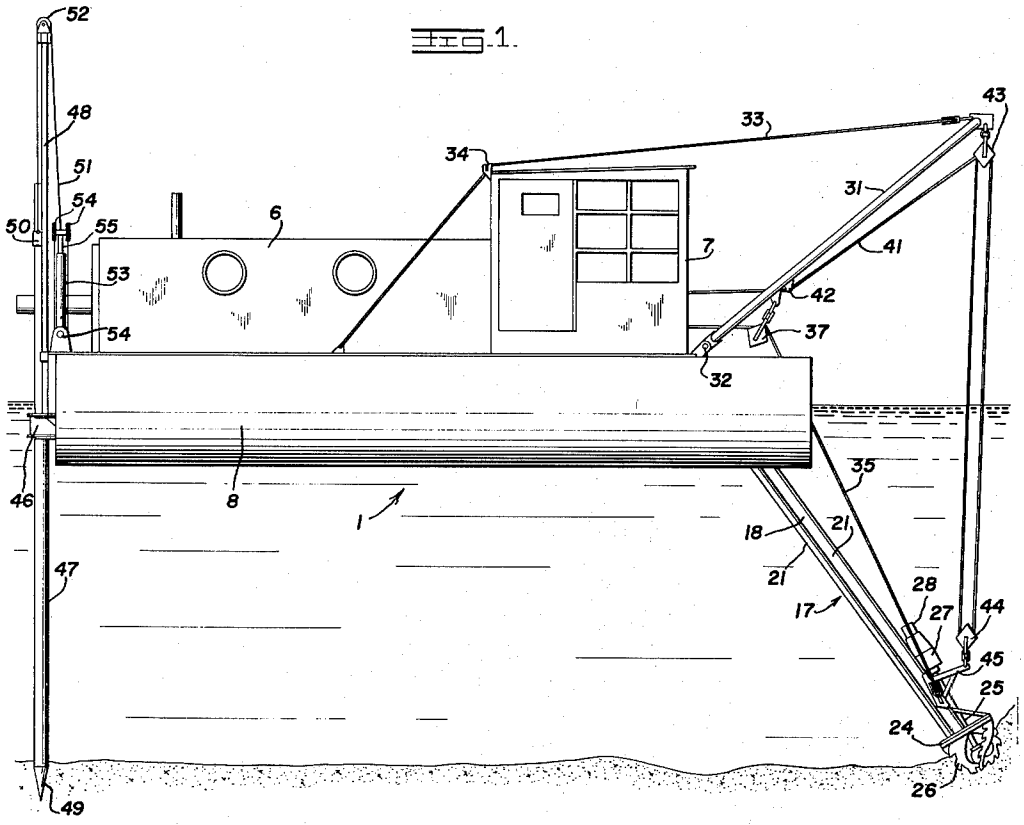
Oct. 24, 1961 J. H. MILNE 3,005,273

DIXIE DREDGE

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FIG. 1.



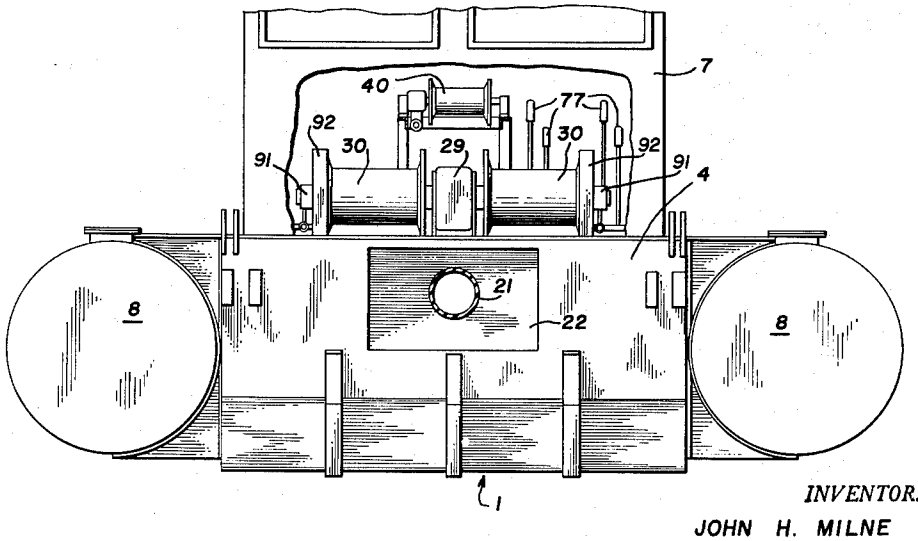


FIG. 4.

