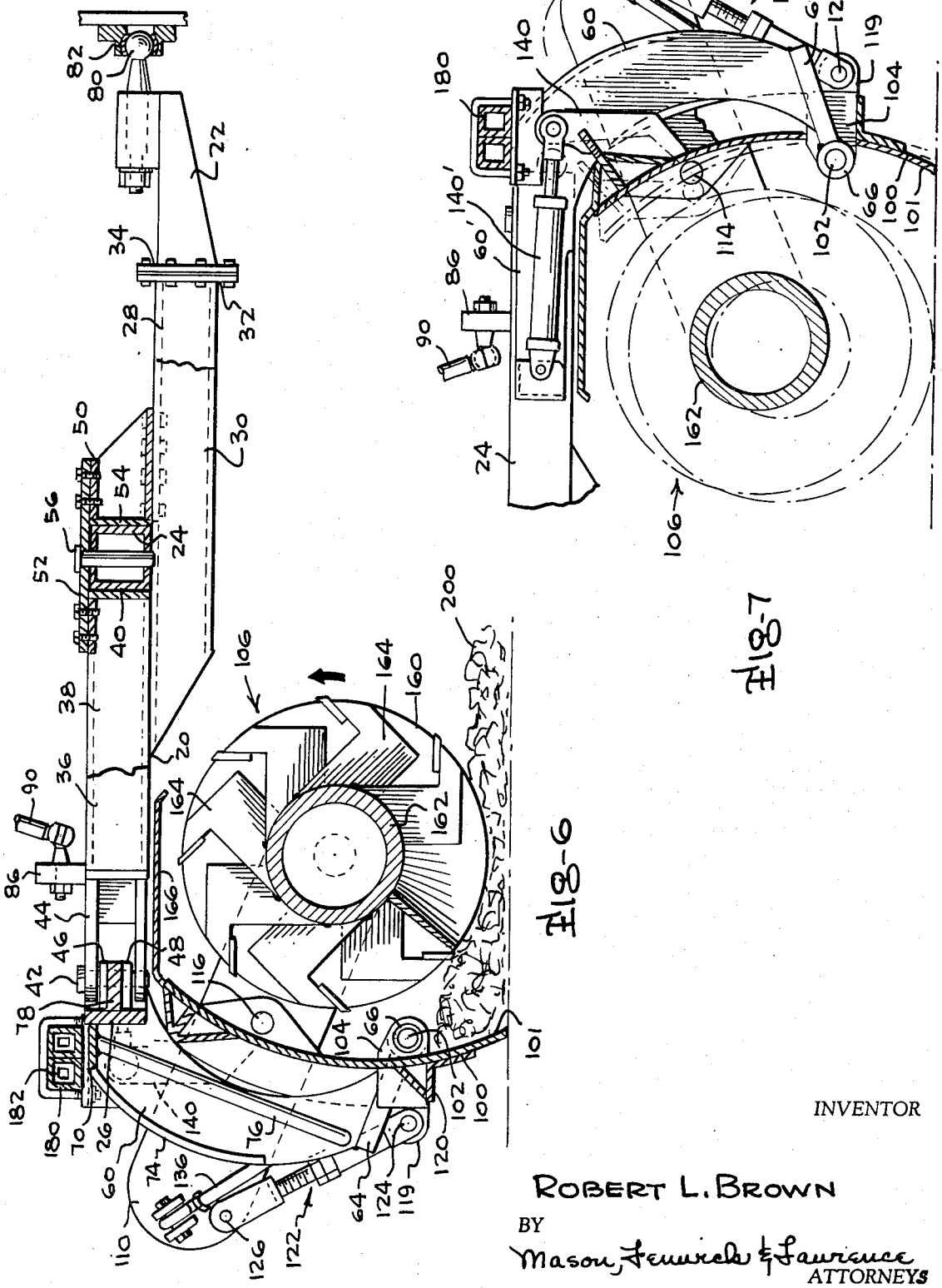

FIG-7

FIG-6

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FINE GRADING DEVICE FOR RUBBER TIRE ROAD GRADER

The subject invention is directed to the field of earth moving equipment and is specifically directed to a highly accurate fine grading device connectable for use on a conventional road grader.

