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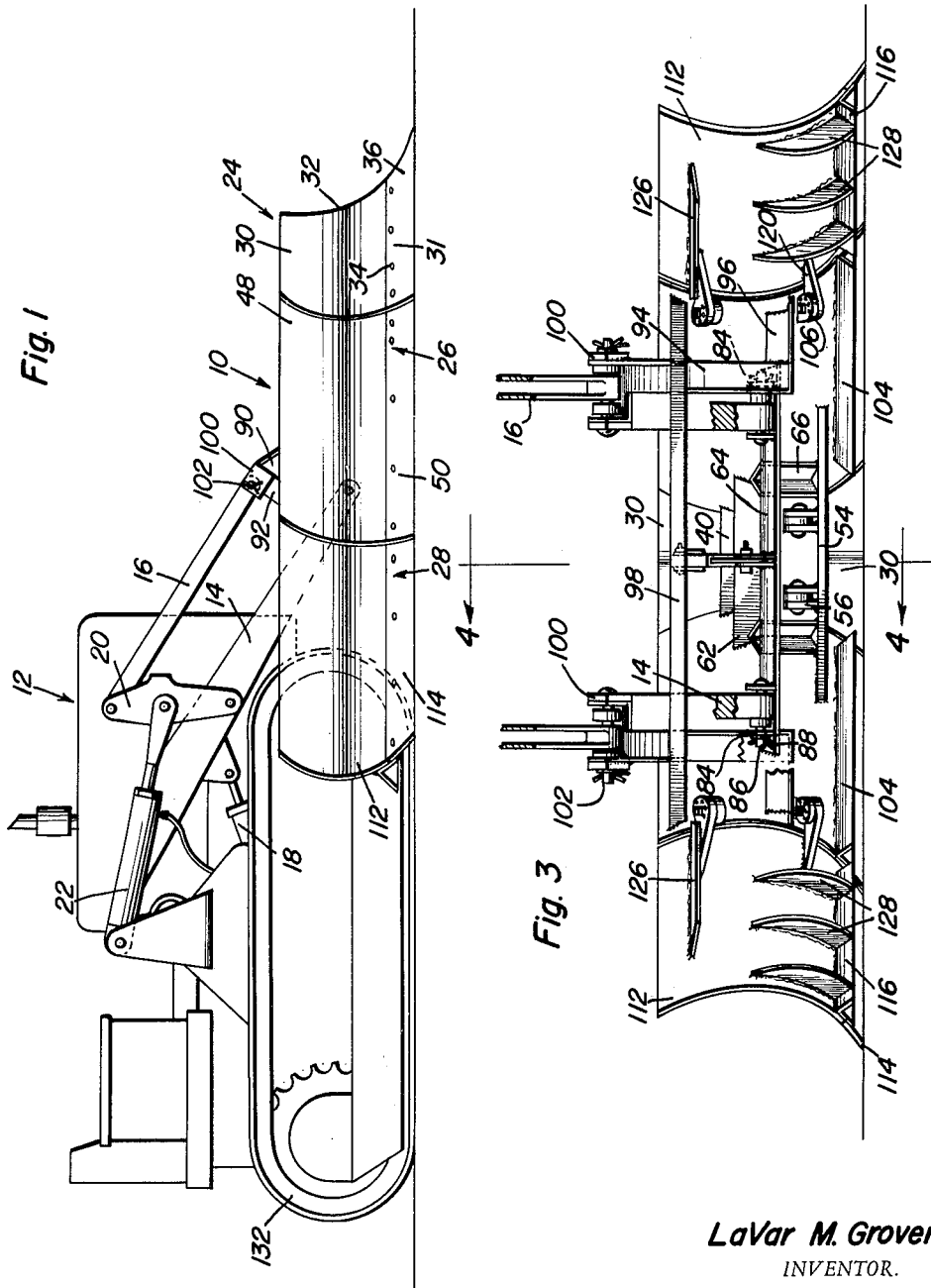
LA VAR M. GROVER

