

[54] **HYDRAULICALLY CONTROLLED
DITCHING PLOW HAVING A
COUNTERBALANCING WHEELED
TRAILER**

[75] Inventor: **George M. Briar**, Bristol, Pa.
[73] Assignee: **Thiokol Chemical Corporation**,
Bristol, Pa.

[22] Filed: **April 15, 1970**

[21] Appl. No.: **28,214**

Related U.S. Application Data

[63] Continuation of Ser. No. 702,690, Feb. 2, 1968,
abandoned.

[52] U.S. Cl.37/98, 172/413, 180/10,
280/496, 280/504

[51] Int. Cl.E02f 5/02

[58] Field of Search37/98, 44, 46; 280/496, 504,
280/508, 514; 172/395, 398, 413, 423;
37/44, 46; 180/10

[56] **References Cited**

UNITED STATES PATENTS

2,651,858 9/1953 Schwindt.....37/98

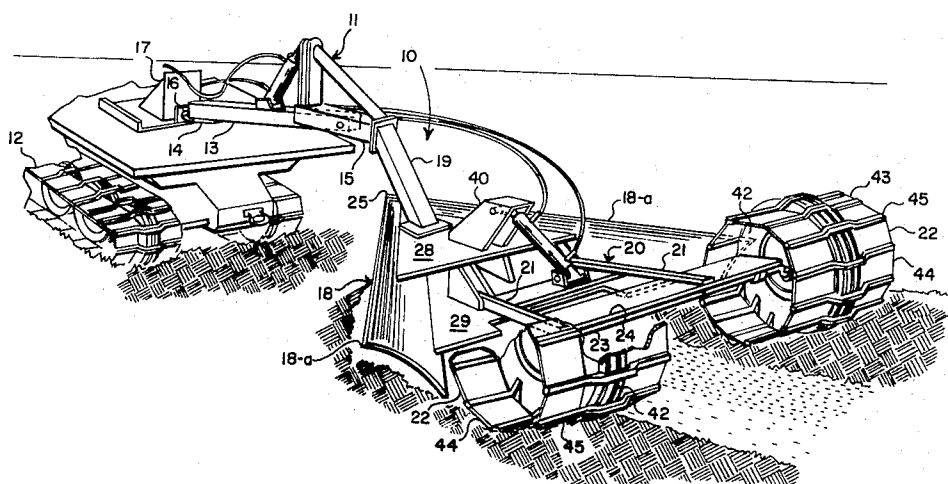
1,377,609	5/1921	Tovnsend	280/496
2,426,532	8/1947	Tierney	280/504
3,442,035	5/1969	Hymel	37/98
2,787,845	4/1957	Manning	180/10 X
2,756,830	7/1956	Hurthig	180/10 X
2,695,466	11/1954	Porter	37/98
1,775,483	9/1930	Biefeld	37/44
2,261,874	11/1941	Cundiff	378/98
2,014,479	9/1935	Martin	172/398 X
3,111,174	11/1963	Fry et al.	172/413 X