The need for highly accurate grading means for obtaining a graded surface with a minimum amount of variation from a desired height has resulted in numerous devices directed toward this need.

Unfortunately, the prior known systems have frequently failed to provide adequate accuracy in maintaining a desired grade level notwithstanding the fact that such machines have been extremely complicated and consequently expensive to manufacture and maintain. Moreover, many of the prior known systems have been in the form of unitary machines comprising a driven support vehicle with the grading means fixed to the vehicle and supported therefrom. Consequently, such devices have been much more expensive than would be the case if the grading means per se could be connected to a conventional vehicle such as a conventional grader.

The obvious desirability of being able to mount a grading attachment on a conventional grader is complicated by the large number of conventional graders of different sizes, models and manufacturers which are presently in use.

Therefore, there has been an unmet need prior to this invention for a highly accurate fine grading device capable of providing a fine graded surface within minimum tolerances but also being capable of use with conventional currently available grading equipment.

It is the object of this invention to provide a new and improved fine grading device capable of high grading accuracy and also capable of being mounted on a conventional road grading machine.

Obtainment of the object of this invention has been achieved through the provision of a grading device which can be attached to a conventional road grader and which includes a blade extending transversely across the path of movement of the grader with a rotary auger being closely spaced forwardly of the blade. The rotary auger is continuously driven by hydraulic motor means for removing the major portion of the earth in front of the blade and depositing it alongside the work path as the grader moves along the surface being graded. In fact, optimum grading accuracy is obtained by having the blade remove only a small percentage of the total earth being removed during the passage of the device along the work path.

The auger and the blade are unitarily connected together on an auxiliary support frame for vertical adjustment by automatically controlled hydraulic cylinder means which is controlled by a guide line stretched along each or either side of the work path. In practice, the lower or cutting edge of the blade should always be agiven fixed distance below the guide line. This fixed distance is maintained by constant monitoring of the guide line by conventional means as the machine moves along the work path and consequent control of the cylinders supporting the blade and auger. However, it has been observed that optimum grading accuracy can best be obtained in different soil conditions by varying the height of the auger with respect to

the cutting edge of the blade. This height variation is manually maintained by the operator of the device in accordance with the nature of the soil through which the blade and auger are being moved. However, this adjustment of the height of the auger with respect to the blade should be made with a minimum amount of vertical displacement of the lower edge of the blade in order to maintain a fixed vertical distance between the lower edge of the blade and the guide line. In other words, the vertical distance between the lower edge of the auger and the lower edge of the blade which determines the amount of bite that the auger takes of the earth in the work path as it is slowly advanced along the work path should be adjustable with a minimum variation in the height of the blade cutting edge.

Obtainment of a substantial degree of auger adjustment with little or no blade vertical height variation is achieved by this invention through the use of a unitary connection between the blade and the auger so that they are supported by a unitary framework with this framework being mounted for pivotal movement about an axis spaced substantially in vertical alignment with the cutting (lower) edge of the blade forward of the front face of the blade between the blade and the auger. The pivot axis is also in substantial horizontal alignment with the axis of rotation of the auger. Consequently, this critical location of the pivot axis provides a substantial vertical displacement of the auger with respect to the blade when the blade and auger are unitarily pivoted with practically no vertical displacement of the blade occurring.

The entire inventive assembly can be attached to conventional existing control arms of a conventional road grader by the automatically controlled double-acting hydraulic cylinders connected to ball and socket connectors on the grader. The front of the auxiliary frame is also connected to the grader by conventional ball and socket arrangement. The ball and socket connectors are those that are currently employed for supporting a conventional blade frame on road graders presently in use. Consequently, the fine grading attachment comprising the subject matter of this invention is interchangeable with the conventional blade assembly on the presently known road graders. However, the device could also be supported on a specially designed vehicle if desired.

