Feb. 16, 1954 O. L. GREGERSON 2,669,040

V TYPE DITCHING MACHINE ADJUSTMENT

Filed Sept. 17, 1946 2 Sheets-Sheet 1

FIG. 1.

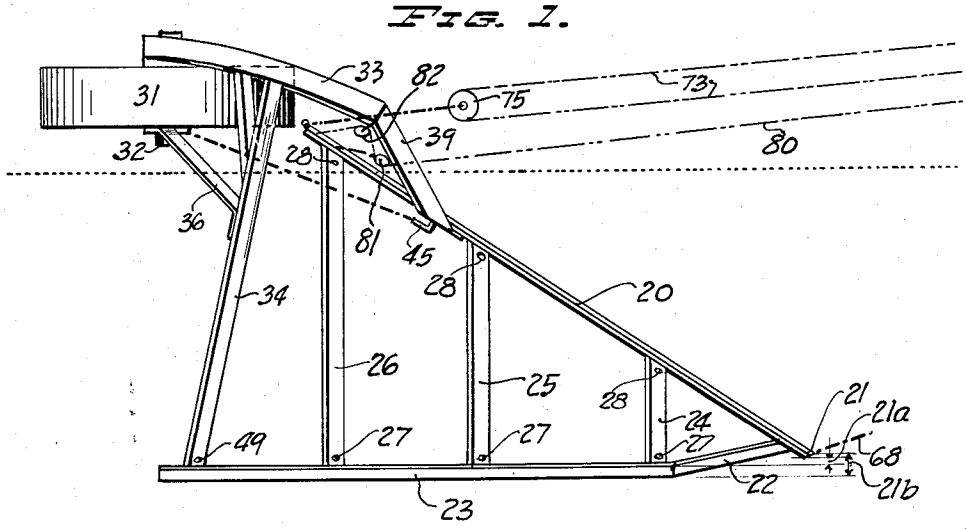


FIG. 2.

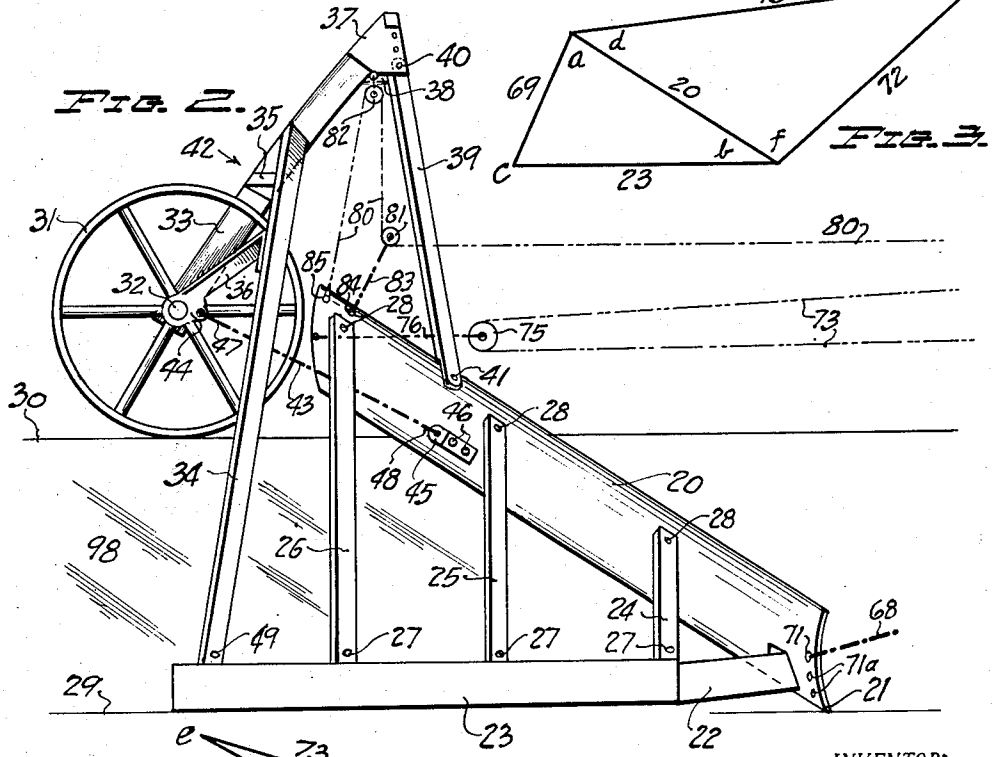


FIG. 3.