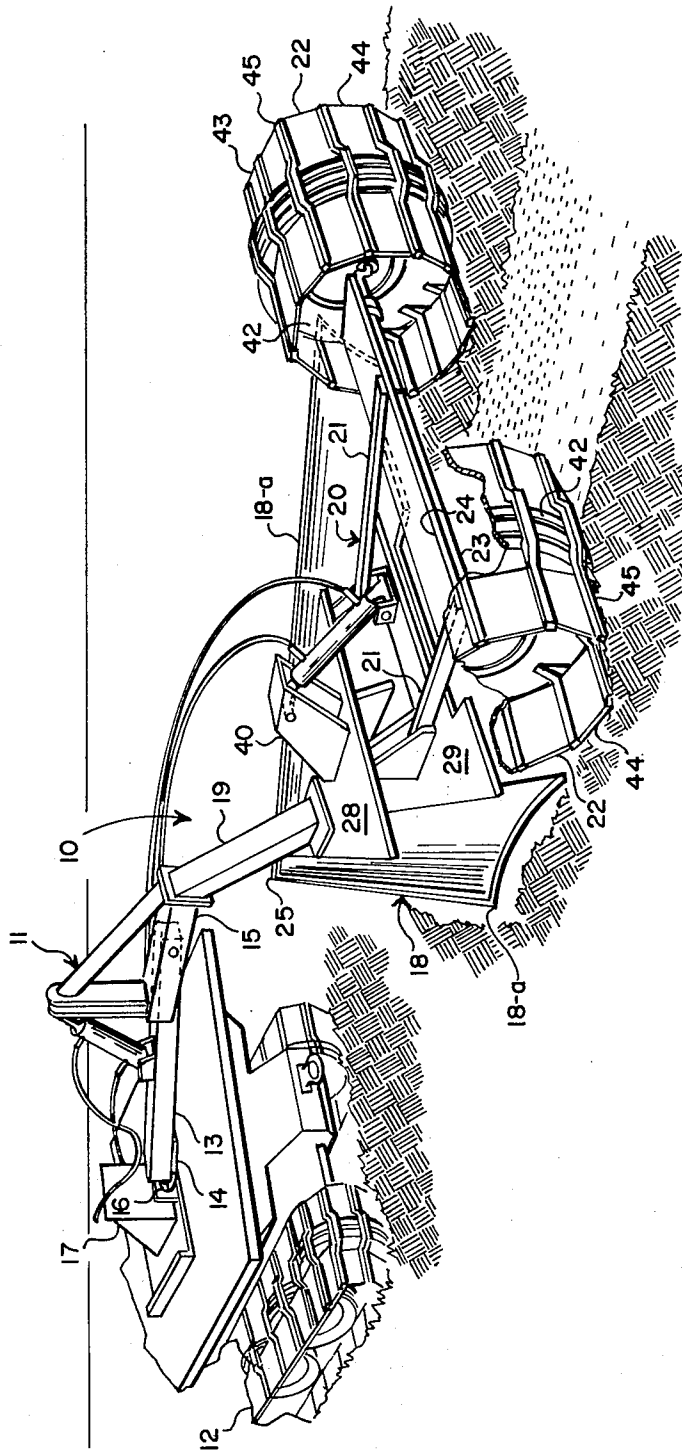
Primary Examiner—Robert E. Pulfrey
Assistant Examiner—Clifford D. Crowder
Attorney—Thomas W. Brennan

[57] **ABSTRACT**

A device for preparing drainage ditches having a moldboard assembly mounted on a steel frame and positioned thereon between a trailer and a tractor vehicle. The moldboard is arranged for raising and lowering thereof by hydraulic actuators operating a split tongue, is uniquely counterbalanced, and the trailer is movable and supported on track laying wheels for low ground pressure.

