

United States Patent

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[72] Inventor **Kenneth P. Goltz**
Clovis, Calif.
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[73] Assignee **Small Business Administration**
San Francisco, Calif.

[54] DITCH BUILDING MACHINE 11 Claims, 18 Drawing Figs.

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280/43.23, 180/79.2
[51] Int. Cl. E02f 5/02
[50] Field of Search 37/98;
280/82, 83-85, 493-494, 444, 43.23, 34, 492;
180/79.2, 79.2 A

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Primary Examiner—Robert E. Pulfrey
Assistant Examiner—Clifford D. Crowder
Attorney—Julian Caplan

ABSTRACT: A ditch building machine has a front lister on which a prime mover and hydraulic pump are mounted and has a forward extending steering tongue which may be pivoted about its transverse horizontal and vertical axes. Behind the front lister are movable listers pivotally attached about a vertical axis to vary the width of the bottom of the ditch. Behind each movable lister is a moldboard pivoted thereto about both vertical and transverse horizontal axes. The rearward end of each moldboard is supported by a ground wheel which rests on the ground to the outside of the ditch. Structure is provided for controlling the angle of the moldboard relative to the longitudinal horizontal axis of the machine and relative to the horizontal to vary the width and depth of the ditch (and likewise the slope of the sides). Spoil blades are pivotally mounted to the rear of the moldboards to smooth the banks ahead of the rear wheels.

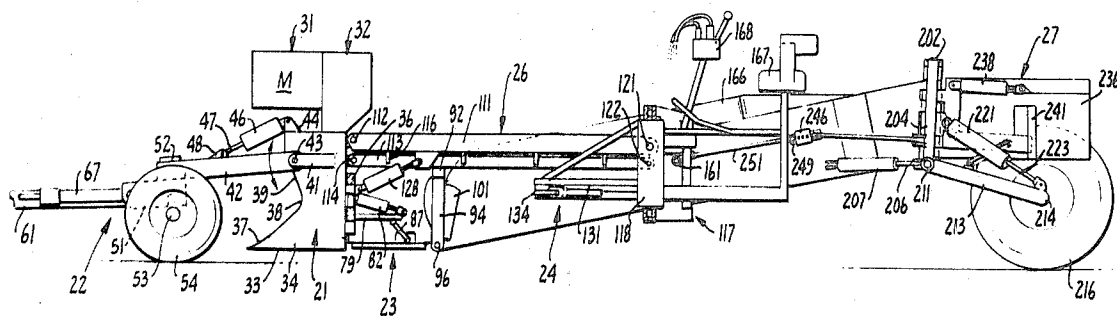


FIG. 1.

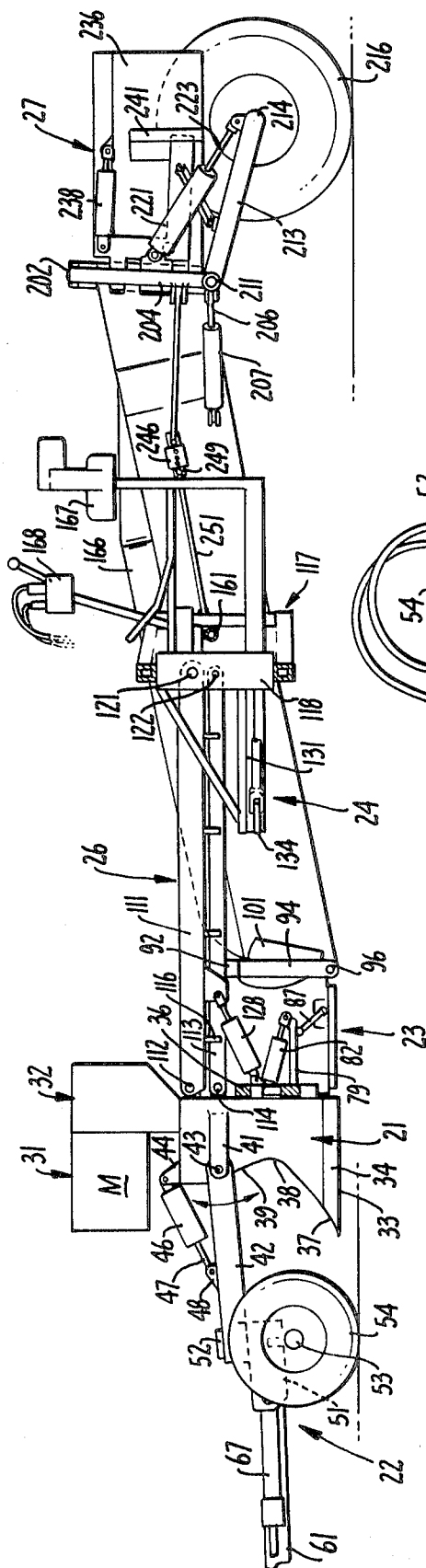
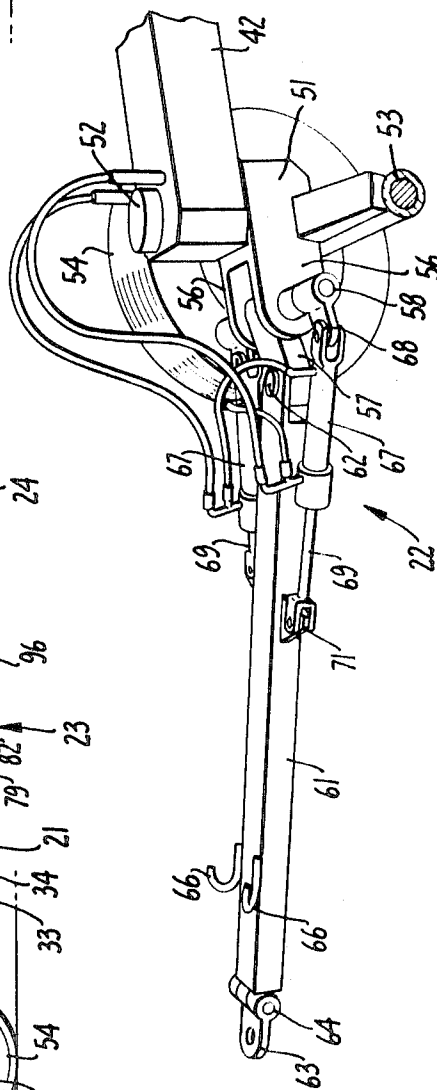


FIG. 3.