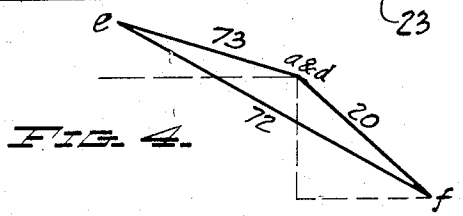


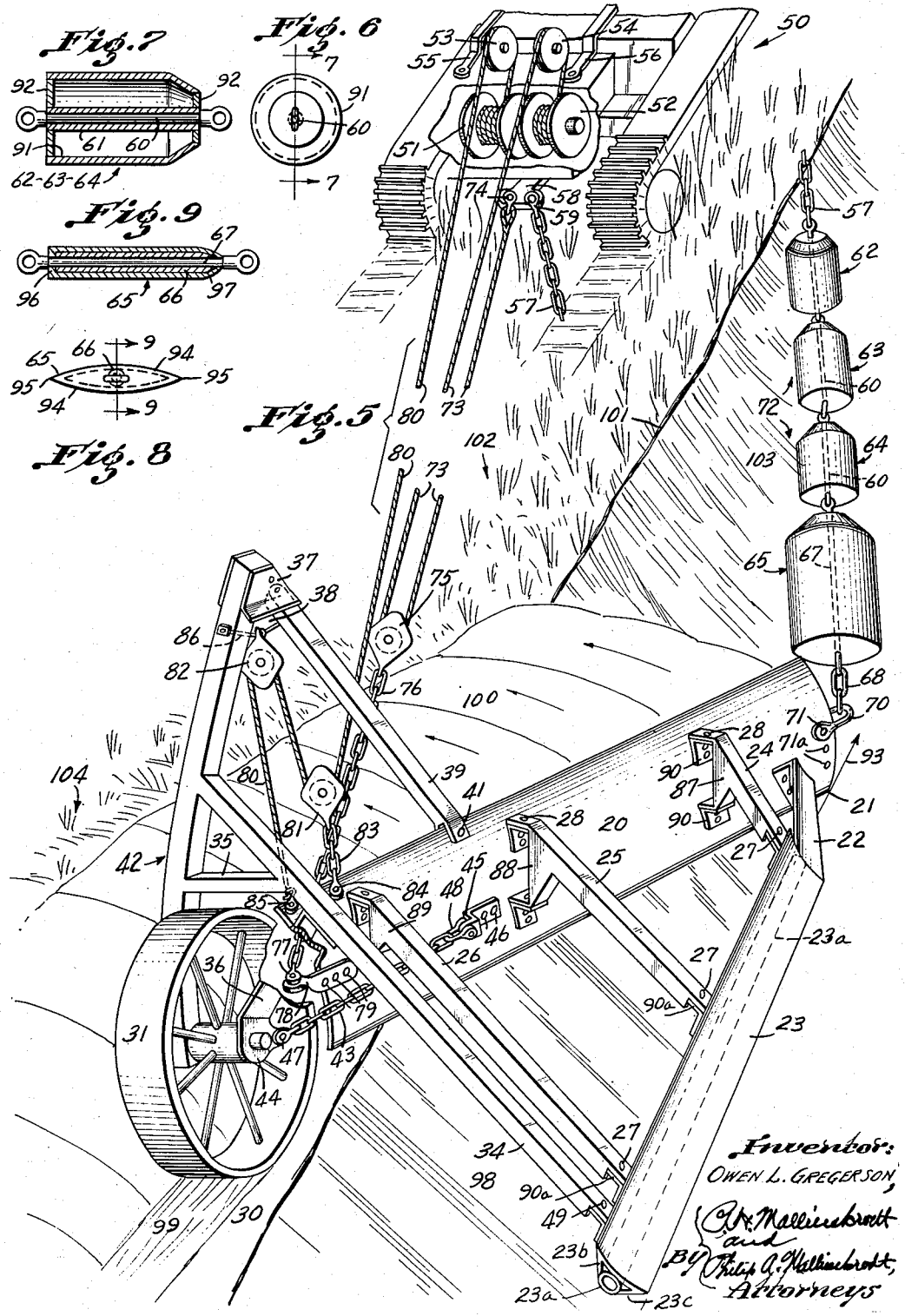
FIG. 4.