Improved results obtained by this invention are due largely to the fact that the invention effectively enables the elimination of all slippage of the rear drive wheels of the grader which are passing over the surface being graded. Such slippage or spinning of the wheels creates indentations in the finished surface and causes the entire machine to settle downwardly so suddenly that it is difficult for the automatic control device system to react in time to maintain a finished surface that is smooth and at the correct elevation. The adjustably mounted rotary auger preceding the cutting edge of the blade is vertically adjustably mounted so that the cutting edge of the blade removes only a small amount of material from the surface being graded and the forward driving power conveyed through the drive wheels is consequently substantially reduced. Moreover, the auger bite can be adjusted to compensate for variations in density or hardness of the soil to prevent spinning of the wheels as the grader moves from one type of soil to

another. Since the auger removes the major portion of the soil being removed along the work path and this removal is effected entirely by virtue of rotation of the auger, the resistance to forward movement of the grader is much less than would be the case if the blade were the sole device for removing the soil above the grade level.

It is essential that the grader be capable of advancing at a very slow rate of speed so that the automatic control device for maintaining the height of the blade at the desired elevation have sufficient reaction time in which to make corrective movements. This slow speed is accomplished by using a very low travel gear or other slow drive devices on the grader and high power requirements of the hydraulic motor for driving the auger are met by adding an auxiliary high capacity hydraulic pump to the motor grader, power take-off shaft.

Other objects and advantages of the subject invention will be better understood from the following specification and claims when read in light of the accompanying drawings in which:

FIG. 1 is a perspective view of the preferred embodiment of the inventive concept;

FIG. 2 is a side elevational view of the preferred embodiment with portions removed for clarity;

FIG. 3 is a plan view of the preferred embodiment;

FIG. 4 is a sectional view taken along lines 4—4 of FIG. 3;

FIG. 5 is a sectional view taken along lines 5—5 of FIG. 4;

FIG. 6 is a sectional view taken along lines 6—6 of FIG. 3; and

FIG. 7 is a sectional view taken along lines 7—7 of FIG. 3.

Turning first to FIG. 2, it will be seen that the preferred embodiment of the invention, which is generally designated **10**, is associated with a conventional road grader **11** having drive wheels **12** and steering control wheels **13** on an elongated main frame member **14** for supporting work attachments depending therefrom. Additionally, the grader is provided with a drive motor for driving wheels **12** and the various engine accessories. The preferred embodiment **10** of the invention is suspended from the main frame **14** of the conventional grader by ball and socket connections **15** attached to control arms **16** (only one of which is shown in FIG. 2) which extend along each side of frame **14**. Arms **16** are normally employed for supporting a conventional grader blade.

The preferred embodiment includes a main attachment frame generally designated F and which includes a horizontal draw bar **20**, an end connector frame member **22** (FIG. 6), a semi-circular arcuate frame member **24** (FIG. 4) and a transversely extending main cross piece **26** (FIGS. 1 and 4) which provides support for the other components of the grading attachment.

Draw bar **20** comprises a forward portion consisting of first and second parallel channel or box frame members **28** and **30** (FIG. 1) which have a connector plate **32** welded to their forward ends. A second connector plate **34** is welded to the rearmost end of the end connector frame **22** and the connector plates **32** and **34** are bolted together to provide a fixed rigid connection between the elements **28, 30** and **22**. The purpose of providing the detachable connection between these elements is to reduce the overall size to enable loading of the attachment upon a truck for transportation. Otherwise the length of the components would exceed most statutory width lengths and could not be legally transported in many states. Additionally, a plurality of connector frame members **22** having different length and height dimensions can be provided for enabling connection of the device to different road graders in which the positions of the female pivot socket **82** will vary. Moreover, the size of the male connector ball **80** can also be varied in order to accommodate various female pivot sockets of different sizes. Consequently, the device will be interchangeably mountable upon a wide variety of road graders having different height female pivot sockets and various frame lengths.

The rearmost portion of the draw bar **20** is formed of a pair of identical frame components **36** and **38** connected on their forward ends by a curved plate **40** (FIG. 6) and which are connected to the upper surface of the frame components **28** and **30** respectively to extend rearwardly for pivotal connection to the transverse main cross piece **26**. This pivotal connection of components **36** and **38** to cross piece **26** is enabled by means of a pivot pin **42** mounted in a bracket **44** extending from the rearmost ends of members **36** and **38** and a pair of bracket plates **46** and **48** welded to the front surface of cross piece **26**. Pin **42** extends through bracket **44** and plates **46, 48** as shown in FIG. 6.