INVENTOR.
KENNETH P. GOLTZ
BY *Julian Caplan*
ATTORNEY

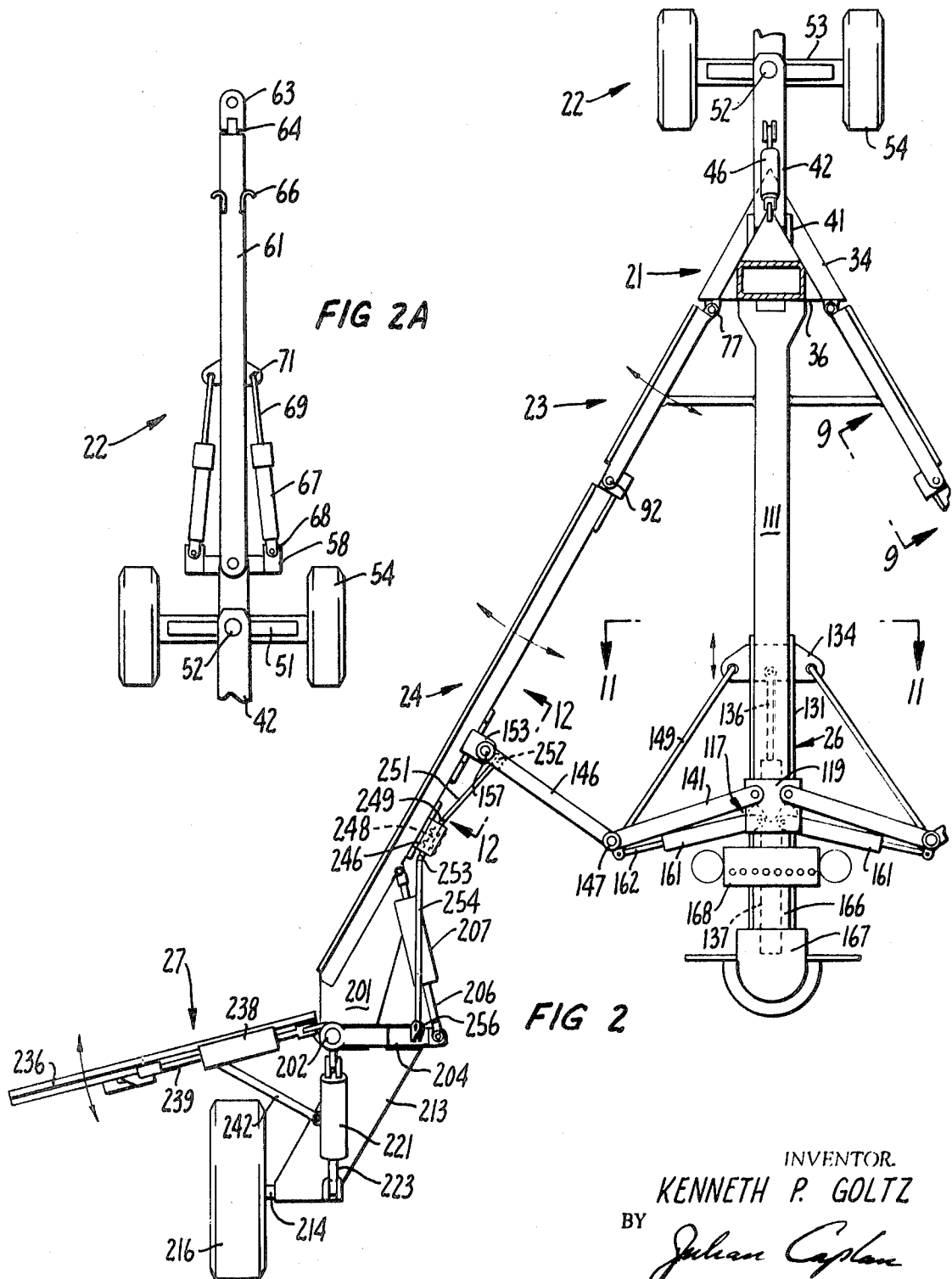


FIG 2

INVENTOR.

KENNETH P. GOLTZ

BY

Julian Caplan

ATTORNEY

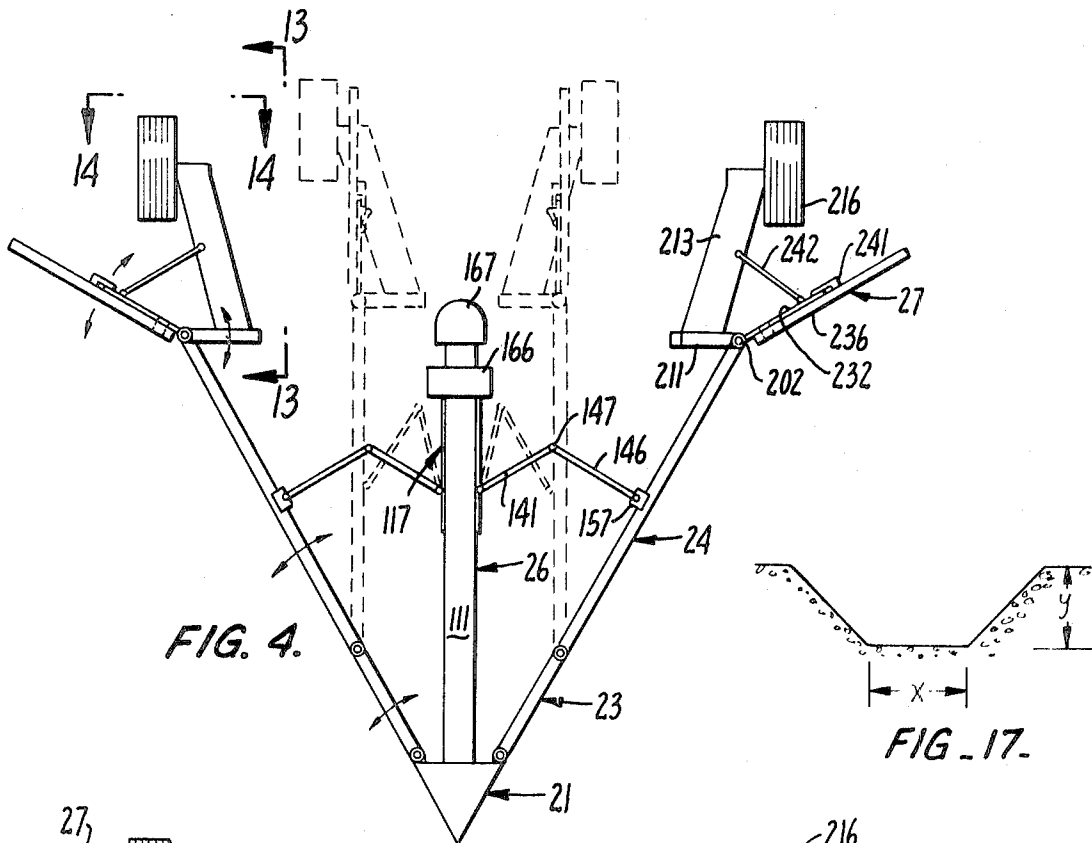


FIG. 4.

FIG. 17.

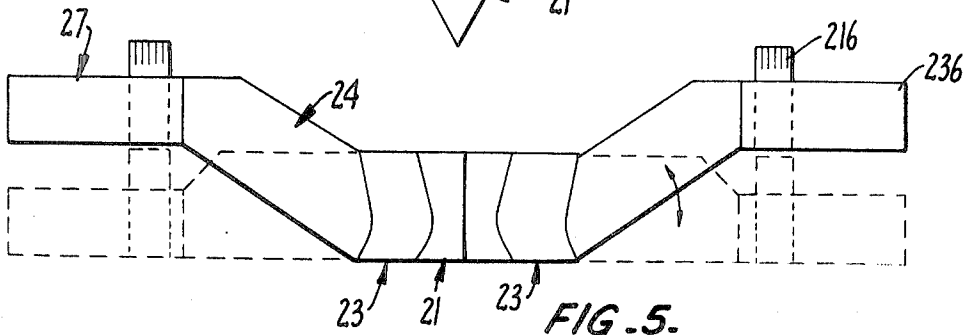


FIG. 5.