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Feb. 16, 1954 O. L. GREGERSON 2,669,040

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Filed Sept. 17, 1946 2 Sheets-Sheet 2



Patented Feb. 16, 1954 2,669,040

UNITED STATES PATENT OFFICE

2,669,040

V-TYPE DITCHING MACHINE ADJUSTMENT

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Application September 17, 1946, Serial No. 697,489

12 Claims. (Cl. 37—98)

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This invention relates to a ditching machine or ditcher and more particularly to an assembly which includes a prime mover such as a tractor for imparting motion to the ditching machine proper.

Among the principal objects of the invention are to provide apparatus that is adapted for:

(a) Advantageously constructing new waterways, such as canals, ditches, and so on.

(b) Cleaning, digging-out or reconstructing existing waterways.

(c) Efficiently controlling its traveling earth-digging element or elements.

(d) Exercising a high degree of maneuverability, including especially cases where it is necessary to pull around bridges, headgates or other structures that may be encountered in the course of its travel.

(e) Cleaning or re-forming a waterway channel without removing the water therefrom.

(f) Traveling conveniently remote from its tractive prime mover.

(g) Advantageous and relatively inexpensive manufacture.

Other objects will become evident as the following detailed description proceeds.

In attaining the said objects according to the invention, a relatively heavy moldboard is connected to a landside element so as to form substantially a V-shaped frame that is adapted to travel trailingly along the course of a waterway channel with the vertex of the V in advance. The landside element trails longitudinally along the bottom of a waterway channel while the moldboard, commencing at the vertex of its connection with the landside, is trained obliquely upwardly and backwardly across one side of the channel so that the rear portion of the moldboard rises above the corresponding bank of the channel.

Two draft points are provided, one, the forward or principal draft, in proximity to the vertex of the V-frame or the nose portion of the moldboard, and the other or rear control draft, in proximity to the protruding end portion of the moldboard above the bank. Advantageously, the protruding end portion of the moldboard is floatingly supported by a trailing wheel that is in turn flexibly connected to the rear of the V-frame. This frame with its appurtenances constitutes the ditching unit proper and is flexibly connected to a tractive unit located in advance of, but remote from, the ditching unit. The tractive unit may comprise a tractor of the endless tread type provided with a drawbar and with reeling drums. A draft chain extends from the forward draft point

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of the ditcher to the drawbar of the tractor, while control cables run from the rear draft point and from the floating control point of the moldboard to the respective reeling drums. Thus, the ditcher, whether in a channel or out of it, becomes highly maneuverable.

Novel features include the method of controlling the moldboard so that it shall assume the proper working angle, by selectively transferring the weight thereof to the trailing wheel through the use of the control cable; and the method of withdrawing the machine from a ditch or other waterway, and returning or reentering the machine in needful maneuvering.

In the accompanying drawings,

Fig. 1 represents a plan of the ditching machine proper, that is to say, apart from the prime mover, this figure being somewhat in diagrammatic form;

Fig. 2, a near-side elevation corresponding to Fig. 1;

Fig. 3, a diagrammatic plan showing the triangular relation between the cutting elements of the ditching unit and the control means extending from the cutting elements to the prime mover;

Fig. 4, a rear end elevation corresponding to Fig. 3;

Fig. 5, a view in perspective of the complete assembly substantially in the working position as seen from the rear, portions in this figure being broken away for convenience;

Fig. 6, an end elevation of a pilot roller forming a minor part of the assembly;

Fig. 7, a vertical section taken on the line 7—7 in Fig. 6;

Fig. 8, an end elevation of a nose float forming a detailed part of the assembly; and

Fig. 9, a vertical section taken on the line 9—9 in Fig. 8.

Referring to the drawing, the numeral 20, Figs. 1, 2, and 5, designates a moldboard which, in the working position as shown, is angularly trained across a side of a canal both with relation to the longitudinal extension means as well as from the bottom of the waterway to a bank thereof. Just back of the nose 21 of the moldboard is a connection member 22 which extends from the moldboard to a landside 23. Also extending from the moldboard to the landside is a plurality of struts, in this instance three, 24, 25, and 26. These struts are removably connected to the landside in any suitable way, for example, by means of bolts 27, and similarly connected to the moldboard by means of bolts 28. The removable feature is de-

sirable for dissembling the machine and in moving it from place to place, but obviously, the connections between the struts and the landside and the moldboard could be permanent, made so, for example, by means of rivets or welding (not shown).