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Fig. 2.

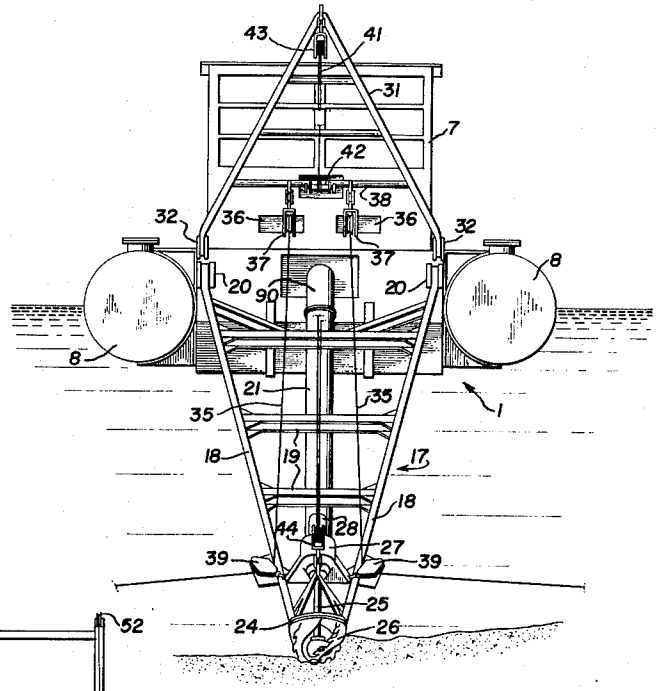
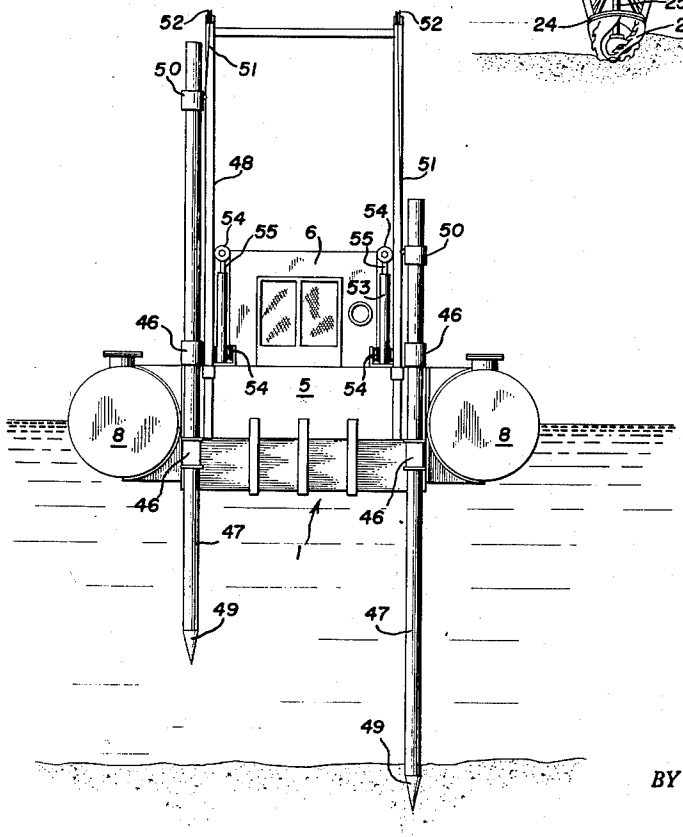


Fig. 3.