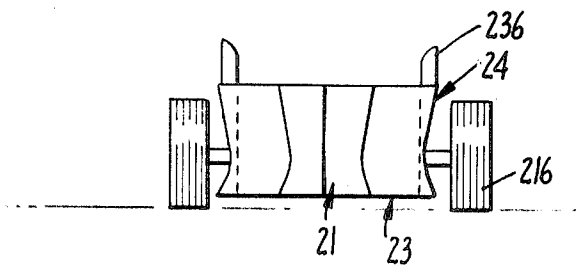
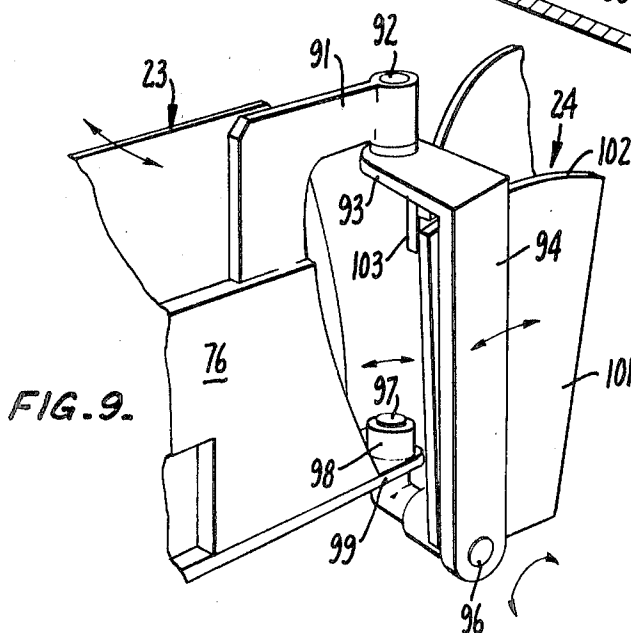
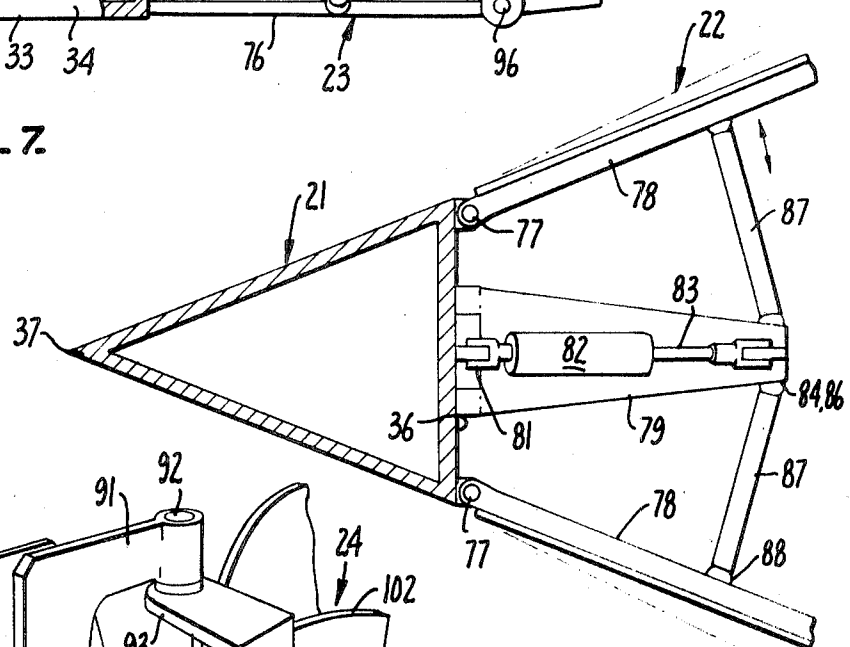
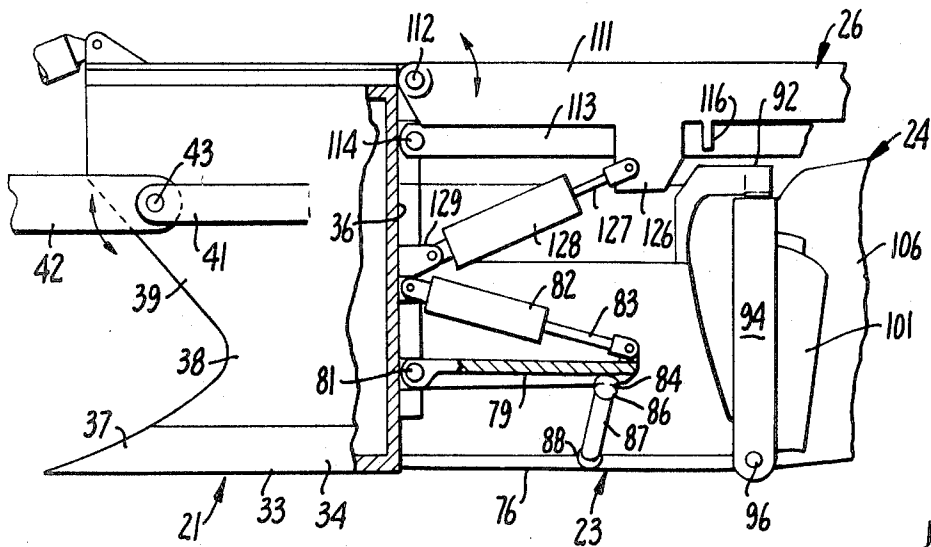


FIG. 6.

INVENTOR.
KENNETH P. GOLTZ
BY *Julian Caplan*
ATTORNEY



INVENTOR.
KENNETH P. GOLTZ
BY *Julian Caplan*
ATTORNEY

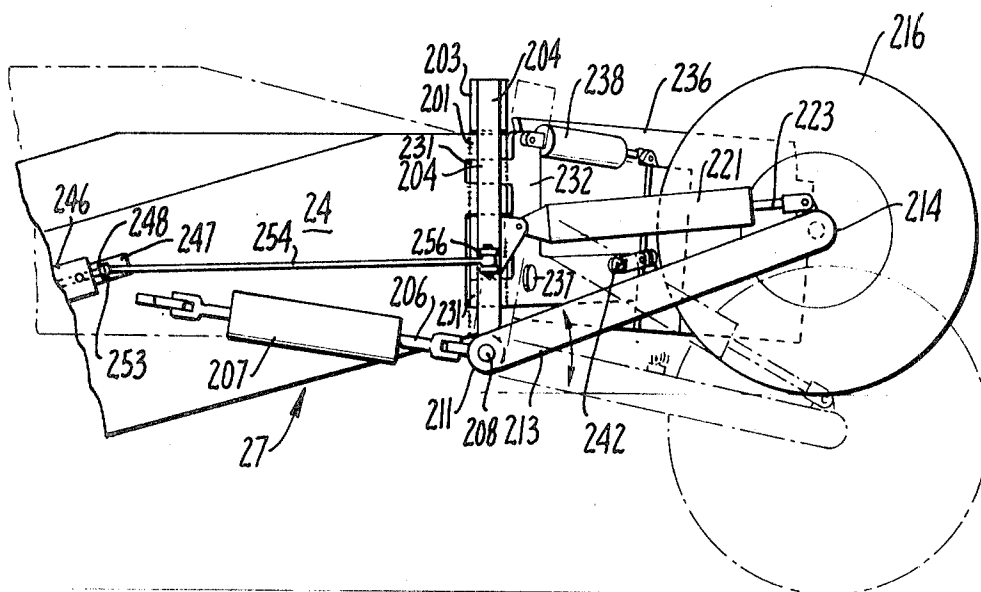


FIG. 13.