A brace frame **50** is attached to the upper surface frame components **28** and **30** and has a top plate **52** connected to the rear of the components **36, 38**. A curved plate **54** completes a curved opening through the brace frame through which arcuate frame **24** extends. A pin **56** is provided to extend downwardly through a hole in plate **52** and through the arcuate frame **24** to lock the arcuate frame **24** in position. However, removal of pin **56** from the arcuate frame **24** allows frame **24** etc. to pivot about pin **42** by virtue of the fact that the ends of frame **24** are weldingly connected to each end of the main transverse frame component **26**.

First and second curved vertically extending pivot support plates **58** and **60** are respectively welded to the extreme ends of the main transverse frame component **26** and respectively have horizontal arms **58'** and **60'** embracingly curving around the rear portion of the arcuate frame member **24** as shown in FIG. 1. The horizontal arms **58'** and **60'** are welded to the external surface of the curved frame **24** as shown in FIG. 4.

Plates **58** and **60** extend downwardly to terminate at their lowermost ends in pivot shoe means **62** and **64** (FIG. 3) respectively welded to their lower ends. The pivot shoe means **62** and **64** respectively support identical bearing sleeves **66** (FIGS. 7 and 6) which provide a pivotal support for a blade assembly to be discussed hereinafter.

It should be noted at this point that the main attachment or auxiliary frame F consists of a unitary structure comprising the arcuate frame **24**, the main transverse member **26**, draw bar elements **36, 38, 28** and **30** and the pivot support plates **58** and **60**. Additional strength and rigidity is provided the frame F by means of a rearwardly extending brace plate **70** extend-

ing rearwardly from the main transverse frame component **26** adjacent the entire middle thereof, gusset plates **72** and **74** respectively welded adjacent each end of member **26** and to the pivot support plates **58** and **60** as best shown in FIG. **3** and a pair of rod brace members **76** welded to the lower ends of the pivot support plates **58** and **60** and to plate **70** on the middle portion of member **26** as clearly shown in FIG. **3**. Additionally, a forwardly extending linear brace plate **78** extends forwardly from the main transverse frame component **26** along the front face thereof and along the entire length thereof as best shown in FIG. **1**.

Support for the forwardmost end of the frame F is provided by a pivot ball type male connector member **80** attached to the forward end of the connector frame **22** and receivable in a conventional female pivot socket **82** on the grader frame as best shown in FIGS. **2** and **6**. The rear portion of the frame F is supported by ball and socket connectors on support bracket plates **84** and **86** extending upwardly from the upper surface of arcuate frame **24** and connected to piston rods **88** and **90** of control cylinders **92** and **94** which have ball socket connectors **15** attached to their uppermost ends. The ball and socket connectors **15** are connected to the control arms **16** of the grader as has been noted previously.

Bearing sleeves **66** which are welded to the forward ends of pivot shoes **62** and **64** provide support for a scraper blade **100** which extends perpendicular to the path of travel of the grader **11**. Support for blade **100** is provided by a pair of pivot pins **102** which are each mounted on the forward end of and between a pair of bracket plates **104**. Bracket plates **104** are attached to blade **100** and extend forwardly from the front face **101** of blade **100** as shown in FIG. **7**. It should be noted that the pivot pins **102** are located in substantial vertical alignment with the lower edge of the blade **100**. It should also be noted that the pivot shoe members **62** and **64** each extend forwardly between two of the plates **104** through respective openings in blade **100** to terminate in front of the forward surface **101** of the blade in the manner illustrated by pivot shoe **64** in FIGS. **6** and **7**. It is this construction which provides for pivotal movement of the blade **100** about the axes of pins **102**.

A rotary auger **106** is supported for rotation in bearings mounted in auger support plates **108** and **110** which are respectively pivotally connected to blade **100** by pins **114** and **116** extending from brackets mounted adjacent the top of the front face **101** at each end of the blade **100**. The purpose of the pins **114** and **116** is to provide for initial pivotal adjustment of the auger support plates **108** and **110** and auger **106** supported thereon with respect to the blade **100**. Following such adjustment, the support plates **108** and **110** and the supported auger **106** are locked in fixed relationship with respect to the blade **100**.