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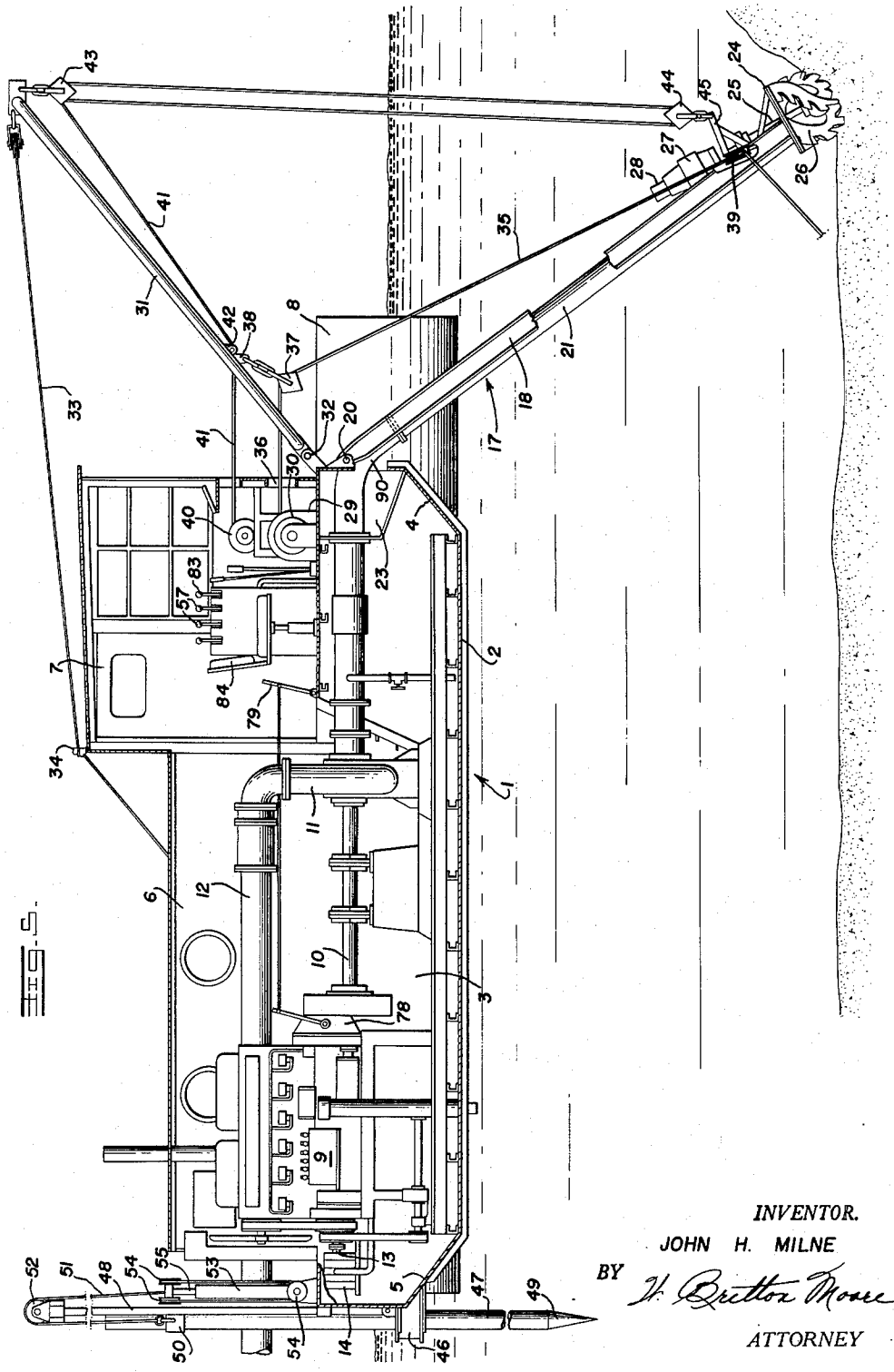


FIG. 3.