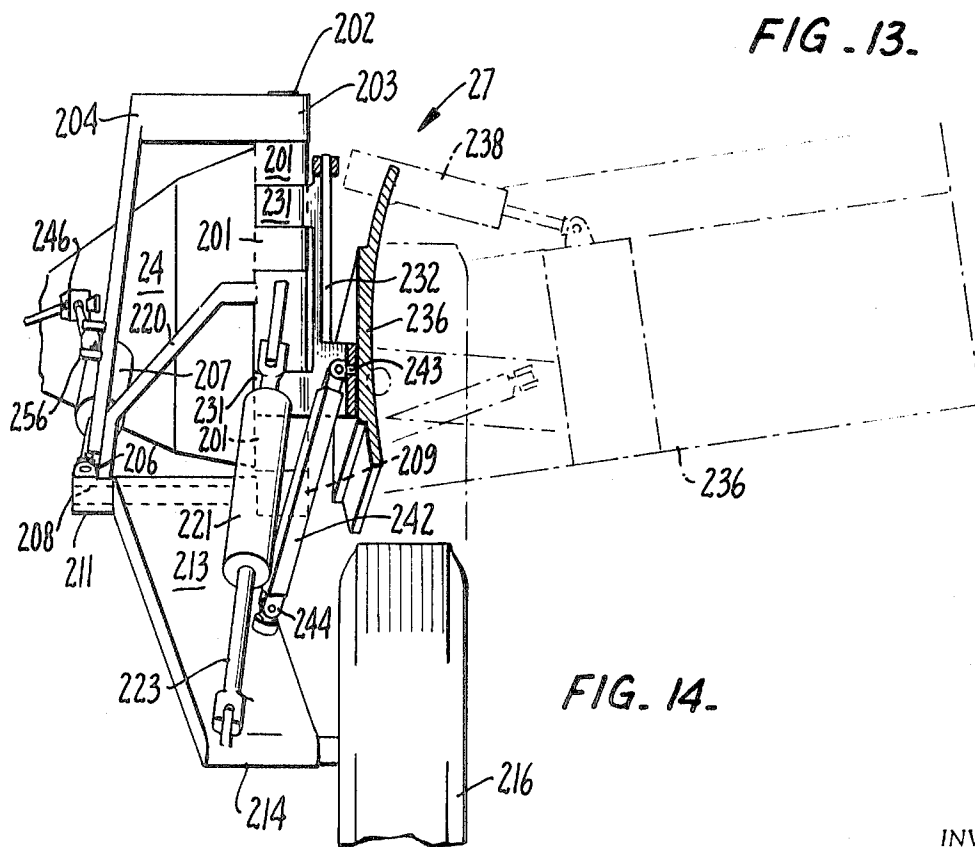


FIG. 14.

INVENTOR.
KENNETH P. GOLTZ
BY *Julian Caplan*
ATTORNEY

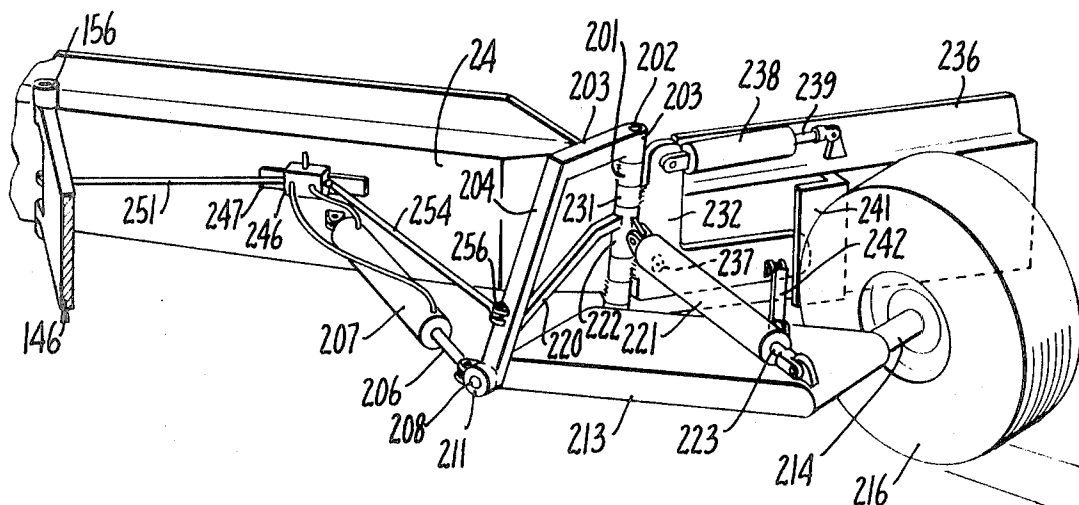


FIG. 15.

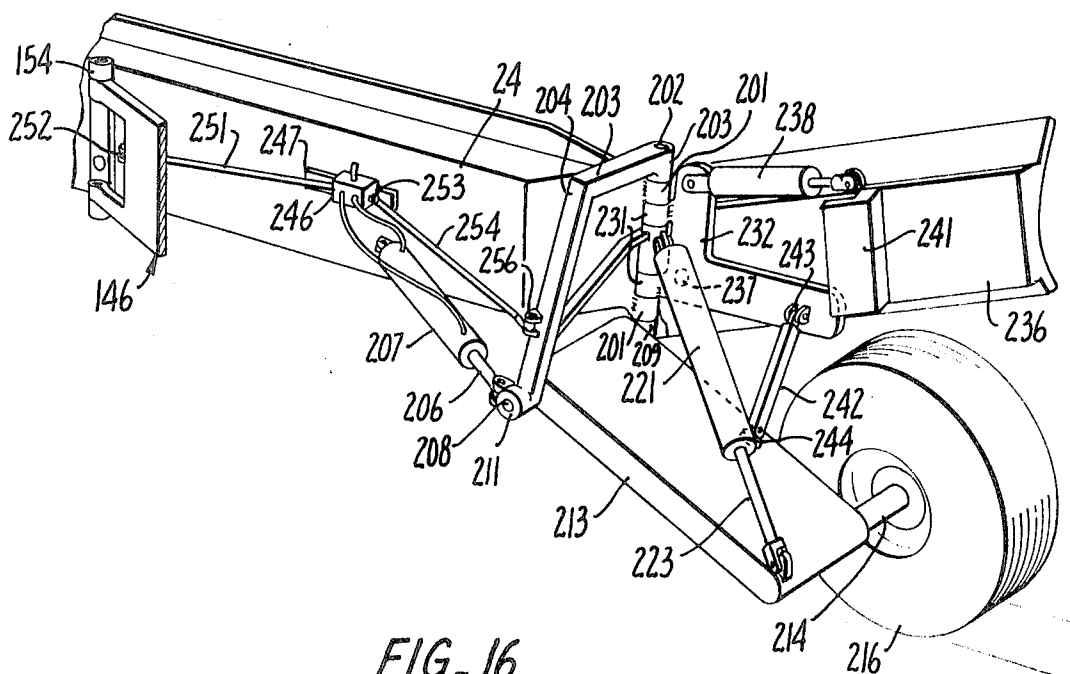


FIG. 16.