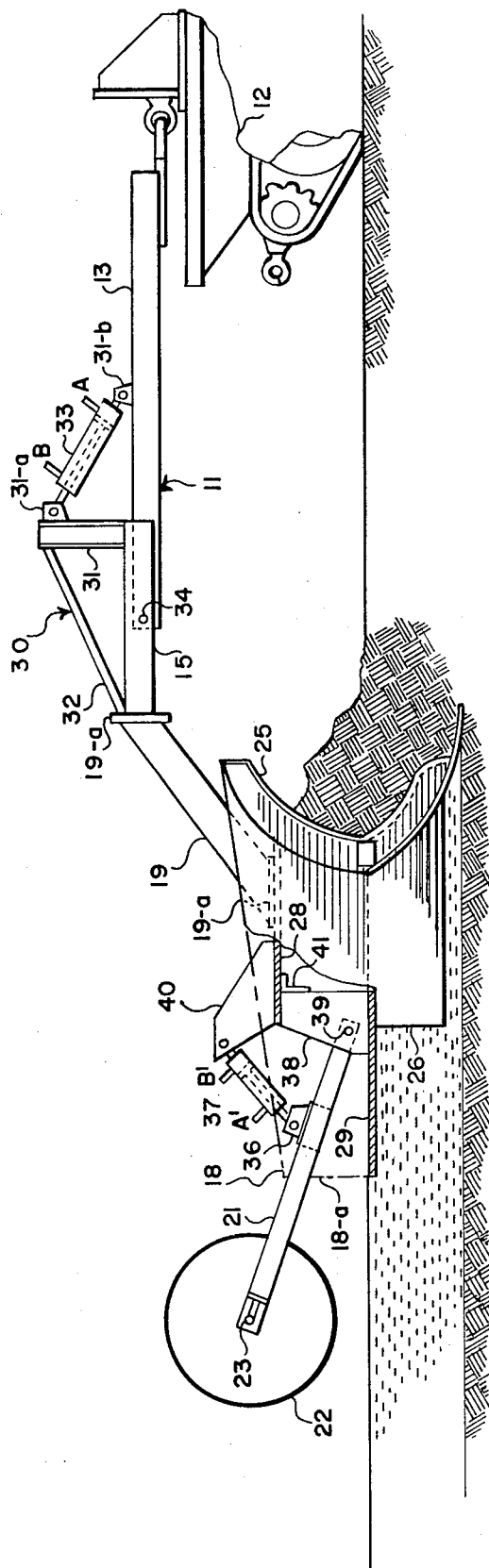
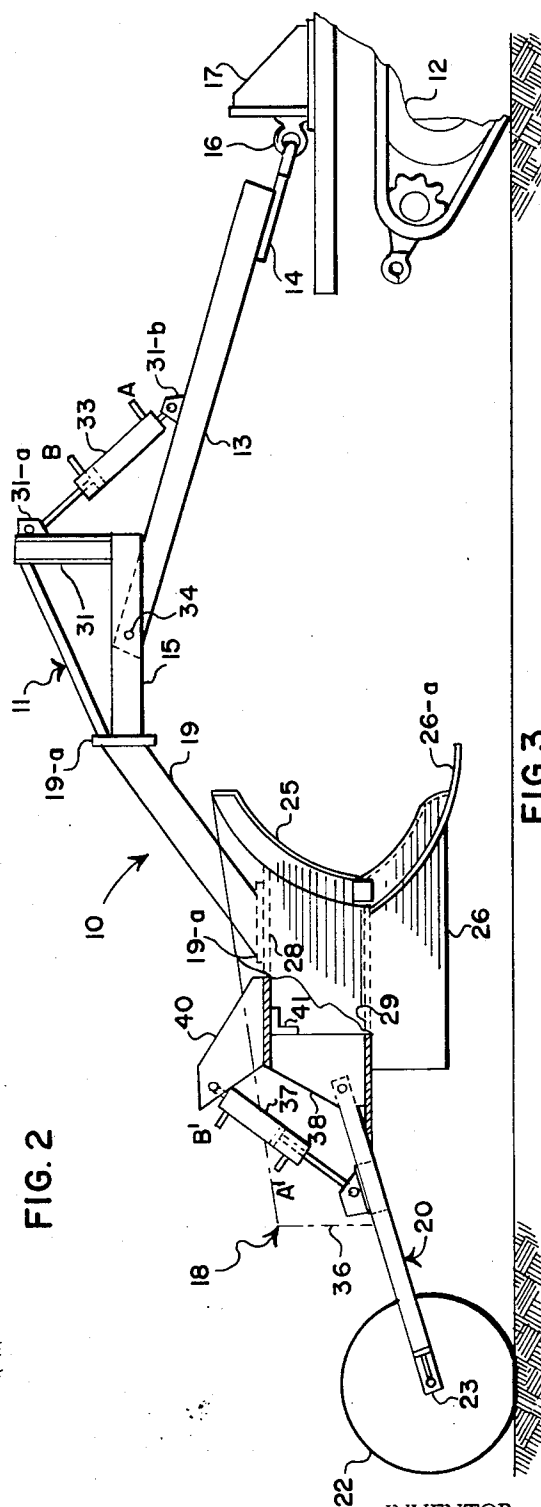
7 Claims, 5 Drawing Figures