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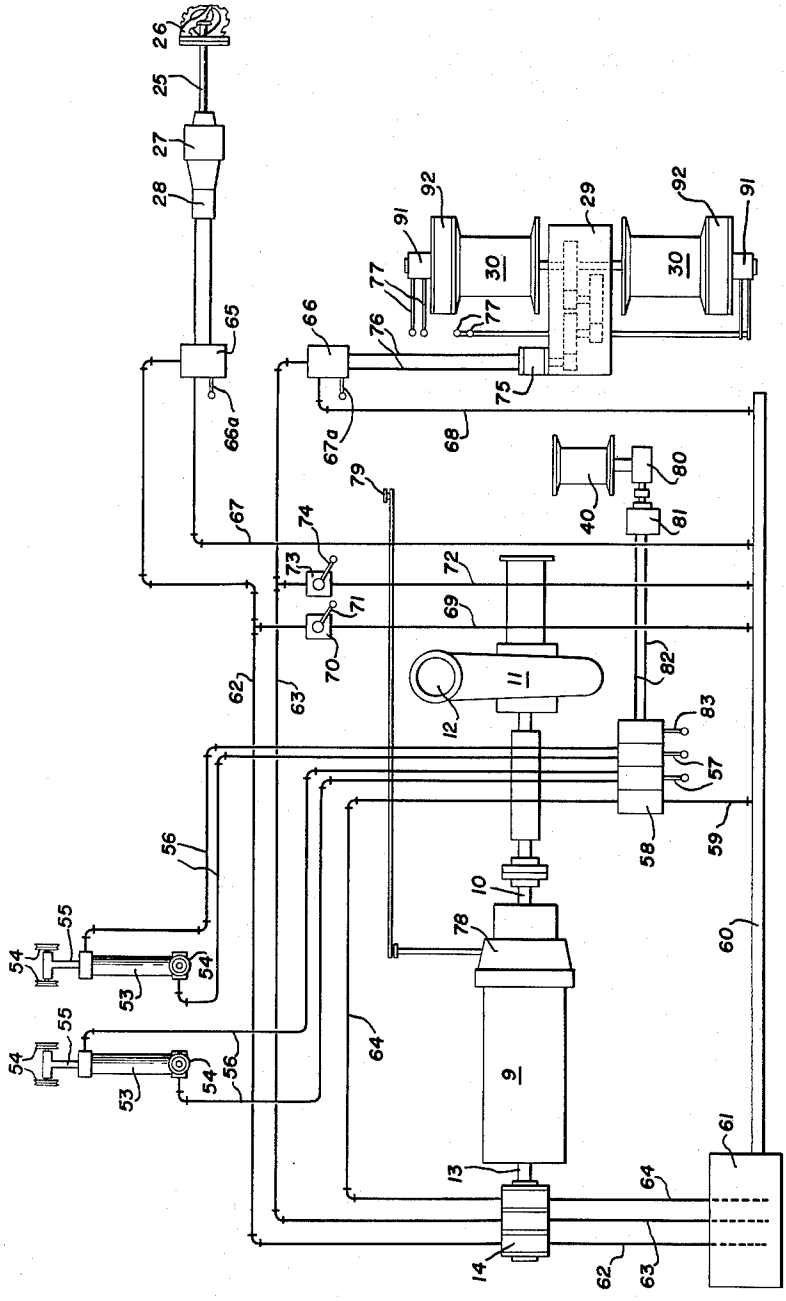


FIG. 6.

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DIXIE DREDGE

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1 Claim. (Cl. 37—64)

This invention relates to hydraulic dredges of the type commonly employed for excavating material submerged below the surface of water in a lake, stream or the like.

It has been common practice to use hydraulic dredges for excavating submerged material in various bodies of water. These dredges have been mounted on buoyant hulls and provided with dredge machinery for this purpose. However, such dredges have been found objectionable and unsatisfactory for various reasons, because of the necessity of utilizing complicated and expensive electrical and/or mechanical power plants which materially increased their weight and affected their buoyancy. In other words, these barges had definite design limitations due to their size and balance problems.