INVENTOR
KENNETH P. GOLTZ
BY *Julian Kaplan*
ATTORNEY

DITCH BUILDING MACHINE

This invention relates to a new and improved ditch builder machine. More particularly, the invention relates to a tractor drawn machine which plows a trapezoidal cross section ditch or cleans a previously excavated ditch of the type used for irrigation and the like. Ditch building machines of this general type have a steering section at the front, a fixed lister or plowlike portion, an adjustable lister on either side of the rear of the fixed lister, and a moldboard on each side at the back of each adjustable lister. The fixed and adjustable listers govern the width of the bottom of the ditch and the moldboard governs the width and slope of the sides of the ditch. The present invention comprises improvements in the construction, and particularly in the actuation of the machine parts which have been mentioned.

With respect to the steering portion of the machine, the present invention takes advantage of the balancing and leveling effect of the front axle suspension. Provision is further made during transport of the machine in a truck so that the steering tongue can be turned backwards against the moldboard, thereby reducing the overall length of the machine and facilitating truck transport.

With respect to the adjustable listers, provision is made for a mechanism which enables the machine to accommodate between a 2½ foot and 6 foot bottom width of the ditch. Such adjustability is accomplished by use of a single hydraulic cylinder which acts upon a hinged master plate which is in turn connected by ball and socket joints to the adjustable listers.

A still further feature of the invention is the use of a main frame tube which is hinged about a transverse horizontal pivot to the back of the front lister and is hinged at the rear to a sub-frame containing portions of the actuating mechanism for the moldboards and also containing the operator's seat and controls. The tube is pivoted in conjunction with a parallel bar hinged to the same members as the tube which insures that the rear mechanism is always parallel to the front lister, and since the front lister is horizontal, the rear mechanism which has been described and particularly the operator's seat is also horizontal. The arrangement which has been described further improves the actuation of the spreading and elevating of the moldboards and minimizes danger of collapse of such mechanism. In addition, the mounting of the seat in the fashion which has been described insures that the operator is never elevated as high as the moldboard, a relationship which is of particular value where deep ditches are being dug.

Another feature of the invention relates to the main moldboard hinge, whereby the moldboard is hinged to the movable lister. Such hinge comprises two axes which are perpendicular to each other and intersecting adjacent the bottom rear corner of the adjustable lister. This hinge arrangement has a number of advantages. One such advantage is that the moldboard cutting edges remain closer to the lister cutting edges in shallow and also in deep ditches. Another advantage is that a clean, sharp corner is formed at the bottom of the ditch. Still another advantage is the fact that the inward and outward movement of the moldboard is facilitated.

Another feature of the invention is the assembly for mounting the guide for the spreader arms. As has been stated, the lister and the base of the spreader arm guide assembly are maintained horizontal in accordance with the present invention at all times. Such relationship is important because the spreader arms are intended to be vertical at all times so that bending stresses on the spreader arms are not excessive.

Another feature of the invention is the fact that the spreader arms for the moldboards are maintained vertical. The guide assembly is, as has been stated, maintained horizontal. The axes for hinging the arms to the moldboard are maintained vertical, and the arms themselves are linked together at one-half of their total width. This construction enables the spreader arms to actuate the moldboard for width and height adjustment thereof.

One of the important features of the present invention which particularly distinguishes this machine from previous machines is the fact that the rear end of each moldboard is supported by a wheel which is mounted in outrigger fashion on the side of the ditch rather than being supported by the bottom of the ditch. In previous ditch building machines, the support for the rear end has rested on the bottom of the ditch and thus necessarily has been of limited width. By supporting the moldboards on the bank to either side of the ditch, great stability is achieved.

Still another feature of the invention is the mounting of the rear wheels so that they are automatically guided in the same direction as the front wheels. Preferably the wheels are supported in conjunction with the mounting of spoiler wings which are blades moving ahead of the rear wheels and smoothing the bank. Preferably, the spoiler wing is hinged along an axis which is common to the wheel caster pin, and the rear wheels are hinged longitudinally with the same caster. This arrangement facilitates mounting of the wheels and of the spoiler.

Another feature of the invention is the fact that the arm which controls the spoiler may be adjusted to such a position as to bring the spoil blade to a straight back position during transport of the machine. Such arrangement permits the machine to be so compactly adjusted that its overall width complies with the highway width of load regulations.

Other objects of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings in which similar characters of reference represent corresponding parts in each of the several views.

In the drawings:

FIG. 1 is a side elevational view of a portion of the machine with elements on the rear side thereof removed to reveal internal construction.

FIGS. 2 and 2A are composite top plan views of the machine.

FIG. 3 is a perspective view of the forward or towing section of the machine.

FIG. 4 is a schematic plan showing adjustment of the moldboard width.

FIG. 5 is a front elevational view of the structure of FIG. 4 also showing height adjustment of the moldboard.

FIG. 6 is a view similar to FIG. 5 showing the moldboards folded to retracted position.

FIG. 7 is an enlarged sectional view partly broken away in section showing the actuating mechanism for the movable listers.

FIG. 8 is a top plan of the structure of FIG. 7.

FIG. 9 is a perspective view of the hinge of the moldboard to the adjustable listers taken substantially along the line 9—9 of FIG. 2.

FIG. 10 is a perspective view of a portion of the moldboard spreader mechanism.

FIG. 11 is a vertical sectional view taken substantially along the line 11—11 of FIG. 2.

FIG. 12 is a fragmentary elevational view of the hinging of the spreader arms to the moldboard as viewed substantially along the line 12—12 of FIG. 2.

FIG. 13 is a schematic sectional view taken substantially along line 13—13 of FIG. 4 and showing the wheels in different positions of elevation.

FIG. 14 is a fragmentary elevational view substantially along the line 14—14 of FIG. 4 showing a portion of the mounting of the spoiler blade and ground wheels.

FIG. 15 is a fragmentary perspective view of the structure of FIGS. 13 and 14, showing the rear wheels and spoil blades in working position.

FIG. 16 is a view similar to FIG. 15, showing the members in transport position.

FIG. 17 is a schematic cross-sectional view of a typical ditch dug by the machine.