INVENTOR.
GEORGE M. BRIAR

BY *Thomas W. Bannan*



INVENTOR.
GEORGE M. BRIAR

BY *Thomas H. Bannen*

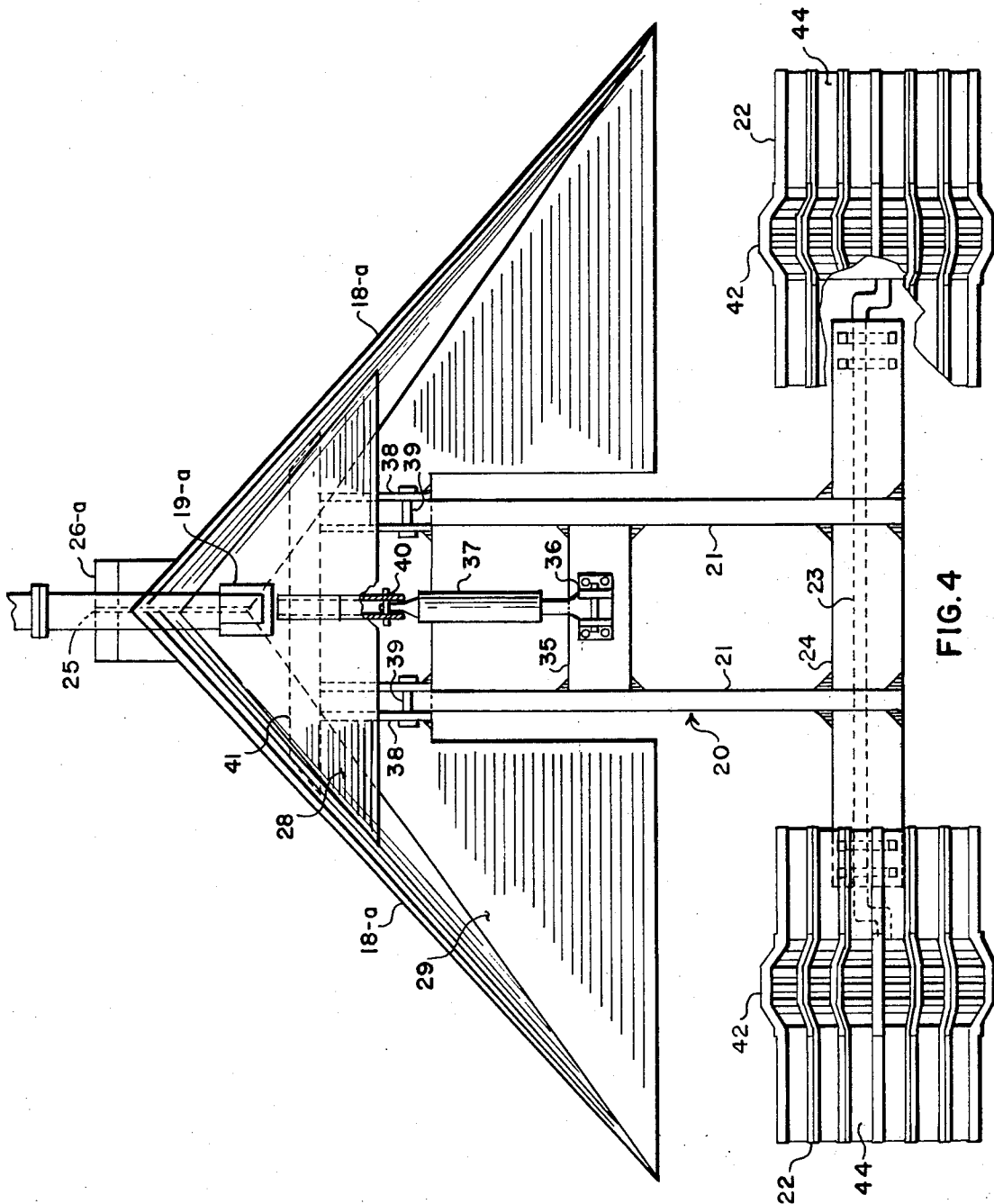


FIG. 4

INVENTOR
GEORGE M. BRIAR

BY *Thomas H. Brunner*

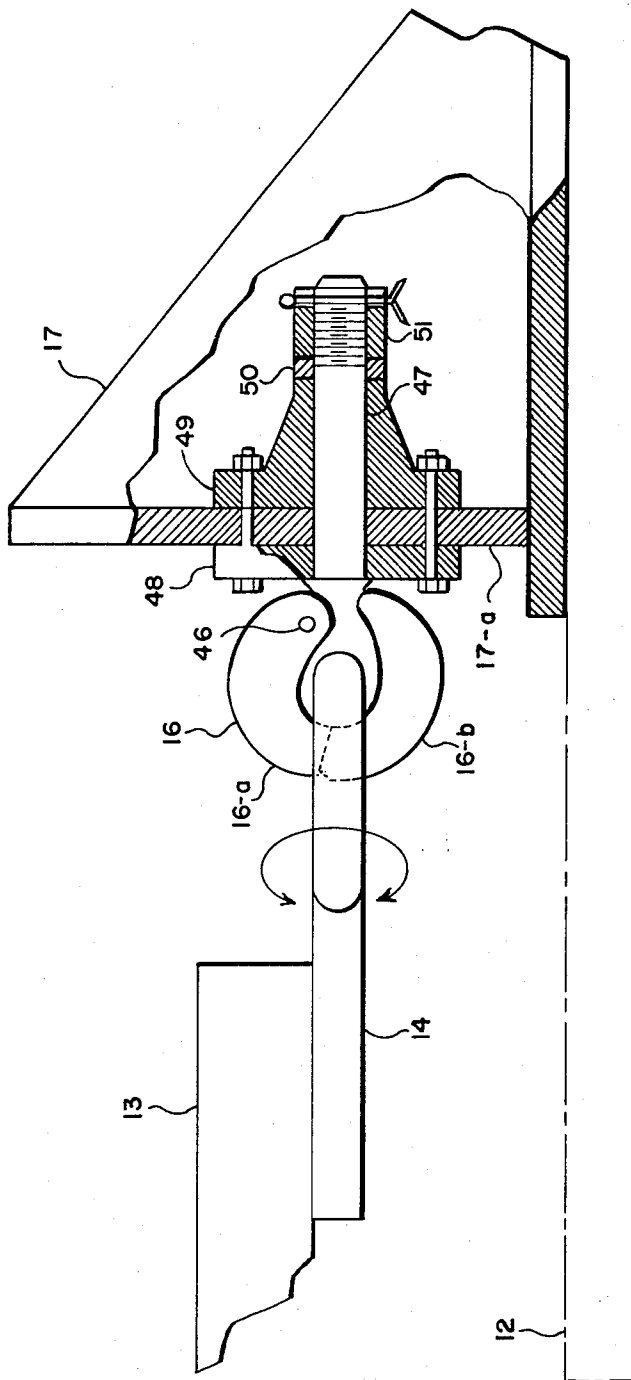


FIG. 5

INVENTOR
GEORGE M. BRIAR

BY *Thomas H. Bounan*

HYDRAULICALLY CONTROLLED DITCHING PLOW HAVING A COUNTERBALANCING WHEELED TRAILER

This application is a continuation of application Ser. No. 702,690 filed Feb. 2, 1968.

This invention relates in general to earth working devices, and to apparatuses for preparing drainage ditches and the like in soft and marshy areas. More particularly, this invention is concerned with a tractable plow-like or moldboard device in combination with a tracklaying vehicle which is capable of traversing soft, marshy ground while efficiently working said ground to prepare, in a single pass thereof, a precise drainage ditch of predetermined depth and width, while simultaneously forming earth shoulders adjacent the open sides of the ditch and displaced therefrom a predetermined distance.

In the art of preparing drainage ditches and the like in marshy or soft ground, it is desirable to cut an even and level ditch in undisturbed ground while forming mounds of earth adjacent the edges thereof which are displaced a considerable distance therefrom. Thus immediate areas alongside both edges of the ditch remain flat having an elevation unchanged from the ground before the ditch is formed. In prior art devices of the type wherein the ditching tool itself is mounted on a trailer or wheeled frame, it has been common to mount the tool so as to trail behind, or in between, (directly over the rear axle) the rear wheels of the trailer. By this means the trailer is always rolling over undisturbed ground and support for the wheels is obtained thereby. However, such vehicles are limited to relatively hard ground because of the inherently higher ground pressures generated by the wheels. Further, necessarily severe limitations are imposed with respect to the distance behind the trailer wheels the ditching tool can be suspended and still perform its necessary function, and counterbalancing the ditching tool itself becomes a practical impossibility.

Other prior devices have attempted to overcome these problems by mounting the plow or ditching tool on the front of a tracklaying vehicle, which is, of course, a low ground pressure type machine due to its wide tracks and greater ground area contact features. This, however, presents other problems not the least of which is the inability to observe the front end or "knife" of the moldboard or plow as the ditch is being formed. Also, since the ditch made by this means precedes the power vehicle, there is always present a "bull dozer" problem of controlling the blade height and attitude while forming a precise ditch, since necessarily ground pressure will be so high as to present the danger of caving in the ditch sides. To overcome this problem "bull dozer" type vehicles usually must make several passes over the ground in order to prepare a single ditch.

It is therefore an object of this invention to provide a moldboard equipped device for preparing ditches in soft or marshy areas in a single pass thereof.

Another object of this invention is to provide a device of the character referred to wherein the moldboard is height and attitude adjustable and carried in a tractable framed vehicle having low ground pressure characteristics.

A still further object is to provide a device of the character described wherein the moldboard is

suspendable between the rear wheels of the tractable vehicle and the front end of the frame thereof.

Still another object is to provide a device of the character described wherein the tractable vehicle tongue due to its unique manner of connection to the tractor remains substantially level through said tractor rolls and pitches.