In existing dredges, with mechanical or electrical power plants, there necessarily are definite limitations as to the depth at which they will dig because the power plant is located on the hull and drive is imparted to the cutter head arranged on the forward end of the ladder through a drive shaft extending along the ladder, between the power plant and cutter head. Hence, if it becomes necessary to dig deeper than the limits for which the barge and boom are designed, it is necessary to remove the boom and drive shaft and replace the same with a longer and heavier ladder and shaft. Naturally, it follows that when this is done, the weight balance of the barge is disturbed and its efficiency will be materially reduced. As a matter of fact, there are very definite limitations to which the ladders and drive shafts can be increased to effect deeper digging because the increased weight at the digging end of the apparatus will affect its balance and the increase in length and weight of the drive shaft will decrease the cutting power of the head.

Existing barges have also been so complicated and cumbersome that the expense of manufacturing and maintaining them have been almost prohibitive.

It is, therefore, an object of the present invention to provide a barge mounted on a buoyant hull equipped with a hydraulic system for actuating and controlling a cutter head.

Another object of the invention is the provision of a hydraulic floating dredge wherein the cutting head and driving mechanism therefor is arranged at the forward end of the supporting ladder so that the overall weight of the dredge is materially reduced and the cutting efficiency correspondingly increased.

Still another object is the provision of a floating barge equipped with a hydraulic system for actuating and controlling a cutter head which eliminates the use of expensive, cumbersome and complicated electrical and/or mechanical power plants and which will have all of the functional advantages of these types of motors without the operating disadvantages thereof.

A further object is the provision of a floating barge wherein a compact cutter head assembly and drive unit is removably located at the forward extremity of the supporting ladder so that, when fluid is delivered from the hydraulic power plant on the hull to the drive unit of the cutter head assembly, a high degree of torque will be imparted to the cutter head to efficiently operate the latter.

Still a further object is to provide a floating barge equipped with a compact cutter assembly including a cutter head, hydraulic motor and a relatively short drive shaft interconnecting the motor and cutter head, which

cutter assembly is so located at the forward end of the supporting ladder that the desired maximum horsepower will be imparted to the cutter regardless of the size of supporting ladder employed.

Another object resides in the provision of a floating barge wherein a hydraulic cutter assembly is located on the forward end of the supporting ladder and which assembly remains constant and may be reassembled on a larger ladder when it becomes necessary to excavate deeper, and yet insure of the cutter being operated at the desired power and efficiency.

Still another object is the provision of a floating barge wherein the compactness and lightness of the hydraulically controlled cutter assembly permits of considerable latitude in the size of ladder employed without affecting buoyancy and balance of the barge.

A still further object is to provide a floating barge wherein the entire cutter assembly and drive therefor is arranged on the forward end of the supporting ladder which materially reduces the overall weight of the ladder and permits greater degrees of maneuverability thereof which enables greater depth to be obtained and increased productivity.

A further object is the provision of a floating barge wherein the control of its entire operations is hydraulic so that a hydraulic pump maintains a constant pressure and supplies the necessary power needed for the hydraulic cutter head power unit and the other hydraulic accessories.

Still a further object is the provision of a floating barge which is novel in that the long drive shaft on the supporting ladder has been eliminated and replaced by a hydraulic cutter unit mounted near the forward end of the ladder so that its short power shaft to the cutter head eliminates maintenance problems with misalignment and bearings for the long conventional drive shaft.

These and other objects and advantages will be apparent as the following description is considered with the accompanying drawings, wherein:

FIGURE 1 is a side elevation of my floating barge in operative position;

FIGURE 2 is a front elevational view thereof;

FIGURE 3 is a rear elevational view thereof;

FIGURE 4 is an enlarged fragmentary front elevational view, partly broken away, of the apparatus illustrated in FIGURES 1 to 3, inclusive;

FIGURE 5 is an enlarged longitudinal sectional view, partly in elevation, of the apparatus shown in FIGURES 1 to 3, inclusive; and

FIGURE 6 is a diagrammatic illustration of the control system for actuating the several hydraulic devices embodied in the invention.