FIGS. **6** and **7** illustrate the manner in which the auger **106** is initially adjustably positioned with respect to the blade **100**. Specifically, the rear side of blade **100** is provided with a pair of rearwardly extending adjustment brackets **118** and **119** (FIG. **3**) which are welded to the blade adjacent each end thereof above a rear brace plate **120** extending along the length of blade **100** on the rear face of the blade. Identical rod and sleeve adjustment means are pivotally connected to the brackets **118** and **119** by a pivot pin **124** and to the upper or rearmost end of the support plates **108**, **110** by a pivot pin **126**.

Adjustment of the two adjustment means **122** connecting each end of blade **100** to the auger support plates **108**, **110** serves to pivot the auger support plates **110** and **108** about the pins **114** and **116** fixed to the ends of blade **100**. Consequently, the position of the auger **106** is adjusted with request to blade **100** is an obvious manner as shown in FIG. **7**. Once the desired adjustment has been achieved, no further adjustment is normally necessary and blade **100**, auger support plates **108**, **110** and auger **106** constitute a unitary structure. Additional threaded rod members **134** and **136** (FIG. **3**) extending between the blade and the auger support plates **108** are provided for locking the blade and auger in fixed relative position following the adjustment thereof.

It is emphasized that the blade **100**, auger support plates **108**, **110** and auger **106** are consequently fixedly connected to each other to constitute a unitary structure. This unitary structure is pivotally supported by coaxial pins **102** fixed to blade **100** and pivotally extending through sleeves **66** on the forward ends of pivot shoes **64** and **62** as was previously discussed. Therefore, the auger **106** and the blade **100** which are connected by the elements **108**, **110** and **122** pivot about the axis of pins **102**.

Pivotal movement of the unitary blade-auger structure **100**, **106** etc. for lifting or lowering the auger is enabled by first and second unit adjusting places **138** and **140** which are welded to the rear side of the blade **100** adjacent back brace plates **141** as best shown in FIG. **3**. The upper ends of plates **138** and **140** are respectively connected to cylinder **138'** and **140'** which are pivotally connected to frame members **141** extending from arcuate frame **24** as shown in FIG. **1**.

Auger **106** is driven by a hydraulic drive motor **142** (FIGS. **1** and **3**) through a step-down transmission **144** connected to the auger support plate **108**. The output of step-down transmission **144** is to a drive sprocket in a chain housing **146** on the right side of support plate **108** as viewed in FIG. **4**. A chain **148** is driven by the output from the transmission **144** and extends about a sprocket on an auger drive shaft **150** extending through auger support plate **108**. Consequently, rotary movement is imparted to the auger **106** from the motor **142**. A separate identical hydraulic motor could be mounted on the plate **110** if such should be desired; however, it has been found that a single high power motor **142** is adequate for driving the auger. However, a great deal of power is required for driving the auger and it is necessary to provide an auxiliary hydraulic pump to be driven by the grader motor. The hose connections etc. for operating the hydraulic motor **142** are not shown in the drawings since such would merely serve to clutter the drawing and obscure the true invention.

Auger **106** comprises a spiral plate **160** extending outwardly from a heavy body cylinder **162** along the entire length of the body cylinder. Additionally, the auger is provided with a plurality of intermediate digger teeth **164** positioned intermediate the adjacent convolutions of the spiral blade **160** which extend outwardly radially approximately one or two inches (depending upon soil conditions) beyond the outer

periphery of blade **160** for dislodging rocks etc. as the auger is rotated in the direction of the arrow in FIG. 6. A shield **166** extends forwardly from the upper edge of the blade **100** to prevent such material from being thrown rearwardly toward the operator by the rotation of the auger **106**.

A control means support beam **180** extends outwardly from a hollow box channel **182** connected to the top of the main transverse member **26**. Such a beam **180** extends from each side of the device and is adjustably retained by clamping means **186** associated with the channel **182** in an obvious manner. Conventional line detecting switch means, sensors or tracers **190** are supported on the ends of the beam **180** for detecting a conventional wire or line **192** extending along each side of the path of movement of the machine. The detecting means **190** etc. is conventional and forms no part of this invention. However, it should be understood that the detecting means **190** etc. provides electric over hydraulic signals to the supporting cylinders **92** and **94** for raising and lowering the blade to maintain the lower or cutting edge of the blade **100** a fixed vertical distance below the guide lines **192**.