In Fig. 2, the landside 23 is shown in its working position along the bottom 29 of a canal, the bank of the canal being shown at 30 and a substantially finished side of the canal at 98. Disposed to travel along the canal on the bank 30 is the trailing wheel 31, which is journaled on a stub axle 32, that extends outwardly from the trailing wheel so as to carry the lower end of a mast 33. Connected to the mast, for example by welding, is the upper end of a strut 34, this strut and the mast being further rigidly connected to each other by means of a brace 35 so as to conveniently produce an A-frame. A brace 36 extends advantageously from the opposite end of the axle 32 to the strut 34. At the top of the mast 33 are warped gusset plates 37 and 38 between which is secured the upper end of a strut 39, the securement being effected by any suitable means, for example, a bolt 40, which allows a limited movement of this strut, the lower end of the latter being similarly fastened to the moldboard 20 by means of the bolt 41.

Flexibly connecting the A-frame 42 to the moldboard is a chain 43 that serves to harness the trailing wheel 31 to the moldboard. For this purpose one end of the chain is connected to a lug 44 on the brace 36, the other end of the chain being connected to the bracket 45 that is fast on the moldboard 20, in this instance by means of rivets 46. The chain fastenings may be of any suitable kind such as the respective clevises 47 and 48. The strut 34 is removably connected to the landside 23 by any suitable means, for example, a bolt 49. Thus, the A-frame 42 with its trailing wheel 31, has largely a "floating" relation to the moldboard and the landside, thereby bringing about certain desirable flexibility of connection between these parts relative to the control mechanism presently to be described.

Means operative to propel the ditching machine along its course comprises for illustration, a prime mover, which in this instance is a tractor of the endless tread type represented at 50, Fig. 5. This tractor preferably includes a self-contained mechanism operative to selectively manipulate the moldboard and consists conveniently of usual winding or reeling drums 51 and 52 as well as usual guide sheaves 53 and 54. The winding drums are operative through the respective, usual levers 55 and 56. Power for driving the operating drums is supplied from the usual engine (not shown) through a usual transmission mechanism (not shown).

The main draft member is indicated at 72 and preferably comprises an articulative chain 57 followed by a series of obstacle overriding pilot elements. A clevis 59 connects one end of chain 57 to the tractor drawbar 58, the other end being connected to an elongated, eyeletted link 60 that has a shaft portion on which is rotatably mounted a tube 61 forming a fixed part of a pilot roller 62. This first roller is articulatively connected to a second pilot roller 63 which also is mounted on a similar link, the successive rollers forming a group suited to the requirements of any particular case. In this instance are shown three pilot rollers, the last one 64 being articulatively connected to a nose float 65 fixed on a tube 66 which latter is rotatably mounted on the shaft portion of a link 67 that in turn is connected to a short chain 68, the last link of which is connected to a clevis 70 that is pivotally connected to the front end of the moldboard 20 at 71. Alternative holes 71*a* for the pivot pin are provided in the moldboard 20. A flexible auxiliary draft member comprising principally, for example, a wire cable 73, has one end thereof connected to the drawbar 58 by means of a rope socket 74. This cable extends through a pulley block 75 and the other end of the cable passes over the guide sheave 54 and is wound on the drum 52. The pulley block 75 is attached to a link chain 76, the other end of the chain being connected to the rear end of the moldboard 20 by means of a clevis 77 pivotally connected to an arm 78 that is fast on the moldboard, for example, by means of rivets 79.

In order to properly control the operation of the moldboard, means is provided for raising or lowering the moldboard with respect to the trailing wheel 31. In the present instance, the raising and lowering functions are accomplished by means of a flexible cable 80 that passes through the pulley blocks 81 and 82. The pulley block 81 is advantageously connected to the moldboard by means of a relatively short chain 83 having the clevis 84, the latter being pinned to the moldboard. The near end of the cable 80 is fastened to the moldboard by means of a rope socket 85. The pulley block 82 is necessarily located at a point appreciably above the pulley block 81, an advantageous point of fastening being provided in proximity to the top of the mast by means of an eye-bolt 86.