Referring more particularly to the drawings, wherein similar reference characters designate like parts throughout the seveal views, numeral 1 illustrates generally a barge, preferably formed of steel construction and embodying a bottom 2, flat parallel side walls 3, and a bow and stern end walls 4 and 5. The walls 4 and 5 are preferably inclined at their lower portions to facilitate the shifting of the barge in the water or upon a mobile trailer. The barge is preferably provided with an enclosed deck house 6 and an operator's housing 7 at the forward end thereof so that the various main operational parts are enclosed and protected. Detachably connected with the opposite sides of the barge 1 are flotation tanks 8, preferably of cylindrical form and connected to the sides by suitable brackets or the like. The tanks have a diameter substantially equal to the height of the barge and create additional buoyancy to the barge which is necessary because of the relatively narrow width of the latter. The purpose in having the tanks detachable is to

permit their removal when the barge is to be transported over a highway by a suitable low-bed trailer thus reducing the overall width of the device to that conforming with highway regulations. The tanks are chambered intermediate their ends for the storage of fuel or the like.

Rigidly mounted with the barge adjacent its stern portion and preferably upon a longitudinal center line thereof is a power plant 9, in the form of an internal combustion diesel type engine or the like. The engine is of conventional type and a drive shaft 10 extending forwardly therefrom serves to drive a centrifugal hydraulic suction pump 11, with the pump serving as the suction medium for pulling the dislodged subsurface materials from the cutter head to be discharged through a pipe line 12 that leads toward the stern portion of the barge for connection to a distribution pipe line, not shown, as is well known. The motor 9 has a rearward drive shaft 13 that serves to actuate a hydraulic pump 14 which generates hydraulic pressure to serve the various operational devices to be described.

A substantially V-shaped ladder generally designated at 17, preferably formed from metal I beams 18 suitably welded or otherwise secured together at their forward ends and having spaced transverse braces 19, is pivotally connected, as at 20, adjacent opposite sides of the bow end of the barge. The beams 18 support the cutter head assembly on the forward ends thereof so that arcuate movement of the ladder moves the cutter into and out of engagement with the subsurface material to be cut and dredged. Connected to the underside of the beams 19 and extending longitudinally thereof is an elongated flow pipe 21 which projects through an opening 22 formed in the forward wall 4 and which opening 22 leads to a compartment 23 in the bow portion of the hull. The pipe 21 connects through the compartment 23 to the pump 11 by means of a flexible rubber tube 90.

At its forward end the pipe 21 communicates with a suction plate 24 through which extends a drive shaft 25 mounted on suitable bearings and at the forward end of which is mounted a cutter head 26.

The rearward end of the shaft 25 is connected to a planetary gear reducer 27 which is powered by a hydraulic motor 28. It will be noted that the shaft 25 is relatively short and that the longitudinal axes of the cutter head 26, the shaft 25, the gears 27 and motor 28 extend downwardly with relation to the longitudinal axis of the ladder 17, such angular relation being approximately 20°.

Within the operator's housing 7 there is centrally and forwardly mounted a gear reduction box 29 connected to which at either side thereof is a swing drum 30.

A V-shaped boom 31 has the free ends of its legs pivotally connected at either side of the bow of the barge, as indicated at 32, and is normally maintained in operative position extending forwardly and upwardly, as indicated in FIGURES 1 and 5 by means of a cable 33 extending from the apex portion thereof to a spud 34 or the like centrally mounted upon the rear portion of the roof of the operator's housing 7.

A cable 35 extends from each of the drums 30 through a suitable opening 36 in the forward wall of the housing 7, thence over a pulley block 37 suspended from a cross piece 38 forming a part of the boom 31, thence forwardly and downwardly to a pulley 39 and thence outwardly to anchors (not shown), the pulleys 39 being mounted upon either side of the lower or forward end of the ladder 17.

Centrally mounted in the housing 7 adjacent the drums 30 is a ladder hoisting drum 40. A cable 41 extends forwardly from the drum 40 and thence is entrained over a pulley 42 carried by the cross piece 38, thence upwardly to a pulley block 43 suspended from the apex portion of the boom 31, thence downwardly to a pulley block 44 connected to a bracket 45 mounted atop the lower end portion of the ladder 17, thence back to the block 43 where it is fastened, all as indicated in FIGURES 1 and 5 of the drawings.