A further object of this invention is to provide a device of the character described wherein ditches are formed in soft ground by a moldboard or plow attachment which is counterbalanced in operation by the rear portion of the device.

Other objects will become apparent from the following description and reference to the drawings wherein like reference numerals refer to like parts throughout and in which:

FIG. 1 is a pictorial rear elevational view, partially sectioned, of the invention showing the plow or moldboard in its operational position and being counterbalanced therein by a rear trailer assembly attached thereto;

FIG. 2 is a side elevation of the invention, partially broken away, showing the moldboard in its ditch forming position, and a portion of the ditch being formed thereby;

FIG. 3 is a view similar to FIG. 2 showing the vehicle with the moldboard or plow being transported over the ground;

FIG. 4 is a top view of the rear portion of the invention showing the trailer assembly thereof, its attachment to the moldboard or plow, and other constructional details; and,

FIG. 5 is an elevational view, partially sectioned of the pintle hook connection of the invention.

Referring to the drawings, and in particular to FIG. 1, the invention is a ditching device 10, comprising a frame 11, attached to a tractor 12 preferably of the tracklaying type, by means of a split, or hinged tongue 13, a pivoting arm 15, a drawbar 14 thereon coupled to a swivel pintle hook 16 on a mounting bracket 17. Mounting bracket 17 is positioned substantially inboard of the trailing edge of tractor 12 for a reason to be explained more fully hereinafter.

In FIG. 1, the ditcher of the invention is shown in its ditch forming position and in operation. As shown, it further comprises a V-type plow, or moldboard, assembly 18 having a pair of blades 18a. Moldboard assembly 18 is attached to frame 11 at its forward end by a steel attachment tube, or mounting post 19, which is angularly disposed to provide clearance when actuating plow 18, and to a trailer 20 which comprises a pair of steel rails 21 mounted between a pair of rear wheels 22 on axle 23 by means of a structural member 24 fixed thereto. In FIG. 2 (and FIG. 4) plow or moldboard 18 comprises a knife edge 25, removable ditching shoe 26 and top and bottom plates 28 and 29 respectively. Attachment tube 19 is fixed to the upper side of top plate 28 by means of mounting flange 19a by welding or bolting, as indicated, and by a similar flange 19a fixed to pivot arm 15 at its other end. Pivot arm 15 together with structural members in the form of an upright beam 31 and support tube 32 comprise a main pivot assembly 30. Beam 31 is fitted with a lug 31a for attachment of one end of a forwardly positioned, actuating cylinder 33. Approximately midway in pivot arm 15 a drilled

hole is provided for attachment, in pivoting engagement therewith, of tongue 13 by means of a pivot or connecting pin 34 or the like as shown. Arm 15 is a steel structure of U-shaped cross section said "U" opening downwardly, and is of sufficient width to receive the aft end of tongue 13. A matching drilled hole is provided through which pin 34 passes.

Referring to FIG. 4, which is a top view of the rear end portion of the invention, trailer 20 comprises a pair of rails 21 attached to a structural member 24. Member 24 is formed from suitable construction channel or the like, and is attached to axle 23 by any well-known means, e.g. hold down U-bolts, or by welding if more convenient, and supported by wheels 22. Bottom plate 29 has its aft portion cut back to provide clearance for rails 21. Intermediate of rails 21, a transverse support plate or beam 35 is attached therebetween, which is provided with a mounting lug 36 for swivel pin attachment of an aft, or plow control, actuating cylinder 37. Two pairs of vertical clevis plates 38 are provided between top and bottom plates 28 and 29 and spaced apart thereon so as to receive the ends of rails 21. Drilled connecting pin holes are provided in each end of rails 21 and in vertical clevis plates 38 for insertion of pins 39 with sufficient clearance to permit trailer 20 to swivel, or rotate, thereabout. Clevis plates 38 further provide support, both between top and bottom plates 28 and 29, and plow or moldboard blades 18a, thereby resulting in a more rigid structure.

Mounted on top plate 28 is an upper clevis connector or lug 40 comprising a pair of vertical plates provided with drilled holes through which passes a connecting pin for attaching the opposite end of cylinder 37. Support for lug 40 and additional support for top plate 28 is provided by a transverse angle 41 (shown dotted in FIG. 4) and fastened at its ends by welding to blades 18a inboard thereof.