Since the moldboard 20 is usually of considerable width from top to bottom and has considerable weight, it is desirable that the struts 24, 25 and 26, be securely braced to both the moldboard and the landside, in this instance, by means of the respective bracketed portions 87, 88 and 89. For convenience in dissembling when moving a machine from place to place, as hereinbefore touched upon, the bolts 28 serve to engage connection angles 90, Fig. 5, that are fast on the moldboard. Similarly, the bolts 27 engage connection angles 90*a* fast on the landside. In use, the landside is subjected to reactionary stresses from the moldboard and therefore must be of sturdy construction. Accordingly, a tubular member 23*a* extends longitudinally along the back of the landside and is connected thereto by the longitudinal plates 23*b* and 23*c* to form a rigid assembly, this for illustration, being accomplished by welding the component parts together as required.

The general details of the pilot rollers, such as 62, 63 and 64 are indicated in Figs. 6 and 7, where the shell 91 and the tube 66 of each roller are connected to the respective heads 92, by welding. The general details of the nose float are indicated in Figs. 8 and 9 where the shell consists of steel plates 94 curved to a relatively long radius and welded together at the edges 95 thereof to define a rather flattened configuration, the two plates 94 being provided with a rear head 96. The forward end of the nose float is curved, as at 97, to facilitate riding over obstacles.

The flattened configuration of the nose float stabilizes its motion as it glides along through or over silt and mud, and it in turn imparts a certain degree of stability to the moldboard and landside, while the connection member 22 improves the advancing attack of the moldboard upon the material encountered in its advance.

it has been found that excellent results are obtained when the line of the upper edge of the landside, extended, is spaced somewhat outside of the nearest point of the moldboard, as designated at 21*a* in Fig. 1, while at the same time, the line of the lower edge of the landside, extended, is spaced apart from the nose of the moldboard a distance 21*b*, considerably greater than the distance 21*a*.

In operating the ditching assembly two men are usually employed, both having their stations preferably on the motive unit, one to guide it and the other to manipulate the control mechanism per se that actuates the control lines running to the ditcher. As represented in Fig. 5, the ditcher is drawn along a canal or other waterway in the general direction of the arrow 93. The operator of the ditcher manipulates the levers 53 and 54 to achieve the results desired in any particular case, while the driver guides the tractor 50 in accordance with these same desired results. The remoteness of the tractor from the ditcher depends upon the particular local conditions encountered from time to time. If the banks happen to be quite firm and the vegetation not too heavy, the tractor may travel rather closely to the channel, but if the conditions are not favorable, the tractor must travel a course spaced a greater or lesser distance from the channel.

Some of the results obtainable by means of the invention are in general visualized in Fig. 5. Assuming that the blade 20 has been set at the proper angle, as determined by varying conditions, such as those peculiar to a particular waterway with respect to the final results desired, it will be observed that in traveling in the direction of the arrow 93, the moldboard 20 is trained across and cuts into a side of the waterway so as to practically roll up a layer of refuse earth or spoil together with any vegetable growth thereon. This spoil is rolled onto the respective bank of the waterway and leaves the side of the latter in substantially the finished form indicated at 98, while the trailer wheel follows the moldboard along a path that may very considerably, but that in general follows the representation at 99. The layer of spoil being removed, generally follows the representation at 100, the arrows indicating its rolling movement.

Irrigation canals and ditches are subject to having the banks grown over, and even the sides and bottom of a waterway itself covered with vegetable growth, such as willows, grass and wild shrubbery of various kinds. A considerable network of deeply penetrating roots is developed that from year to year produces a growth which gives trouble by impeding the flow of water through the waterway and reduces very materially the carrying and earning capacity thereof. Therefore it becomes necessary at frequent intervals to remove the vegetation that is objectionable and wild, and re-form the sides and banks of the canal or ditch. The utility of the invention in accomplishing this work will readily be understood from what has been explained.

A representation of some of the objectionable features encountered, is set forth in Fig. 5 where along the bank portion 101, growing grass has gotten very long and trails down into the waterway channel. At 102 is indicated a growth of willows. As a consequence, the side 103 of the channel, because of the wash of the current and the deposition of silt or other obstructive matter, has become de-formed to an objectionable extent. As the ditching machine moves forward along such a waterway, the obstructing matter is removed, usually at one passage of the machine. As the machine advances and the spoil is rolled up onto the bank, the vegetable growth of any substantial height is bent over and flattened down by the oncoming rolling action of the spoil 100, such flattening being suggested at 104.