3,206,879

DITCHING PLOW HAVING MOVABLE SECTIONS

Filed March 28, 1963

4 Sheets-Sheet 1



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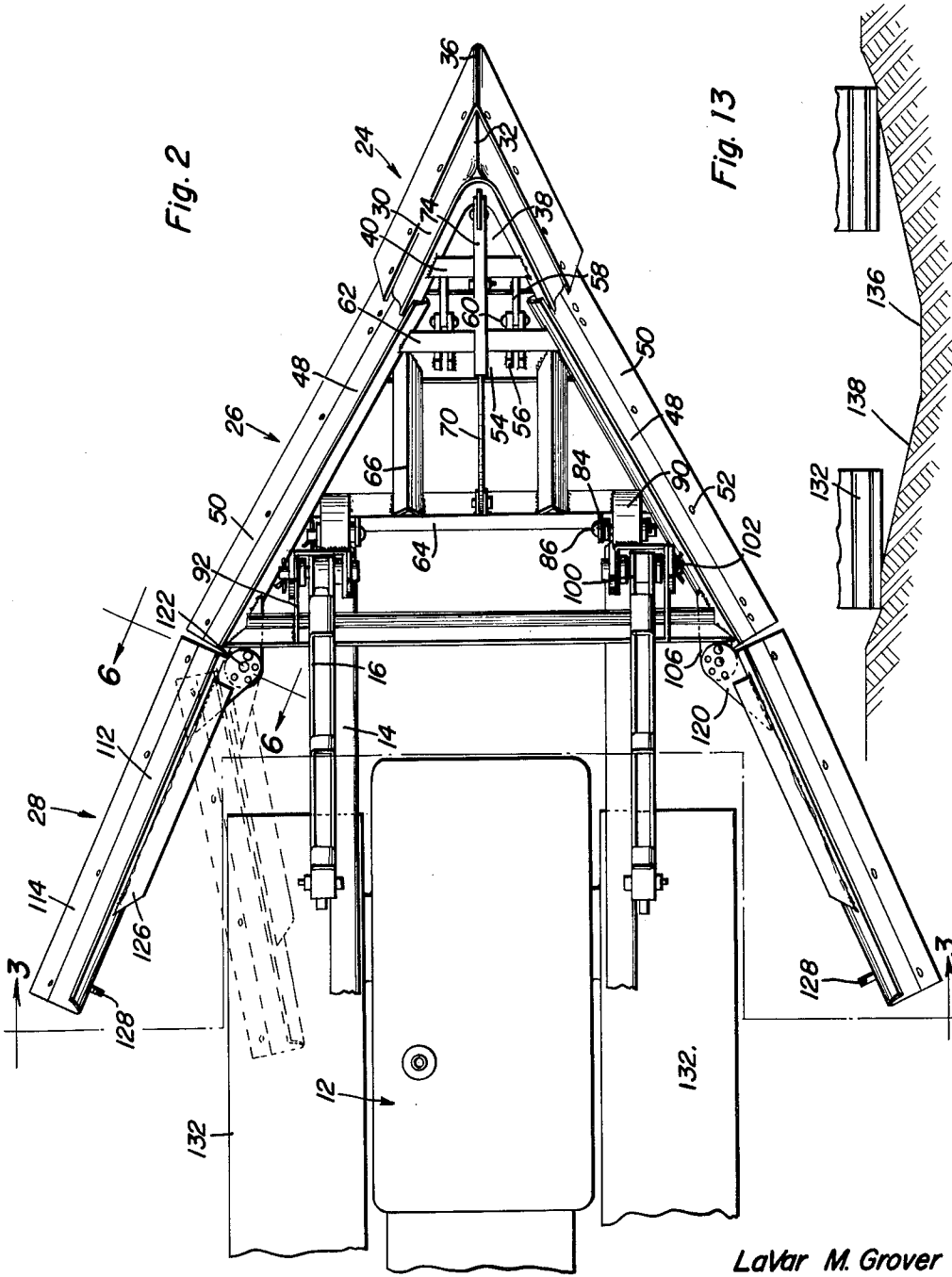
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DITCHING PLOW HAVING MOVABLE SECTIONS