Vertically and slidably mounted in collars 46 affixed to the barge 1 at either side of the stern of the barge is a pair of elongated cylindrical spuds 47. An inverted U-shaped bracket 48 is likewise affixed to the upper side of the stern of the barge. Each of the spuds 47 is pointed at its lower end, as indicated at 49, and adjacent its upper end is provided with a fixed collar 50 to which is connected a cable 51, the cables being entrained over pulleys 52 carried at the upper end of the bracket 48 and extend thence downwardly to rams 53 through pulleys 54 mounted on the deck and on the piston rods 55 of each of the rams 53.

Each of the rams 53 has connected thereto a pair of fluid lines 56, each pair of which is connected to a ram control lever 57 and a multiple control valve structure 58. The valve 58 is connected by means of a fluid line 59 to a fluid return line 60 which, in turn, connects with a hydraulic oil tank 61. Feed lines 62, 63 and 64 lead from the tank 61 to the pump 14 and from thence, the lines 62 and 63 connect with 4-way valves 65 and 66, respectively, while the line 64 goes on to connect with the valve 58.

The valve 65 is provided with a control lever 66*a* and a fluid line 67 interconnects the valve 65 with the return line 60. The valve 66 is provided with a control lever 67*a* and a fluid line 68 interconnects the valve 66 with the return line 60.

The line 62 is connected with the return line 60 by means of a fluid line 69 which has interpolated therein a flow regulator 70 provided with a control handle 71. The line 63 is connected with the return line 60 by means of a fluid line 72 which has interpolated therein a flow regulator 73 provided with a control handle 74.

The reduction gear 29 is provided with a hydraulic motor 75 for driving the same and the motor 75 is connected with the 4-way valve 66 by a pair of fluid lines 76. The drums 30 are connected to the output shaft of gear box 29 thru clutches 91 and band brakes 92 connected to four control levers 77. A clutch 78 is interspersed between the motor 9 and shaft 10 and is provided with a suitably connected clutch control lever 79.

The drum 40 is connected to a reduction gear 80 which is, in turn, connected to a hydraulic motor 81 and a pair of fluid lines 82 interconnect the motor 81 with the multiple valve 58, the lines 82 being controlled in the valve 58 by means of a control lever 83. It will be seen that all of the various control levers, are mounted in the housing 7 for convenient manual operation by an operator who may be seated upon an operator's seat 84 conveniently positioned in the housing 7.

In operation, it will be apparent that to transport the entire apparatus from place to place, it is only necessary to disassemble the ladder 17 and boom 31 together with the tanks 8 from the remainder of the apparatus, whereupon the boom and ladder may be mounted atop the cabin 6 and housing 7 in any convenient manner while the tanks 8 may be carried separately upon another road vehicle. The spuds 47 may be disassembled and positioned at either side of the barge 1 upon its conveyance. In this manner the entire apparatus may be transported over ordinary roads without coming into conflict with highway laws and regulations as to size of vehicle, loads carried thereby, etc. When the apparatus has been brought to a work site, it may be first lowered to the ground in any convenient manner, adjacent the water area in which it is to work. The tanks may then be assembled upon either side of the barge, the spuds 47 again placed in proper position as shown in FIGURES 1 and 5, for example, and the boom 31 and ladder 17 then pivotally mounted upon the forward end of the barge 1 as shown in FIGURE 5.