It has been found that optimum accuracy in grading can be obtained by adjusting the pivotal position of the auger **106** and the blade **100** by actuating the pivot cylinders **138'** and **140'** for pivoting the plates **138** and **140** along with the blade **100** and auger **106**. Such adjustment is normally made by the operator as the device goes through varying types of soil. However, while this adjustment causes a substantial variation in the height of auger **106**, substantially no vertical variation of the lower or cutting edge of the blade **100** is caused by such pivotal adjustment as is evidenced from inspection of FIG. 7 of the drawings which illustrates two different positions of the blade and the auger as would be caused by actuation of cylinders **138'** and **140'** to vary the height of the auger **106**. Such adjustment serves to vary the bite taken by the auger as it is moved forwardly through the soil **200** being graded. It has been found that optimum grading accuracy can easily be obtained with the auger **106** removing the majority of the soil and only a small percentage of the soil being removed by blade **100**. Normally, the best results are obtained with the lowermost portion of the digger teeth **164** on auger **106** being spaced approximately even with or slightly above the lower or cutting head edge of blade **100**. Therefore, the subject device serves to provide an extremely accurate grade as the grader **11** is moved slowly forward with the auger **106** rotating in the direction of the arrow in FIG. 2. Auger **106** removes the majority of the earth being graded and blade **100** provides the finishing accuracy. Grader **11** is normally driven at a very slow speed of approximately one mile per hour and auger **106** is rotated at approximately 80 rpm. The necessary slow forward speed of movement requires the use of an extra low gear in the grader.

It should be understood that numerous modifications of this invention will undoubtedly occur to those skilled in the art; however, the invention is to be limited solely by the appended claims.

I claim:

1. A highly accurate grading means supported on a main attachment frame supported on a power driven vehicle having a main frame and drive means for movement along a path to be graded, said grading means comprising elongated blade means having a lower cutting edge supported by pivotal support means connected to said main attachment frame, said blade means extending substantially transverse to the path of travel of said vehicle, linkage connecting means connected to and extending from said blade means, elongated rotary earth cutting auger means supported by and connected to said linkage connecting means having an axis of rotation parallel to said blade means positioned for rotation immediately forward of said blade means, control means for moving said auxiliary support frame vertically for maintaining the lower edge of the blade at a desired elevation, said pivotal support means supporting said blade means, said linkage connecting means and said rotary auger means for unitary pivotal movement about a pivot axis positioned forward of the front surface of said blade means between the front surface of said blade means and the axis of rotation of said rotary auger and in substantial vertical alignment with the lower cutting edge of said blade, and actuator means for unitarily pivoting said auger and said blade about said pivot axis for adjusting the height of said auger with respect to the surface being graded without any substantial change in the elevation of the lower cutting edge of said blade with respect to the surface being graded.

2. The invention of claim 1 wherein said earth-cutting auger includes a plurality of radially extending digger teeth and a spiral blade.

3. The invention of claim 2 wherein said pivotal support means supporting said blade means and rotary auger for unitary movement includes first and second vertically extending spaced pivot support plate means extending downwardly from said attachment frame along the rear side of said blade, pivot shoe means extending forwardly from the lower edge of each of said pivot support plate means through a respective aperture in said blade and terminating forwardly of the forward surface of said blade, a pivot pin means connecting the forward end of each of said pivot shoes to bracket plates extending forwardly from said blade so that said blade and auger are pivotally supported by said pin for pivotal movement by said actuator means.

4. The invention of claim 1 wherein said pivotal support means supporting said blade means and rotary auger for unitary movement includes first and second vertically extending spaced pivot support plate means extending downwardly from said attachment frame along the rear side of said blade, pivot shoe means extending forwardly from the lower edge of each of said pivot support plate means through a respective aperture in said blade and terminating forwardly of the forward surface of said blade, a pivot pin means connecting the forward end of each of said pivot shoes to bracket plates extending forwardly from said blade so that said blade and auger are pivotally supported by said pivot pin for pivotal movement by said actuator means.