The machine which is the subject of the present invention consists of a plurality of sections hinged together about axes

and in sequences hereinafter described in detail. The front portion of the excavating sections comprises a fixed lister 21 which is a pointed plowlike member which is normally horizontal disposed and which first enters the ditch. In advance of the lister 21 is a steering section 22 which is pivotally attached to the front of the lister and controls the depth and direction of movement of the lister, being dragged by one or more tractors. Behind the fixed lister 21 and to either side thereof are adjustable listers 23 hinged thereto about vertical pivot axes. The angles of the adjustable listers relative to the fixed listers determine the width of cut of the bottom of the ditch. Behind each of the adjustable listers is a moldboard 24, an elongated blade which slants upwardly and outwardly and excavates the side of the ditch, controlling the slope and width thereof. The position of the moldboard relative to the adjustable lister is controlled by moldboard spreader assembly 26, the front end of which is pivotally connected to the fixed lister and the back of which is connected to the moldboard. At the rear of each moldboard is an assembly 27 which comprises ground engaging wheels which rest upon the bank outside of the confines of the ditch and also in advance of each wheel a spoiler blade which smooths the bank to form a path for the wheels. The various sections heretofore mentioned will now be described in order.

FIXED LISTER

Fixed lister 21 supports on its top a motor 31 and a hydraulic pump 32. The bottom edge 33 of the lister is horizontal, preferably having a hardened blade 34 on either side. Blades 34 converge forwardly as viewed in plan. The back 36 is vertical and transverse. Viewed in side elevation (FIG. 1) the prow 37 slopes from bottom edge 33 upwardly rearwardly to a radius 38 and then the portion 39 above radius 38 slopes upwardly forwardly. The width of prow of lister 21 determines the minimum width of the bottom of the ditch being dug.

Lister 21 above edge 39 has a pair of forward extending apertured pads 41 to which is attached drawbar 42 pivoted about a horizontal transverse pin 43. Above lister 21 is a bracket 44 to which is pivotally mounted hydraulic cylinder 46, the rod 47 of which is pivotally connected to a pad 48 on drawbar 42. Extension and retraction of rod 47 controls the angle of drawbar 42 relative to lister 21.

STEERING TONGUE

In advance of drawbar 42 is steering tongue assembly 22. Said assembly has a chassis 51 which is connected to the forward end of drawbar 42 by a vertical kingpin 52. Chassis 51 is supported by horizontal axle 53 to the outer sides of which are wheels 54 which engage the ground ahead of the machine. The forward end of chassis 51 is formed with clevis arms 56 and between arms 56 is a link 57 pivotally connected thereto by shaft 58. Steering tongue 61 is connected to link 57 by means of vertical pivot shaft 62. At the forward end of tongue 61 is a towing eye 63 connected thereto by a transverse pin 64. Eye 63 may be connected to a tractor or other towing implement. Where a pair of tractors are used, hooks 66 are connected to the forward end of tongue 61 and the cables may be used to connect each hook 66 to a tractor or other towing instrumentality.

Steering of tongue 61 relative to drawbar 42 is accomplished by means of steering cylinders 67 on either side of tongue 61. The rearward end of each cylinder 67 is connected to eye 68 on shaft 58. The rod 69 of each cylinder 67 is connected to a bracket 71 on tongue 61. The cylinders 67 on opposite sides of the machine are double acting and are cross connected so that the left-hand rod 69 is advanced and the right-hand rod 69 retracted in equal distances and vice versa.

The function of the steering assembly is as follows: As the tractor or tractors pull tongue 61, actuation of cylinders 67 controls the angle of link 56 relative to the tongue and this in turn controls the direction of wheels 54. Since drawbar 42 is directly connected to chassis 51, the entire machine follows in

line depending upon the energization of the cylinder 67. As will hereinafter be explained, rear wheels are so controlled that they follow the direction of front wheels 54. In addition to controlling the direction of movement of the machine, cylinder 46 also determines the depth of cut of front lister 21. Thus the operator by energization of the cylinders 67 and 46 determines both the direction and depth of lister 21.

ADJUSTABLE LISTERS

Immediately behind the rear end 36 of lister 21 are the adjustable listers 23 which are movable between a longitudinally extending position wherein the ditch is of minimum bottom width to an outward projecting position where the width of the bottom is maximum. The bottom edge of each adjustable lister 23 is coplanar with the bottom edge 33 of lister 21. A vertical pivot shaft 77 interconnects the frame 78 of each adjustable lister with front listers 21. A plate 79 is pivotally connected by means of pivot 81 to the back 36 of lister 21. Pivoted to the back 36 is hydraulic cylinder 82, the rod 83 of which is pivoted to the outer end of plate 79. Plate 79 on its undersurface carries sockets 84 which receive balls 86 on the inner ends of arms 87. The outer ends of arms 87 have ball and socket joints 88 which are connected to the bottom edge of adjustable lister 23. When cylinder 82 is energized, rod 83 is extended and plate 79 is depressed, forcing the arms 87 outward and spreading the adjustable listers to pivot about their vertical pivots 77. In this manner, the width of the bottom of the ditch may be controlled.

MOLDBOARD

Moldboard 24 comprises an elongated hollow member on either side of the machine which is connected immediately behind adjustable lister 23. The frame 76 of adjustable lister 23 at its rearward end has an arm 91 carrying a vertical pivot shaft 92 which is connected to horizontal arm 93 extending from vertical brace 94. The lower end of brace 94 carries a horizontal pivot 96, the outer end of which has vertically upward portion 97 received in eye 98 attached to bracket 99 which is an extension of frame 76. Pivot 96 and portion 97 are sometimes referred to herein as an "L-shaped pivot." Pivoted about shaft 96 is a pivot plate 101 having an arcuate upper surface 102 and received between member 94 and a guide 103 depending from underside of arm 93.

Plate 101 is fixed to the back of the hollow moldboard frame 106. By actuating means hereinafter described in detail, moldboard 24 is pivoted about shaft 96 and also about axes 92, 97, it being understood that the axes of shafts 92 and 97 are in vertical alignment and that they intersect the axis of pivot 96. It is a function of the hinging of the moldboard 24 relative to adjustable lister 23 to permit the moldboard to assume any angle relative to the horizontal depending upon the depth of the ditch being dug and further to permit the moldboard to swing inwardly and outwardly about the vertical axes 92, 97 to control the width of the ditch. The actuation means is next described.

MOLDBOARD ACTUATING MECHANISM

Means is provided for elevating the rearward end of the moldboard 24 and also for adjusting its spread. Extending rearward from lister 21 is guide 111 which is preferably a piece of rectangular mechanical tubing in which various hydraulic hoses and controls are housed. The forward end of guide 111 is pivoted to the rear surface 36 of lister 21 about a horizontal transverse pivot 112. Immediately below and parallel to tube 111 is a bar 113 pivoted to end 36 about pivot 114. Vertical alignment guides 116 depend from guide 111 and maintain bar 113 in alignment.

At the rear of guide 111 is a subframe designated generally by reference numeral 117 comprising two spaced-apart vertical members 118 connected together at their tops by transverse member 119. The back end of guide 111 is pivoted to members 118 by transverse horizontal pivot 121 and the bar

113 is pivoted by pivot 122. The spacing between pivots 121 and 122 is identical to that between pivots 112 and 114 and hence members 111 and 113 are at all times parallel. Such arrangement insures that members 118 are at all times vertical, and thus parallel to back 36 despite angular variation of guide 111.