An important consideration in the operation of the machine is the flexibility of its control means. This flexibility is based on the fact that the operation takes place in two selectively variable, contiguous triangular planes having a side in common along which a hinging action takes place, as illustrated in the diagrams of Figs. 3 and 4. The moldboard 20 and the landside 23 are represented by the so designated intersecting straight lines that constitute two sides of a triangle, the third side being an imaginary line 69 joining the far extremities of lines 20 and 23. This triangle has vertices *a*, *b*, *c*, and obviously lies in the plane of operation of the machine. The other triangle has the sides 72 and 73, and the vertices *d*, *e*, *f*, the third side being 20 in common with the triangle *abc*. The side 72 represents the main draft member with its appurtenances, and the line 73, the auxiliary draft member with its appurtenances.

In any particular ditcher the triangle *abc* obviously is constant, but the triangle *def* is subject to variation, first, because the main draft member 72 can be varied from time to time by adding or subtracting chain links according to general requirements, and second, because the auxiliary draft member 73 can be and is varied momentarily according to specific requirements as the assembly moves along. This selective variation in the side 73 along with the fact that contiguous vertices *a* and *d* are in common subject to selective elevation or depression, by means of the control line 80, combines to bring about the high degree of maneuvering flexibility of the apparatus of the invention.

It is to be observed that the triangle *abc* of Fig. 3 lies wholly in the line 20 of Fig. 4.

While the fields in which the machine of the invention finds employment are quite numerous, one that is representative and brings out its novel maneuverability, is the cleaning of irrigation canals. This field seems deserving of special mention. Ordinarily, irrigation canals flow through districts where land is under a high degree of cultivation and hence canals are beset with many obstructions, such as individual headgates through which the users of water are served, bridges, and so on. Canal work of this character also brings out a significant advantage of the present machine in that its entire performance is continuous and occurs in transit, that is to say, there is no stopping of the machine because of the obstructions aforesaid, while ditching machines of other types in common use, almost invariably require stopping at any obstruction followed by a tedious procedure of getting the machine out of the channel and replacing it on the opposite side of the obstruction—an intermittent performance at best.

When the present machine encounters headgates, it is not necessary to take the machine out of the channel at all, for the reason that the outboard portion of the moldboard can be raised sufficiently high on the mast so that almost any headgate structure is cleared. As soon as the moldboard has passed over, it can again

be lowered into the digging position in the channel without fuss or fanfare. An unique feature of manipulation of the machine is that in the interval of the said passing over, the weight of the moldboard is practically taken off the carrier wheel 31, with the result that only the weight of the wheel comes on the headgate structure, therefore seldom causing any damage to the same.

Also unique is the passing of a bridge. As soon as the machine approaches the bridge, the auxiliary cable 73 and the control cable 80 are lengthened out or unreeled, so as to throw the entire tractor pull onto the nose of the machine, thereby raising it out of the channel and concentrating the entire pulling stress on the landside. This results in bringing the machine up, out of the channel immediately in front of the bridge, and to pass the same without further ado, all during transit. After passing, the two cables are again shortened, or reeled in, so that the machine is guided back into the channel. At this point is where the particular novel utility of the runner 22, which has hereinbefore been designated as a "connection member" is manifested, in that it guides the nose of the machine generally in the longitudinal direction of the runner, instead of allowing the landside to impose its guidance on the nose.

When the machine is used in a digging operation, the depth of the digging is controlled by slacking the auxiliary cable 73 and at the same time allowing the pull of the main draft member 72 to raise the nose to the desired extent, since the tendency of the main draft member without this control is to sink the nose deeper and deeper into the soft material at the bottom of a canal. The novel utility of the nose float 65 consists in keeping the nose of a machine in such a position that the uniform line of the channel is maintained.

Also unique in the operation of the machine is the fact that it is maneuvered entirely by remote control so that the cleaning of a canal can easily be accomplished even though it is full of water. This is of considerable importance when it is realized that withdrawing the water from a canal is not only an item of expense, but also that it occasions inconvenience and often money losses to the users of water from the canal.