Each of wheels 22, best shown in FIG. 1 and FIG. 4, comprise an ordinary rubber tired wheel 42 mounted on the ends of axle 23, and peripherally supported by endless track 43. Track 43 comprises a pair of rubberized fabric belts 44 having a plurality of spaced apart grousers, or cleats, 45 attached thereto to provide traction and support for belts 44, while simultaneously enabling transport of plow or moldboard 18 over soft terrain at very low ground pressures. In construction, track 43 is constructed the same as, or similar to, the tracks of vehicle 12.

FIG. 5 illustrates, in detail, pintle hook 16 and its installation on bracket 17. Pintle 16 is generally of a type exemplified by a device manufactured by the Holland Hitch Company of Holland, Michigan, specifically the model designated by that company as T-60-AOS. However, any swivel mounted device of suitable design will suffice, the FIG. 5 illustration being comprised of a pair of juxtaposed jaws 16a and 16b, the upper one of which, 16a, rotates, to open the jaws, about a pin or post 46. Extending from jaw 16b is a shaft 47 which passes through flanges 48 and 49, bushing 50 and is fastened by means of cotter keyed nut 51 on its threaded end. Flanges 48 and 49 are fastened to vertical mounting plate 17a of bracket 17 on either side thereof by bolts as shown. Hook 16, though fixed in position on plate 17a, is still free to rotate with shaft 47 in response to rolling motion of frame 11 and drawbar

14, as indicated by the arrows in FIG. 5 for a purpose which will be more fully explained in what follows.

In operation of the invention reference should be made to FIGS. 2 and 3. In FIG. 3, ditching device 10 is shown being transported over the ground, which is presumed to be marsh land, by tractor 12 with moldboard 18 in a raised, non-ditching position. When tractor 12 arrives at a preselected place where a ditch is to be formed, hydraulic pressure (from a source, not shown, carried on vehicle 12) is applied to ports B and B' of cylinders 33 and 37 respectively. Pressure thus applied lowers plow assembly 18, causing arm 15 and tongue 13 to approach the position shown in FIG. 2, and simultaneously pivots plow 18 slightly so that shoe 26 cutting tip 26a enters the ground at a slight angle to initiate trenching. Tractor 12 is moved forward as tip 26a enters the ground and until bottom plate 29 contacts the top surface thereof. Lowering is discontinued by discontinuing hydraulic pressure supply to cylinder 33, but pressure is continued to cylinder 37 until wheels 22 assume the position shown in FIG. 2, i.e., are clear of the ground. At this point plow 18 is in the FIG. 2 position and ditching operations are under way. In FIGS. 2 and 3 the pistons of cylinders 33 and 37 are shown dotted to indicate their relative positions during each operative phase.

As seen in FIG. 1 (and FIG. 4) the invention is shown as it forms a ditch. The soil therefrom is forced upward and outward by the V-blades 18a in response to forward motion of tractor 12, and deposited clear of wheels 22 on both sides, leaving relatively flat areas adjacent both edges of the ditch, since, as shown in FIG. 4, blades 18a extend beyond wheels 22. This serves the twofold purpose of providing relatively smooth surfaces for the tracks of vehicle 12 in the event that re-ditching or cleaning of the ditch is subsequently required, and also, in extremely soft or marshy areas wherein plow 18 and shoe 26 may tend to sink below a preselected depth, wheels 22 will contact the ground on the ditch level edge areas and prevent further sinking. The latter is a frequently encountered problem since in many of the marshy and/or swampy areas wherein drainage ditches are necessary, the ground is covered with a relatively thick (6 to 8 inches) matting of grass and vegetation capable of supporting loads if properly distributed, but underneath is extremely soft and therefore, non-load bearing. Hence, the unique suspension of the plow as contemplated in this invention is supported at the ground surface while still being capable of forming the desired trench. Thus, while ordinarily the rear wheels 22 are in a position above the ground and act to counterbalance the plow where it contacts the ground on bottom plate 29, under certain, frequently occurring, circumstances it is desirable to permit them to roll upon the surface alongside the trench and thereby render ample support to moldboard 18 while ditching.

As indicated above attachment of ditching apparatus 10 to vehicle 12 results in further unique features and advantages. It has been found that positioning bracket 17 and pintle hook 16 inboard of the aft end of vehicle 12 to a point approximately amidship thereof provides for increased mobility and maneuverability over prior art devices, without significantly increasing ground pressure. Thus very small radius turns are accomplisha-

ble than heretofore was possible. In uneven terrain such as near river banks, where tractor 12 may roll and pitch, the invention herein is still able to perform its function since tongue 13 and drawbar 14 will remain relatively unaffected due to the swivelling of shaft 47 of pintle hook 16. It has been found that where prior art devices when approaching river bank edges, large gullies and ditches, because of their higher ground pressures must stop operations a short distance from the edges thereof and finish ditching by hand. However, the invention herein is not limited in this respect, since ditcher 10 is simply backed over the edge, plow 18 lowered into position and ditching performed regardless of attitude of tractor 12 over the ground. Thus, it is seen that practically all hand operations are hereby eliminated.