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4 Sheets-Sheet 2



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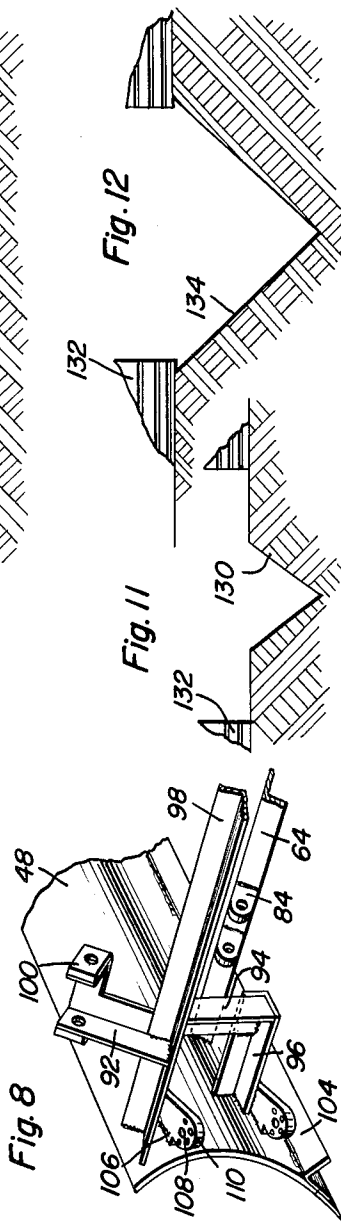
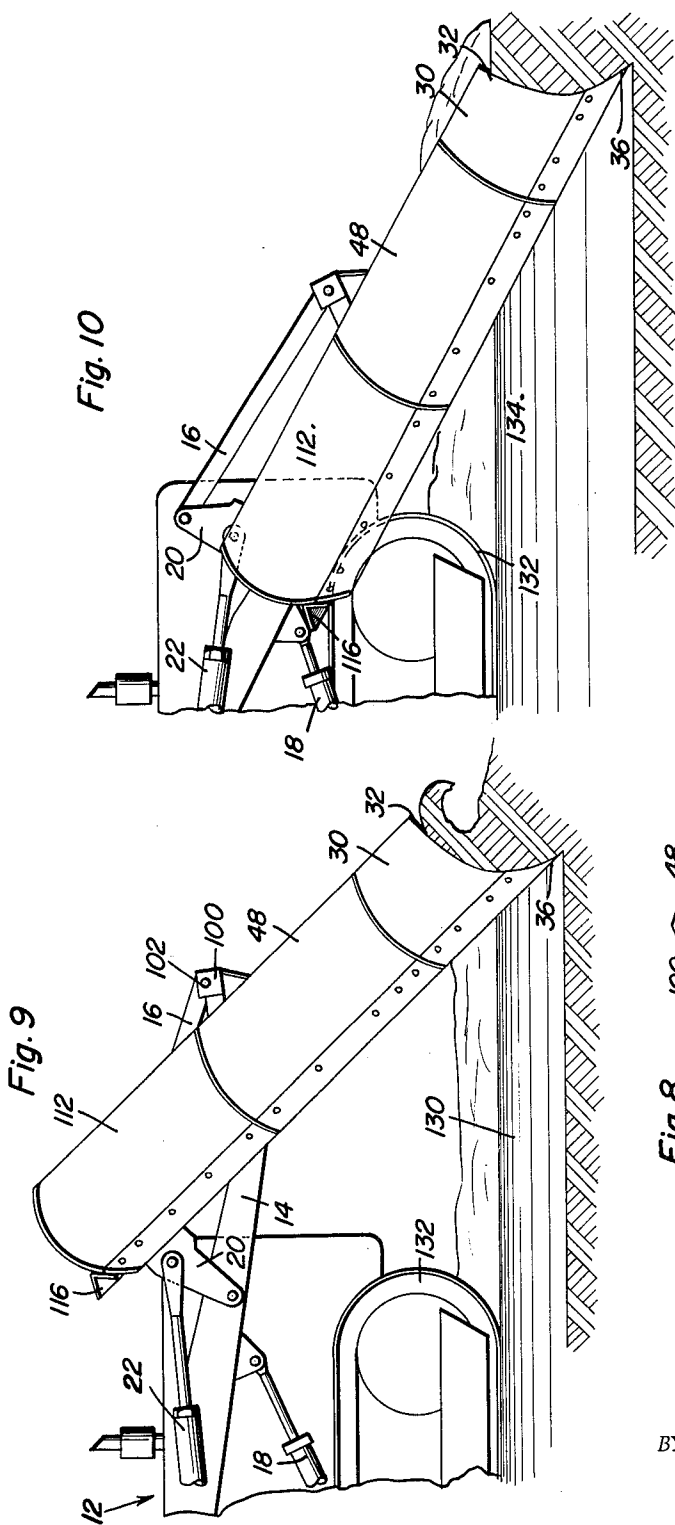
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DITCHING PLOW HAVING MOVABLE SECTIONS

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4 Sheets-Sheet 4



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3,206,879
DITCHING PLOW HAVING MOVABLE SECTIONS

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The present invention generally relates to a ditching mechanism and more particularly to a ditcher specifically adapted to be attached to the forward end of a tractor for use in forming irrigation ditches and lateral ditches or cleaning existing irrigation systems. The invention also may be used to form any type of ditch for either drainage or irrigation purposes and is capable of forming ditches of various depths, shapes and contours depending upon the particular manner in which the ditcher is used.