At the forward end of guide 111 are depending arms 126 which receive the end of rod 127 of cylinder 128, the forward end of which is pivotally connected to pad 129 on back 36. Energization of cylinder 128 controls the vertical inclination of guide 111 and this in turn, as hereinafter explained, controls the inclination of the moldboards 24. It will be understood that cylinder 128 is merely one of several means whereby the pitch of guide 111 may be controlled.

Subframe 117 contains a horizontally disposed fabricated member 131 formed with a downwardly opening slideway 132 in which reciprocates slidable crosshead 133. Crosshead 133 has outward projecting lugs 134 on either side at its front. The rearward end of crosshead 133 is connected to the rod 136 of horizontal cylinder 137 which is supported on subframe 117. Energization of cylinder 137 causes movement of crosshead 133 in slideway 132.

Pivoted to subframe 117 is a first spreader link frame 141, said frame receiving vertical pivot axes 142 at the top and 143 at the bottom, respectively. It is important that link frame 141 as well as link frame 146 which is pivoted thereto are at all times vertical. Frame 146 is pivotally connected to frame 141 by vertical pivot shaft 147. A pin sleeve 148 surrounds pin 147 at the junction of link frames 141 and 146. A connecting rod 149 is pivotally connected to lug 134 and also to sleeve 148.

Moldboard 24 approximately two-thirds rearward of its forward end is provided with a plate 151. Pivoted to plate 151 by horizontal pivot 152 is a bracket 153 having an overhanging lip 154 which is on the inside of plate 151. The outer ends of link frame 146 are pivotally connected to ears 156 on bracket 153 by means of vertical pivot 157. Movement of crosshead 131 therefore causes inward and outward movement of moldboard 24, the link frames 141, 146 pivoting around the axes 142-143, 147 and 157 in a "grasshopper" linkage movement which is illustrated schematically in FIG. 4. In the solid line position of FIG. 4 the link frames 141 and 146 are extended outwardly almost their entire extent of travel, whereas in dotted line position they are folded to a position where the moldboards 24 are parallel to guide 111 and of minimum width.

Auxiliary to the cylinder 137 on either side of the machine is a cylinder 161 connected to a bracket extending rearward from members 118 with its rod 162 connected to hinge sleeve 148. Cylinders 161 have common connections with cylinder 137 and assist the latter in folding link frame 146 and thus in moving the moldboards inward and outward.

Subframe 117 also is provided with a cab 166 elevated above guide 111 and containing an operator's seat 167 and a console 168 having a plurality of valve levers for energization of the various hydraulic controls which are installed on the machine. It is a feature of the construction that the cab 166 is always horizontal by reason of the fact that subframe 117 is likewise always horizontal. Further, the seat 167 is elevated above the level of motor 31 and pump 32 so as to give the operator an unobstructed view forwardly of the machine. However, the moldboards 24 are elevated at a steeper slope than the guide rod 111, and hence the seat 167 is generally below the level of the moldboards during normal operation of the machine.

REAR WHEELS AND SPOILER BLADES

On the rear end of each moldboard 24 are hinge brackets 201 receiving hinge pin 202. Also received by pin 202 is an upper arm 203 which extends inward and is connected to downward bracket 204. The lower end of bracket 204 is connected to rod 206 of cylinder 207, the forward end of which is pivotally connected to the moldboard. The lower end of

bracket 204 receives shaft 208, the inner end of which is connected on pin 202. The forward end of wheel mounting plate 213 pivots on shaft 208. The rearward end of plate 213 carries axle 214 on which is mounted rear wheel 216. Cylinder 221 is pivoted at its forward end to a sleeve 222 on pin 202 which is fixed by brace 220 to bracket 204 and the rod 223 of cylinder 221 is connected to the rearward end of plate 213. Hence energization of cylinder 221 pivots plate 213 relative to shaft 208 and thus raises and depresses the wheel 216 relative to the moldboard 24.

Also on hinge pin 202 are hinge ears 231 connected to L-shaped bracket 232. Spoiler blade 236 is pivoted to bracket 231 about pivot 237. Cylinder 238 is connected at one end to bracket 232 and its rod 239 is connected to spoiler blade 236. Energization of cylinder 238 thus causes blade 236 to swing about pivot 237. About midway outward of spoiler blade 236 is a guide 241 which is vertically disposed in the horizontal position of blade 236. The outer edge of L-shaped bracket 232 is received in guide 241. Hence as blade 236 pivots around pivot 237, it is kept in contact with bracket 232. Tie rod 242 is connected at its outer end by means of swivel joint 243 to the outer end of bracket 232 and at its inner end by means of swivel joint 244 to wheel mounting plate 213. Tie rod 242 performs two functions. In normal usage of the machine it provides a brace supporting the blade 236 against the thrust imposed upon it. Its second function is in transportation. When the machine is being transported from one location to another, wheel 216 is depressed and rod 239 contracted. Tie rod 242 pulls blade 236 and wheel 216 in relationship to each other so that the blade is automatically pivoted above the level of wheel 216 and inward, as is best shown in solid lines in FIG. 14. Hence the blade 236 does not project outward beyond wheel 216 and highway width of load requirements are observed.

As has previously been noted, it is desirable that wheel 216 be pointed in the same direction as wheels 54 despite changes in position of moldboards 24. The body 246 of the hydraulic valve controlling cylinder 207 is mounted for sliding in a longitudinal direction on slide 247 fixed to blade 24. The conventional hydraulic valve spool 248 of valve body 246 slides within said body. The forward end of spool 248 is connected by universal joint 249 to rod 251 and the forward end of rod 251 is connected to an ear 252 which pivots with frame 146. The rearward end of spool 248 is connected by universal joint 253 to rearward extending rod 254, the rearward end of which is connected by pivot 256 to bracket 204. As the spool 248 is moved within body 246, depending upon the positions of rods 251 and 254, energization of cylinder 207 is likewise controlled. The hydraulic connections between valve body 246 and cylinder 207, as will readily be understood by one skilled in the hydraulic control art, are such as to center spool 248 within valve body 247. Hence despite movement of moldboard 24 relative to the axis 154, bracket 204 is swung about axis 202 to maintain shaft 208 and hence to maintain axle 214 parallel to axle 53. The mounting of body 246 on slide 247 accommodates the vertical component of the movement of the moldboard.

OPERATION

In normal operation of the device, the operator seated on seat 167 manipulates the hydraulic controls 168 which govern the various double-acting hydraulic cylinders which are energized from pump 32 driven by motor 31. One or more tractors pull the machine and cause it to move along the ditch. As the tractors advance, the operator actuates the controls for cylinders 67 to steer wheels 54 along the desired course. As has been previously described, automatic means causes the rear wheels 216 to be parallel to wheels 54. The operator also controls cylinder 46 to raise or lower lister 21 and all of the elements rearward of said lister relative to wheels 54 and thus the depth of the ditch is controlled. When the lister 21 is at the desired depth, cylinder 46 is readjusted to maintain such depth.