Other advantages will occur to skilled workers in the art. For example, easy replacement of worn or damaged parts such as shoe 26, which is preferably bolted to bottom plate 29; and trailer 20, which is easily removed by removing three pin connectors. Therefore, while the invention has been described with respect to a single embodiment, it is intended that no limitations are to be imposed thereon except as defined in the sub-tended claims.

What is claimed is:

1. A ditch-forming apparatus adapted to be towed by a tractor vehicle comprising an articulated frame;
 - a moldboard assembly connected to the frame and adapted to be raised and lowered thereon, said moldboard assembly comprising:
 - a V-shaped plow having a knife-edge at the apex of the V and positioned so as to be directed forwardly thereof, a pair of spaced apart horizontal plates fixed in the V of said plow on the aft side thereof, a removable attachment post having one end attached to the top one of said spaced apart plates and removably attached to said frame at its other end, and at least one pair of clevis plates fixedly positioned between said spaced apart plates for supporting said plates and increasing the rigidity of said moldboard assembly, said clevis plates having holes therein for attaching said trailer to said moldboard assembly;
 - means for raising and lowering said moldboard assembly, a ditching shoe forwardly positioned on said moldboard on the bottom thereof having a ditching edge;
 - a wheeled trailer pivotally connected to said moldboard assembly and extending rearwardly thereof;
 - means attached to said moldboard assembly and to said trailer for raising and lowering said trailer with respect to the ground to counterbalance said moldboard assembly when said moldboard is in its ditching mode of operation; and,
 - means for connecting said frame to said tractor, said connecting means being positioned substantially

forwardly of the aft end of said tractor.

2. The apparatus of claim 1 wherein said wheeled trailer comprises a pair of parallel rails having forward ends rotatably connected to said moldboard assembly and rearward ends connected to said wheels, a cross member attached to each of said rails for maintaining said rails in a spaced apart, substantially parallel relationship, and means on said cross member for attaching said trailer raising and lowering means.

3. The apparatus of claim 1 wherein said wheeled trailer further includes a pair of side by side endless belts surrounding said wheels, said belts being connected by a plurality of laterally disposed grousers forming with said belts a track-laying means.

4. The apparatus of claim 1 wherein the articulated frame comprises a pivotable tongue having a drawbar end for coupling said apparatus to said tractor, and a pivot arm attached to said moldboard assembly, said tongue and said arm being pin connected.

5. The apparatus of claim 1 wherein said connecting means is a swivel mounted pintle hook fixed to a bracket attached to said tractor vehicle.

6. The apparatus of claim 1 wherein the wheeled trailer comprises track laying means and is adapted to track entirely within the V of said plow.

7. A ditcher apparatus for forming dimensionally precise ditches in soft or marshy ground comprising, in combination, a tractor propelled on tracklaying means, an articulated frame connected to said tractor comprising a pivotable tongue, a pivot arm connected to said tongue, actuating means connected to said tongue and to said pivot arm for pivoting said tongue, a moldboard assembly attached to said pivot arm adapted to be raised and lowered in response to pivoting of said tongue, said moldboard assembly comprising; means for connection thereof to said pivot arm, a pair of V-shaped blades opening aftwardly, an upper plate fixed between the aft sides of said blades, a bottom plate fixed on the aft side of said blades substantially on the bottom edges thereof, a removable ditching shoe centrally positioned on the bottom side of said bottom plate on the forward portion thereof for forming a dimensionally precise ditch, supporting means extending between said top and bottom plates and attached therebetween for supporting said plates and increasing the rigidity of said moldboard assembly, an axle, a track laying, wheeled trailer having a pair of rails forwardly extending from said axle to said moldboard assembly and attached, in counterbalancing relationship to said moldboard assembly on said supporting means so as to permit rotation of said trailer about an axis through the point of attachment of said rails, and actuating means connected to said trailer and to said moldboard assembly for raising and lowering said assembly and rotating said trailer to counterbalance said moldboard assembly.

* * * * *