5. The invention of claim 2 wherein said control means for moving said attachment frame comprises first and second hydraulic cylinders connected between the main frame of the vehicle and said attachment frame whereby actuation of said cylinders serves to vertically move said blade and said auger.

6. The invention of claim 5 wherein said linkage connecting means upon which said rotary auger means is mounted for rotation comprises first and second auger support plates each respectively pivotally connected intermediate its end to each end of said blade for pivotal movement about an axis transverse to the path of movement of said vehicle with said auger being mounted for rotation on one end of said plates and adjustably extendable and lockable adjustment means connecting said blade and the other ends of said first and second auger support plates for fixedly locking the relative position of said auger and said blade in a desired position of adjustment.

7. The invention of claim 6 wherein said attachment frame means includes a transversely extending main cross piece, a semi-circular arcuate frame member connected adjacent each end of said transversely extending main cross piece and having its arcuate portion extending forwardly therefrom, draw bar means extending forwardly from a pivotal connection connecting said draw bar means to the middle of said main cross piece, pivotal connection means connecting the forward end of said draw bar to said vehicle, and connecting means connecting said forwardly extending portion of said arcuate frame to said draw bar means with said first and second hydraulic cylinders extending from said vehicle being connected to said arcuate frame for supporting said arcuate frame.

8. The invention of claim 7 wherein said means connecting said arcuate frame to said draw bar comprises removable pin means which, when removed, permits pivotal movement of said draw bar with respect to said arcuate frame and said transversely extending main cross piece to reduce the overall width of the grading means by permitting movement of the auger and blade to a canted position relative to the axis of the supporting vehicle for movement to a different location.

9. The invention of claim 8 wherein said draw bar comprises a forward portion consisting of first and second parallel frame members, a connector frame removably connected to the forward end of said parallel frame members and a pair of rear frame components extending parallelly from the upper surface of said forward parallel frame components for connection to said transversely extending main cross piece.

10. The invention of claim 1 wherein said actuator means for unitarily pivoting said auger and said blade about said pivot axis includes first and second hydraulic cylinder means connected between said attachment frame and said blade so that actuation of said first and second cylinder means serves to unitarily pivot said blade, said linkage connecting means and said rotary auger.

11. The invention of claim 10 wherein said pivotal support means supporting said blade means and rotary auger for unitary movement includes first and second vertically extending spaced pivot support plate means extending downwardly from said attachment frame along the rear side of said blade, pivot shoe means extending forwardly from the lower edge of each of said pivot support plate means through a respective aperture in said blade and terminating forwardly of the forward surface of said blade, a pivot pin means connecting the forward end of each of said pivot shoes to bracket plates extending forwardly from said blade so that said blade and auger are pivotally supported by said pivot pin for pivotal movement by said actuator means.

12. The invention of claim 11 wherein said control means for moving said attachment frame comprises first and second hydraulic cylinders connected between the main frame of the vehicle and said attachment frame whereby actuation of said cylinders serves to vertically move said blade and said auger unitarily.

13. The invention of claim 12 wherein said linkage connecting means upon which said rotary auger means is mounted for rotation comprises first and second auger support plates each respectively pivotally connected intermediate its ends to each end of said blade for pivotal movement about an axis transverse to the path of movement of said vehicle with said auger being mounted for rotation on one end of said plates and adjustably extendable and lockable threaded adjustment means connecting said blade and the other ends of said first and second auger support plates for fixedly locking the relative position of said auger and said blade in a desired position of adjustment.

14. The invention of claim 13 wherein said frame means includes a transversely extending main cross piece, a semi-circular arcuate frame member connected adjacent each end of said transversely extending main cross piece and having its arcuate portion extending forwardly therefrom, draw bar means extending forwardly from a pivotal connection connecting said draw bar means to the middle of said main cross piece, pivotal connection means connecting the forward end of said draw bar to said vehicle, and connecting means connecting forwardly extending portion of said arcuate frame to said draw bar means with said first and second hydraulic cylinders extending from said vehicle being connected to said arcuate frame for supporting said arcuate frame.

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