The present invention is specifically adapted for use with a crawler type tractor but may be adapted for use with various types of tractors having different supporting arm structures extending forwardly therefrom for supporting the ditcher forwardly of the tractor so that the ditcher may be vertically adjusted as to its elevational position and also angularly adjusted in order to orientate the ditcher at the proper position.

One of the main objects of the present invention is to provide a ditcher having a generally V-shaped point and rearwardly diverging wings which are pivotally attached to the V-shaped point for movement about generally a transverse axis thereby enabling the V-shaped point to form a flat bottom in a ditch and the wings to form inclined side walls.

Another object of the present invention is to provide a V-shaped ditcher having a V-shaped point and wings attached thereto for pivotal movement about a transverse axis and rear moldboard sections or wings pivotally attached to the rear ends of the aforementioned wings for pivotal movement about a generally vertical axis when the ditcher is disposed horizontally thereby enabling further control and adjustment of the contour of the side walls of the ditch being formed and also enabling the over-all width of the ditcher to be reduced to a desired minimum to enable the tractor with the ditcher attached thereto to traverse roads without exceeding width limits.

A further object of the present invention is to provide a ditcher having structural features enabling it to be attached quite readily to a four point hitch system of a crawler type tractor such as that normally employed for supporting a front end loader or the like.

Still another feature of the present invention is to provide a ditcher having removable rear moldboard sections which facilitate the employment of the ditcher when working small ditches and also enabling the ditcher to work alongside of an obstruction such as a fence, bridge abutment or the like.

Still another object of the present invention is to provide a tractor attached ditcher which is quite rugged in construction, easy to attach and detach from the tractor, versatile in forming and cleaning various shapes and sizes of ditches, capable of being partially collapsed to facilitate ease of handling, and relatively inexpensive to manufacture and maintain.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a side elevational view of the ditcher illustrating it attached to a crawler type tractor with the ditcher in a horizontally disposed non-working position;

FIGURE 2 is a top plan view of the ditcher illustrating

its relationship to the tractor and illustrating the manner in which the rear moldboard sections can be pivoted inwardly;

FIGURE 3 is a rear elevational view of the ditcher with portions thereof broken away illustrating the structure thereof;

FIGURE 4 is a longitudinal, sectional view taken substantially upon a plane passing along section line 4-4 of FIGURE 3 illustrating further structural details of the ditcher;

FIGURE 5 is a sectional view similar to FIGURE 4 but with the moldboard sections pivoted about a transverse pivot axis into angular relation to the V-shaped point;

FIGURE 6 is a detailed sectional view taken substantially upon a plane passing along section line 6-6 of FIGURE 2 illustrating the construction of the moldboard and the pivotal connection between the rear moldboard section and the forward moldboard section;

FIGURE 7 is a detailed sectional view taken substantially upon a plane passing along section line 7-7 of FIGURE 6 illustrating further structural details of the hinged connection;

FIGURE 8 is a rear perspective view of the rear end portion of the interior of a front moldboard section;

FIGURE 9 is a schematic side elevational view illustrating one manner of use of the present invention for forming a ditch;

FIGURE 10 is a view similar to FIGURE 9 but illustrating the ditcher forming a differently contoured ditch;

FIGURE 11 illustrates one form of ditch which may be formed with the present invention;

FIGURE 12 illustrates another form of ditch which may be formed; and

FIGURE 13 illustrates still another form of ditch which may be easily constructed with the ditcher of the present invention.