The anchors (not shown) attached to the cables 35 may then be placed in position at either side of the barge

and the ladder 17 then lowered by means of a hoist drum 40, utilizing the control lever 83 for such purpose. When the cutter head 26 comes into contact with the subsurface material, the ladder 17 will remain in the position selected by means of the drum 40 and its control. At this time, the spuds 47 may be lowered into engagement with the subsurface of the water until the points 49 thereof engage with such surface to maintain the barge in substantially immovable position. One or the other of the spuds 47 may then be raised by means of its associated ram 53, the control levers 57 being utilized for such purpose. The drums 30 may then be rotated under the control of the lever 67*a* and it will be appreciated that the cables 35 are oppositely wound upon their respective drums 30 so that as a cable 35 is paying off one of the drums 30 its counterpart will be winding upon the other drum 30. In this manner the entire barge and its attached apparatus including the ladder 37 will move toward one or the other of the anchors at the ends of the cables 35, thus making it possible to rotate the cutter head 36 in an arcuate path at a given selected depth below the water level. It will be appreciated, of course, that the cutter head may be gradually raised or lowered by means of the cable 41 under the influence of the drum 40 and its control lever 83 either during the arcuate swinging motion above referred to or while the barge is at a comparative standstill. When it is desired to move the barge and its attached mechanisms either forwardly or rearwardly, this may be accomplished by first engaging one of the spuds 47 with the subsurface material and then pivoting the entire barge and its attached mechanisms upon the thusly engaged spud 47, utilizing the action of the cables 35 for such purpose. When the disengaged spud 47 has thus been moved forwardly (or rearwardly, if desired) it may then be reengaged and the first spud 47 then disengaged, such actions taking place under control of the levers 57 and the process repeated making a step-by-step forward or rearward movement of the barge and its attached mechanisms possible.

It will also be appreciated that the cutter head 26 will act to loosen material in the subsurface material which may then be brought up by suction due to the action of the pump 11 and discharged through the pipe 12 to any convenient location such as an area to be filled by such material.

Again, it will be seen that by proper manipulation of the control handles 71 and 74 for operation of the flow regulators 70 and 73, respectively, the speed of the cutter motor 28 and the speed of the drums 30 may likewise be respectively regulated, thus making it possible to secure optimum operational speeds for use in working with the apparatus in various types of material such as sand, mud, clay, silt, marl, gravel, peat, etc.

It will also be seen that, due to the angular relation of the cutter head and its shaft 25 to the longitudinal axis of the ladder 17 it is possible to have the cutter head 26 engage the subsurface material at points closer to the forward end of the barge, than would otherwise

be possible if the cutter head and its drive shaft 25 extended in the same longitudinal axis as that of the ladder 17 as is normally the case in such constructions.

Likewise, it will be appreciated that since the hydraulic motor 28 is relatively close to the cutter head 26 due to the relatively short drive shaft 25, the normal elongated drive shaft is thus made unnecessary. The elongated drive shaft which is normal to such apparatus is made necessary due to the fact that electric and other similar drives may not be submerged without danger to the driving mechanism and the thus elongated shafts are subject to greater strains than the foreshortened drive shaft 25 of the applicant's device. This is made possible due to the fact that the motor 28 is a hydraulic one and may thus be operated without harm below the water level.

While but one form of the invention has been shown and described herein, it will be readily apparent to those skilled in the art that many minor modifications may be made without departing from the spirit of the invention or the scope of the appended claim.

What is claimed is:

An apparatus of the character described comprising a portable barge, a float tank removably mounted upon each side of said barge, a vertically movable spud removably mounted upon each side of the rear end portion of said barge, a ladder pivotally connected to and removably mounted upon the forward end of said barge, a boom removably mounted upon the forward end of said barge, a cutter head, a drive shaft for said cutter head, a hydraulic motor for said drive shaft, said head, shaft and motor being mounted upon the outer end portion of said ladder, a pump mounted in said barge, an engine mounted in said barge and operably connected to said pump, a suction pipe extending from said pump and along and protectively within the side frame portions of said ladder to a point adjacent said cutter head, a discharge pipe extending from said pump to a point remote from said barge, and hydraulic means carried by said barge and operable by said engine for individually moving said spuds, said ladder, and said motor for said cutter head, the principal axes of said cutter head, drive shaft and its associated motor extending forwardly and downwardly at an angle of the order of 20° with respect to the principal axis of said ladder, and the center of area of the cutting portions of said head lying substantially on the longitudinal axis of said ladder, whereby said motor may be mounted relatively close to and protectively above the free end of said ladder and whereby the ladder-twisting torque exerted by said head is held at a minimum value.

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