Directing attention now to FIG. 17, the width of the bottom of the ditch is controlled by movement inward and outward of adjustable listers 23 under the control of cylinder 82. At minimum width, the listers 23 are straight back from lister 21 and at maximum width they are projected to their full extension. The width of the top of the ditch and the slope of the sides are controlled by the outward movement of moldboards 24 about axes 92, 97. The inclination of the moldboards 24 is controlled by pivotal movement of member 26 about transverse pivot 112 under the control of cylinder 128, or other equivalent control means. As has previously been stated, the swinging movement of member 26 is controlled by parallel bar 113 so that the plates 118 are always vertical. The outward swinging movement of moldboards 24 about the axes 92, 97 is controlled by cylinder 137 and cylinder 161. The pivot axes are moved toward and away from the centerline of the machine and this in turn causes the folding of the link frames 141, 146 in grasshopper fashion which has heretofore been described.

A distinctive feature of the invention is the fact that the rear wheels 216 are mounted to ride on the outside of the ditch. Normally the wheels 216 are raised to the position of FIG. 15, or the solid line position of FIG. 13 by actuation of cylinders 221. Spoil blades 236 are adjusted by means of cylinder 238 to smooth the bank ahead of wheels 216.

When the machine is to be transported from place to place, it is desirable that its width be reduced so that it can travel down a highway or fit in the bed of a truck. Accordingly, the movable listers 23 are pivoted inward so that they are longitudinally aligned and the moldboards 24 are also pivoted inward in longitudinal alignment. The rod 223 of cylinder 221 is extended, causing wheel 213 to drop to the position of FIG. 16. At the same time, the cylinder 238 controlling spoil blades 236 is energized to retract rod 239. Tie rod 242 causes the lower edge of spoil blade 236 to move upward and inward, clearing the top of wheel 216 and coming into position parallel to adjustable lister 23 and moldboard 24. To further facilitate compact arrangement of the machine during transportation on a truck, the outer end of rods 69 may be disconnected from brackets 71 and the tongue 61 swung inward toward the lister, thereby reducing the overall length.

What is claimed is:

1. A ditch building machine comprising a lister section for forming the bottom of a ditch, a moldboard on each side of said machine, moldboard mounting means pivotally mounting said moldboard to the side and rear of said lister section for movement in and out transversely of said machine and also for movement of the rear of said moldboard up and down, moldboard actuating means for pivotally moving said moldboard relative to said lister section, a pair of rear wheels, rear wheel mounting means for mounting one said rear wheel on the rear of each said moldboard, whereby said rear wheels rest on the banks of a ditch while said lister section is on the bottom of said ditch and said moldboards extend along the sides of said ditch, said rear wheel mounting means comprising a generally vertical hinge pin on the rear of said moldboard, a shaft connected for oscillatory movement with said hinge pin and disposed perpendicular to said hinge pin, a link on said shaft, an axle on the end of said link opposite said shaft, a wheel on said axle, hydraulic means interconnecting said moldboard and said shaft to pivot said link and said wheel about said hinge pin, and valve means for said hydraulic means, said valve means responsive to movement of said shaft and of said moldboard to automatically pivot said link so that said wheel is parallel to the direction of movement of said machine at any position of said moldboard.

2. A machine according to claim 1, in which said moldboard actuating means comprises a longitudinally extending guide, means pivotally mounting said guide about a transverse horizontal axis to said lister section, guide actuating means for pivoting the rear end of said guide up and down relative to said lister section, a subframe on the rear of said guide, connecting means connecting said subframe to said moldboards for raising and lowering the rear of said moldboards relative to said

lister section, said connecting means including two perpendicularly related pivots whereby said subframe remains vertical at all times and said moldboard pivots about both horizontal and vertical axes at the forward end of said moldboard.

3. A machine according to claim 2, which further comprises means pivotally interconnecting said lister section and said subframe parallel to said guide to maintain said subframe parallel to said lister section as said subframe moves under influence of said guide actuating means.

4. A machine according to claim 1, in which said valve means comprises a spool, means articulately connecting one end of said spool to said moldboard actuating means and means articulately connecting the other end of said spool to said shaft, said last-mentioned means arranged to move said valve to energize said hydraulic means to turn said shaft to maintain the plane of rotation of said wheel parallel to the longitudinal central plane of said machine as the rear end of said moldboard moves in and out relative to said plane.

5. A machine according to claim 1, which further comprises a spoil wing normally positioned ahead of said rear wheel, means mounting said spoil wing on the rear of said moldboard for pivotal movement about a substantially horizontal axis, and means interconnecting said moldboard and said spoil wing to pivot said spoil wing about said axis.

6. A machine according to claim 5, in which said means mounting said spoil wing further comprises a bracket, means mounting said bracket to said moldboard for pivotal movement about said hinge pin and means for pivoting said bracket about said hinge pin to swing said spoil wing in and out relative to said moldboard.

7. A machine according to claim 6, which further comprises a brace, means attaching said brace to said spoil wing for swivel movement relative to said spoil wing, means attaching said brace to said link for swivel movement relative to said link, whereby upon depressing said wheel and pivoting said spoil wing up relative to said horizontal axis, said spoil wing is raised above and inward relative to said rear wheel.

8. A machine according to claim 1, in which said moldboard actuating means comprises a longitudinally extending guide, a subframe on the rear of said guide, a hydraulic cylinder having a rod mounted on said subframe, and on either side of said machine a first link pivoted to said subframe about a vertical axis, a second link pivoted to the outer end of said first link, the outer end of said second link pivoted to said moldboard about a vertical axis, connecting means interconnecting said rod and said links to move the outer end of said second link in and out relative to said subframe, and means pivotally connecting the outer end of said second link to one of said moldboards.

9. A machine according to claim 8, in which said first and second links are connected at a vertical hinge, and said connecting means is pivotally connected to said hinge.

10. A machine according to claim 1, in which said lister section comprises a fixed lister, a movable lister on each side of said fixed lister, means pivotally mounting each movable lister to the side and rear of said fixed lister, and movable lister actuating means for moving said movable listers in and out to vary the width of the bottom of said ditch.

11. In a ditch building machine a lister section, a moldboard on each side of said machine, an L-shaped pivot pivotally connected to the side and rear of said lister section for pivotal movement of said moldboard about both a vertical and a horizontal axis, a rear wheel at the rear of said moldboard, a horizontal shaft connected to said moldboard, a link pivoted to said shaft, an axle on said link, said rear wheel on said axle, means for pivoting said link about said shaft to raise and lower said rear wheel relative to said moldboard, a bracket pivoted to said moldboard about a substantially vertical axis, said shaft held by and pivoting with said bracket, means for pivoting said bracket about said vertical axis, a spoil wing normally positioned ahead of said rear wheel, a second bracket pivotally mounted about said vertical axis to said moldboard, means mounting said spoil wing to said second bracket for pivotal

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movement about a substantially horizontal axis, means for pivoting said spoil wing about said horizontal axis relative to said moldboard, a brace, a first swivel attaching one end of said brace to said second bracket, and a second swivel at-

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taching the other end of said brace to said link, whereby, upon depressing said wheel and pivoting said spoil wing up relative to said horizontal axis, said spoil wing is raised above and inward relative to said rear wheel.

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