The present invention is illustrated in the drawings and generally designated by reference numeral 10 and is adapted for use in combination with a crawler type tractor generally designated by numeral 12. The device may be used with various types of tractors but one practical construction has been employed with a crawler type tractor known as HD-6 manufactured by Allis-Chalmers Co. which is equipped with four forwardly extending arms including two lower arms 14 and two upper arms 16. The lower arms 14 are pivotally supported from the tractor and are lowered and elevated by a hydraulic piston and cylinder assembly 18. The rear ends of the upper arms 16 are supported from a link 20 connected to the lower arms 14 in the manner illustrated in FIGURE 1 and provided with a hydraulic piston and cylinder assembly 22 for controlling the arms 16 thereby providing a parallelogram linkage having four hitch points at the outer ends of the arms. This represents conventional construction insofar as the crawler type tractor is concerned and is manufactured by the aforementioned company and described as the "Tractomotive" system. It is pointed out here that the ditcher of the present invention may be used with various types of tractors and especially with those having four hitch points disposed forwardly of the tractor. However, the ditcher may be modified to enable association with any type of hitch mechanism having vertically spaced hitch points whereby the ditcher attachment 10 may be elevated generally in a vertical direction and also tilted in a vertical plane about generally a transverse axis in order to angularly orientate the ditcher in relation to the horizontal ground surface. The size requirements of the ditcher may vary depending upon the tractor to which it is attached and the type of ditch to be formed thereby.

The ditcher 10 includes a forward rigid V-shaped section or point 24, an intermediate section 26 comprising

two forward moldboard sections and a rear section 28 comprising two rear moldboard sections.

The front section or V-shaped point 24 is provided with a pair of rigidly interconnected moldboards 30 rigidly joined together at their forward ends by a curved apex 32. The moldboards 30 are curved vertically with a generally concave surface facing forwardly and outwardly and a generally convex surface facing inwardly and rearwardly. At the lower edge of each moldboard 30 is a grader blade 31 attached thereto by bolts 34. The forward edges of the grader blade 31 are curved as at 36 to form a continuation of the apex 32 whereby the V-shaped point of the cutter curves forwardly and downwardly into a ditch forming point. Rigidly interconnecting the lower end portions of the moldboards 30 is a cross tie plate 38 rigidly affixed to each moldboard 30 by suitable welding or the like thereby rigidifying the front section or nose section 24. Also interconnecting the moldboards 30 is an upper cross angle support 40 in the form of an angle iron member rigidly affixed to or welded to the moldboards 30 thereby further rigidifying the nose section 24. At the rear of the upper forward end of the apex 32, a lug 44 is attached as by welding. Also, the rear edges of the moldboards 30 are slightly arcuately curved as indicated by numeral 46 and illustrated in FIGURES 4 and 5.

The intermediate section 26 includes a pair of forward elongated moldboards 48 which are arcuately curved in vertical section and which have grader blades 50 attached to the lower edges thereof by bolts 52 or similar fasteners enabling replacement of the blades 50 when desired. Interconnecting the forward lower ends of the moldboards 48 is a lower cross tie plate 54 at generally the same elevational relationship as the tie plate 38. The tie plate 54 has a pair of laterally spaced upwardly projecting and forwardly extending pivot lugs 56 mounted thereon for alignment with and registry with a pair of upwardly extending and rearwardly projecting pivot lugs 58 carried by the tie plate 38. A pivot pin or bolt 60 interconnects the lugs 56 and 58 thereby pivotally interconnecting the intermediate section 26 with the front or nose section for relative pivotal movement therebetween about an axis defined by the pivot pins 60. The lugs 56 are formed in pairs for straddling the single lug 58 and the lug assemblies are orientated on opposite sides of the centerline of the cutter for enabling pivotal movement of the intermediate section 26 in relation to the nose section 24 inasmuch as the forward ends of the moldboards 48 telescope inwardly of and are spaced slightly from the inner surfaces of the moldboards 30 as illustrated particularly in FIGURE 2 and in FIGURE 5.

Above the tie plate 54 and generally in alignment with the angle member 40 but slightly therebelow is an upper transverse angle iron support 62 which rigidifies the upper portion of the forward ends of the moldboards 48. Extending transversely between the moldboards 48 at a position rearwardly of the tie plate 54 and the cross angle 62 and slightly below the level of the cross angle 62 is a cross angle 64 rigidly affixed to the central area of the moldboards 48 but somewhat nearer the rear ends than the forward ends. For rigidifying the cross angle 64 which has the ends thereof welded to the moldboards 48, a pair of supporting braces 66 of inverted angle iron construction extend between the top surface of the cross tie plate 54 and the top surface of the upper angle of the cross angle iron member 64 as illustrated in FIGURE 2 and also in FIGURE 4. The braces 66 are welded to the cross plate 54 and the angle 64 respectively.