Cleaning the bottom of a canal is easily accomplished by the proper manipulation of the control lines, first bringing the V-frame into a position where its plane coincides with the bottom surface of the canal and then drawing it along that surface.

Although more or less specific details are included in the foregoing description, it is to be understood that the invention is not thereby limited.

What is claimed is:

1. A ditching machine comprising a V-shaped frame composed of a moldboard leg and a landside leg; a trailing wheel arranged outside said V-shaped frame to support the outboard portion of said moldboard leg; an A-frame having one leg strut at least partially supported on said trailing wheel and another leg strut connecting the first-mentioned leg strut to said landside; and a flexible connector extending from said A-frame to said outboard portion.

2. A ditching machine comprising a V-shaped frame composed of a moldboard leg and a landside leg; carrier means for the outboard portion of said moldboard leg; said carrier means consisting of a trailing wheel; a mast supported by said trailing wheel; a strut extending from said mast to said moldboard; another strut extending from the mast to the outboard portion of said landside; and flexible draft means operative to harness said trailing wheel to the outboard portion of said moldboard.

3. A ditching apparatus assembly including in combination a ditching unit comprising a V-shaped frame having a moldboard leg and a landside leg extending backwardly from the vertex of the V; carrier means trailing and supporting said moldboard; a prime mover comprising motive means having a drawbar and reeling means; main draft means extending from substantially the vertex of said V-frame to said drawbar; and auxiliary draft means extending operatively from the rear of said moldboard leg to said reeling means.

4. A ditching apparatus assembly according to claim 3, wherein said main draft means comprises a flexible connector having overriding roller means disposed in advance of the vertex of said V-frame.

5. A ditching apparatus assembly according to claim 3, wherein said main draft means includes a nose float in advance of the vertex of said V-frame.

6. A ditching apparatus assembly according to claim 3, wherein said auxiliary draft means comprises a flexible connector extending from said drawbar to the rear portion of said moldboard leg and from said rear portion back to said reeling means; and means operative to selectively control the reeling means.

7. A ditching apparatus assembly according to claim 3, wherein control means is included operative to selectively elevate or to cause the depression of said moldboard relatively to said carrier means.

8. A ditching apparatus assembly according to claim 3, wherein is included pulley means disposed at the rear portion of said moldboard; other pulley means disposed at a high point of said carrier; a second reeling means on said prime mover; and a flexible connector having one end thereof attached to said rear moldboard portion, thence threaded respectively through said second-mentioned and first-mentioned pulley means and finally extending operatively to said second reeling means.

9. An earth excavating plant comprising an excavating unit with a moldboard having a nose portion, and an edge portion extending angularly upwardly and backwardly of said nose portion; means adapted to operatively support said moldboard; a motive unit operative to draw said excavating unit; a flexible main draft connector extending from said motive unit to said nose portion; a flexible secondary draft connector extending from said motive unit to the rear portion of said moldboard; means selectively operative to lengthen or shorten said secondary draft connector as the case may be, during transit; and means selectively operative to elevate or depress the rear portion of the moldboard as the case may be, during transit.

10. An excavating plant including in combination, an excavator having a moldboard and a landside lying operatively in and constituting two sides of a triangular plane; a prime mover remote from said excavator; flexible draft connectors extending from said prime mover to said excavator, said draft connectors forming substantially a second triangular plane having a side

in common with the moldboard side of the first-mentioned triangular plane, said prime mover being located substantially at that vertex of the second-mentioned triangular plane that is opposite the common side; an A-frame having a wheel-carried leg adjacent the free end of said moldboard, the other leg thereof being attached to the free end of said landside; and a flexible control connector operative to raise or lower the moldboard free end relative to said A-frame.

11. An excavating plant according to claim 10 wherein is included means operative to selectively increase or diminish as the case may be during transit, the effective length of that one of said flexible draft connectors which is opposite that vertex of the second-mentioned triangular plane which is located adjacent the angle at the intersection of the moldboard side with the landside side of the first-mentioned triangular plane.

12. An excavating plant according to claim 10, wherein moldboard raising and lowering means extends from said prime mover to that vertex of the first-mentioned triangular plane opposite the landside side thereof; and wherein said prime mover is operative to selectively increase or diminish as the case may be, the length of the said moldboard flexible control connector.

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