At the center of the angle member 64, a pair of upstanding lugs 68 are provided for pivotal attachment to a tilt bar 70 by virtue of a pivot pin or bolt 72. The tilt bar 70 is telescopically engaged in a tilt bar housing 74 having a bifurcated end 76 pivoted to the lug 44 by a pivot pin or bolt 78. The tilt bar housing or sleeve 74

is provided with a plurality of longitudinally spaced apertures 80 for receiving a fastening bolt 82 which may be extended through an aperture in the tilt bar 70 for locking the tilt bar 70 in longitudinally adjusted relation in relation to the housing 74 thereby varying the effective length of the tilt bar for enabling variation of the angular relationship between the front section or nose section 24 and the center section 26 about the pivot axis formed by the pins or bolts 60. FIGURES 4 and 5 illustrate two positions of the front and center sections respectively as determined by the effective length of the tilt bar 70. As illustrated in FIGURE 4, the cross angle 62 serves somewhat as a limit to prevent the center section from being pivoted downwardly beyond a position generally in alignment with the moldboard 30 and the forward edges of the moldboards 48 will come into contact with the cross angle 40 thereby limiting the upward pivotal movement of the moldboards 48 in relation to the moldboards 30.

Attached to the rear angle of the cross angle 64 is a lower hitch connection in the form of two pairs of rearwardly and upwardly extending lugs 84 receiving removable hitch pins 86 which extend through the forward ends of the arms 14 thereby forming a connection between the cross angle 64 and the forward ends of the arms 14. By removal of the pins 86 which are provided with a suitable retaining mechanism such as a cotter pin 88 or the like, the arms 14 may be easily detached or attached to the lower hitch connections. Attached to and rigidly extending upwardly from the cross angle 64 is a pair of upright angle iron support members 90 which are welded to the upwardly facing angle of the cross angle 64. At the upper end of the support angle 90, a support angle brace member 92 is rigidly connected which extends rearwardly and downwardly and in turn is rigidly connected to a reinforcing support brace 94 that extends downwardly in a vertical direction and rigidly affixed to an outwardly extending bracket 96 welded to the moldboard 48 and the lower end of the vertical brace 94 as illustrated in FIGURE 8. The point of interconnection between the brace 92 and vertical support brace 94 is formed by an upper support angle cross brace 98 which extends between and is welded to the upper rear portions of the moldboards 48 as illustrated in FIGURE 8. At the point of connection between the braces 90 and 92, there is provided an upper hitch connection formed by pivot lugs 100 for receiving removable hitch pins 102 for detachably connecting the forward ends of the upper arms 16 to the upper hitch points formed by the lugs 100 thereby connecting the ditcher to the arms at four points with two of the points being located below the top edge of the ditcher and two of the points being located above the top edge of the ditcher as illustrated in FIGURE 3. The cross tie plate 54, the angle 62, the angle 64 and the angle 98 all extend across the center section and rigidly interconnect the moldboards 48 thereby forming a rigid unit which is articulately connected to the front section by the pivot pins or bolts 60 with the tilt bar 70 and housing 74 cooperating to adjust the angular orientation of the center section in relation to the front section. As illustrated in FIGURE 4, the lower rear edge portion of each moldboard is provided with an angle member 104 attached thereto for reinforcing the lower edge of the moldboards 48. Also, as illustrated in FIGURE 8, the moldboard 48 is provided with a pair of horizontally extending pivot lugs 106 on the interior surface thereof which are spaced vertically apart and in vertical alignment with the rear ends thereof projecting generally longitudinally and provided with a central aperture 108 with a plurality of smaller apertures 110 spaced circumferentially about the periphery of the center aperture 108.

The rear section 28 of the ditcher includes a pair of rear moldboards 112 of substantially the same construction as the moldboards 48 insofar as the arcuate curvature thereof is concerned. FIGURE 6 illustrates the construction of the moldboards 112 and the curvature of

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the moldboards 48 and 30 would be the same as illustrated in FIGURE 6. The moldboard 112 includes a grader blade 114 attached to the bottom edge thereof together with an inverted L-shaped reinforcing angle member 116 at the rear edge thereof bridging the connection between the grader blade 114 and the moldboard 112 with fastening bolts 118 being employed for retaining the grader blade 114 removably in position. As is usual in this construction, the fastening bolts 118 have the head thereof countersunk in the grader blade to provide a smooth surface.

The grader blade 112 has a pair of pivot lugs 120 attached to the inner surface thereof at the forward edge with the end portions of the pivot lugs extending longitudinally forwardly for telescoping over and under the pivot lugs 106 respectively. The pivot lug 120 is provided with a central aperture receiving a pivot bolt 122 and the lug 120 is also provided with a series of circumferential apertures for alignment with the apertures 110 in the lug 106 for receiving a removable fastener pin 124 whereby the angular disposition of the moldboard 112 in relation to the moldboard 48 may be adjusted by removing the pin 124, aligning selective of the apertures 110 and corresponding apertures in the lugs 120 and then inserting the pin 124 in place. With this construction, the rear wings or moldboards 112 may be orientated in alignment with the moldboard 48 or swung inwardly to the dotted line position illustrated in FIGURE 2 or any intermediate position desired. Inasmuch as the rear moldboards 112 are not interconnected, a longitudinally extending stiffening flange 126 is provided for stiffening the rear moldboard 112 to prevent flexing or bending thereof.

While an exemplary embodiment has been illustrated in the accompanying drawings and described in detail, various changes may be made without departing from the spirit of the present invention. For example, the moldboards may be provided with ribs or reinforcing flanges along the back surface depending upon the desired strength. The various components are all preferably of welded construction except where removable pins, pivot bolts and the like are employed and the various points receiving the most stress may be strengthened as required.

The device is very easily attached to and removed from the existing tractor by merely pulling the pins 86 and 102 and replacing them when desired. It has been found that only several minutes time is required to place the ditcher on the arms of the tractor. By virtue of the arrangement with the four point hitch, the ditcher may be set at any angle from nearly straight up or perpendicular to the ground to a flat position, horizontal with the ground, and can be raised or lowered to any desired elevation. The angles and elevations of the ditcher are all controlled from the tractor operator's seat by means of the existing hydraulic system provided on the tractor. Thus, the operator of the tractor may readily control the shape of the ditch by controlling the angle to which the ditcher is tilted and also the depth or elevation at which the ditcher is set. FIGURES 9 and 10 illustrate two of the many possible positions of the ditcher. The more perpendicular the ditcher is, the narrower the ditch will be and this ditch will have steeper sloping sides. The more horizontal the ditcher is tilted, the wider the ditch becomes with generally flatter sides as illustrated in the schematic views of FIGURES 11-13. Thus, the ditcher of the present invention is quite versatile since it can make small ditches that can be straddled by the tractor as illustrated in FIGURE 11 and also larger ditches where the tractor crawler treads work from inside the ditch itself. In practical operation, existing ditches of ten to fourteen feet wide have been cleaned with excellent results.

The shape of the bottom of the ditch is controlled by adjusting the angle of the ditcher point or front section in relation to the intermediate section 26 and rear section 28. This angular relation is controlled by the tilt bar 70 and its relationship to the housing 74. Thus, a ditch

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with a two foot flat bottom can be made or any size smaller to a complete V-bottom can be made by adjusting the ditcher point manually before beginning the operation. The rear moldboards or wings 112 are hinged so that they can be folded back when working in close quarters such as when a fence exists on one side or the other. Also, the rear moldboard 112 can be removed completely if desired by removing the pins 124 and bolts 122 which may be desirable when working small ditches. Also, the inwardly folding rear moldboard sections 112 enable the moldboards to be retained within certain width limits which enable the device to be transported legally on state highways and the like. Further, it is pointed out that the same structural arrangements may be employed on larger type tractors and on different makes and models by increasing the size and adapting the hitch assemblies accordingly.

The manner of attaching the grader blade to the lower edge of each moldboard is conventional and the arcuate curvature of the moldboard is such that the soil being moved is caused to roll upwardly and forwardly along the front surface of the moldboard.

FIGURE 11 illustrates a relatively small V-shaped ditch 130 which would be formed in the manner of using the device illustrated in FIGURE 9 in which the crawler treads 132 of the tractor are spaced laterally of the ditch. FIGURE 12 illustrates a deeper V-shaped ditch 134 in which the crawler treads 132 engage the soil surface at the edges of the ditch or the ditch may be somewhat deeper in which event the threads 132 will engage the side walls of the ditch. In FIGURE 13, a flat bottom 136 is illustrated in the ditch with the side walls exteriorly thereof being sloped as at 138 and the tractor treads 132 engaging the side walls. As will be apparent, various types of ditches may be formed or cleaned for various purposes. The orientation of the ditcher at the forward end of the tractor enables a single operator to readily observe the work being performed by the ditcher and enables the operator to adjust the hitch points by extending and retracting the hydraulic cylinders selectively in a conventional manner for varying the angular position of the ditcher. Of course, the position of the rear moldboards 112 must be manually adjusted and will remain in a particular position until they are manually adjusted to another position. Also, the angular relation between the front section 24 and the center and rear sections 26 and 28 is manually adjusted by elevating the tip end of the point when the adjusting bolt has been removed.

In the preferred embodiment of the invention, vertically disposed reinforcing ribs 128 of an arcuate configuration are welded to the rear surface of the moldboards 112 and 48 in longitudinally spaced relation as required for the particular strength requirements of the device.

Also, it is pointed out that the ditcher is equally well adapted for use in combination with rubber tired tractors having front end loaders incorporated therein which employ a double set of hydraulically controlled arms. Manufacturers of such rubber tired tractor-type front end loaders include Caterpillar, Uclid, Michigan, and the like. Mention of the rubber tired tractor-type front end loaders is made inasmuch as the present invention may be employed with any type of vehicle having the double set of hydraulically controlled arms and, if necessary, the points of attachment may be varied as required for adapting the unit to the particular front end loader or tractor involved.

While FIGURE 1 has been described as illustrating the ditcher in a non-working position, this is only true insofar as the forming of a ditch is concerned. However, when the ditcher is in this orientation as illustrated in FIGURE 1, the device has been used quite effectively in dozing dirt, snow and the like into a windrow on each side of the machine. This has been quite effective in clearing roads of snow and otherwise performing the function of a generally V-shaped dozer blade or the like. Also, in the position of FIGURE 1, the device works quite well in

backfilling trenches by traveling parallel with the spoil bank and trench while using one side of the ditcher and moldboard to roll a windrow back into the trench thereby backfilling the trench. When reaching the end of the trench being filled, the tractor is turned around and without making any adjustment whatsoever on the ditcher, the opposite side of the moldboard is used in rolling a windrow back either into the trench or piling the windrow on top of the trench thereby forming a longitudinal windrow for properly filling the ditch.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. A ditcher for attachment to a tractor comprising a generally V-shaped nose section having a pair of rearwardly diverging moldboards rigidly interconnected with each other, a center section comprising a pair of rearwardly diverging moldboards, means interconnecting the rearwardly diverging moldboards of the center section for forming a rigid unit, means articulately connecting the center section with the nose section for relative pivotal movement about substantially a transverse axis thereby enabling the angular relationship of the center section and the nose section to be adjusted, and a rear section comprising a pair of rearwardly diverging moldboards, means adjustably connecting the moldboards forming the rear section to the moldboards forming the center section for pivotal movement about substantially a vertical axis whereby the moldboards of the rear section may be swung laterally inwardly to a retracted position or to a position generally in alignment with the moldboards forming the center section, the articulate connection means between the center section and the nose section is disposed adjacent the bottom of the respective sections with the moldboards forming the center section being telescoped inwardly of the moldboards forming the nose section, and an adjustable length tilt bar interconnecting the upper

end portions of the nose section and center section for locking the nose section and center section in angularly adjusted position.

2. The structure as defined in claim 1 wherein each moldboard is provided with a removable grader blade on the lower edge thereof, and a longitudinal reinforcing angle member attached to the rear surface of at least one of the moldboards for reinforcing the same.

3. The structure as defined in claim 1 wherein said rear section is removably attached to the center section thereby enabling use of the nose section and center section for cleaning or forming small ditches.

4. The structure as defined in claim 1 wherein said rear section is provided with longitudinal reinforcements on the moldboard adjacent the upper edge thereof for rigidifying the rear section.

5. The structure as defined in claim 1 wherein said center section includes vertically spaced pairs of hitch connection points for connection with lift arms on a tractor, said hitch points being connected to the means interconnecting the moldboards forming the center section, the vertical spacing of the hitch points enabling the ditcher to be disposed in inclined position.

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