Dec. 13, 1960

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2,963,801

DREDGE LADDER

Filed Dec. 3, 1956

2 Sheets-Sheet 1

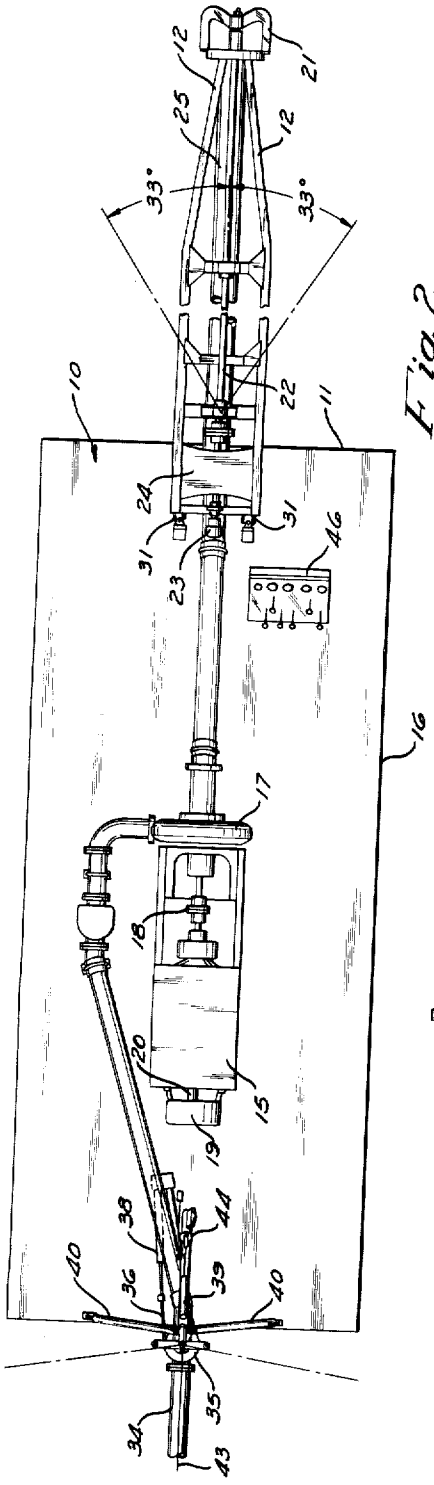

Fig. 2

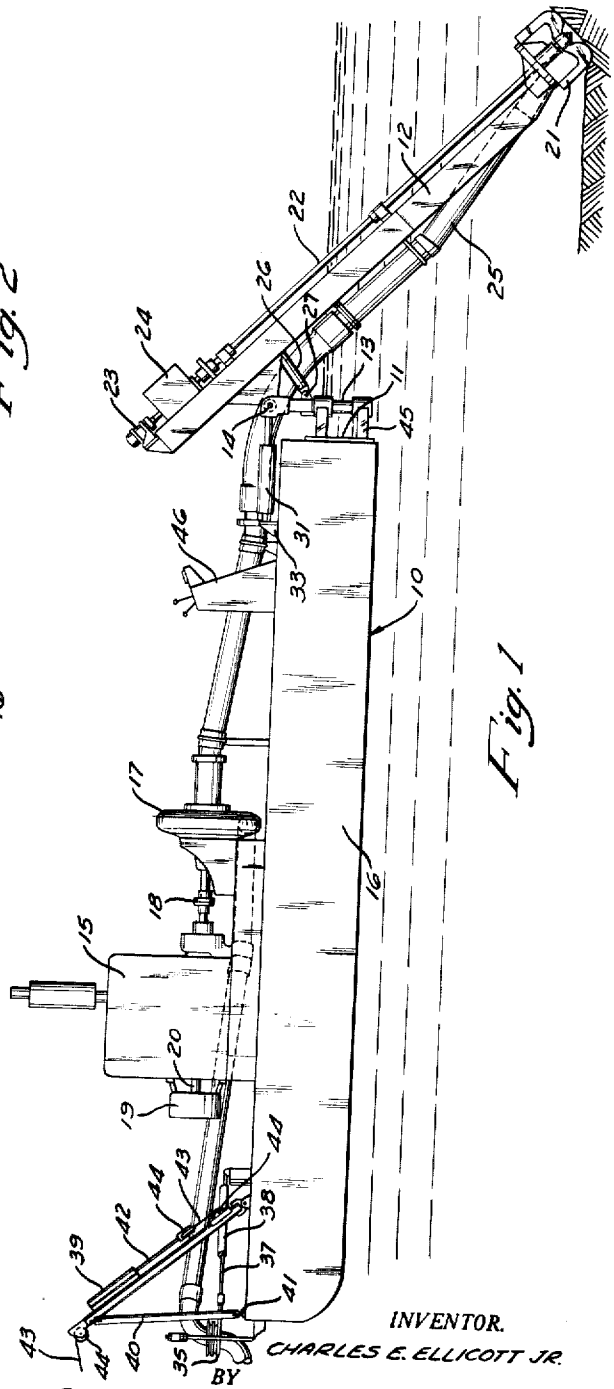

Fig. 1

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2 Sheets-Sheet 2

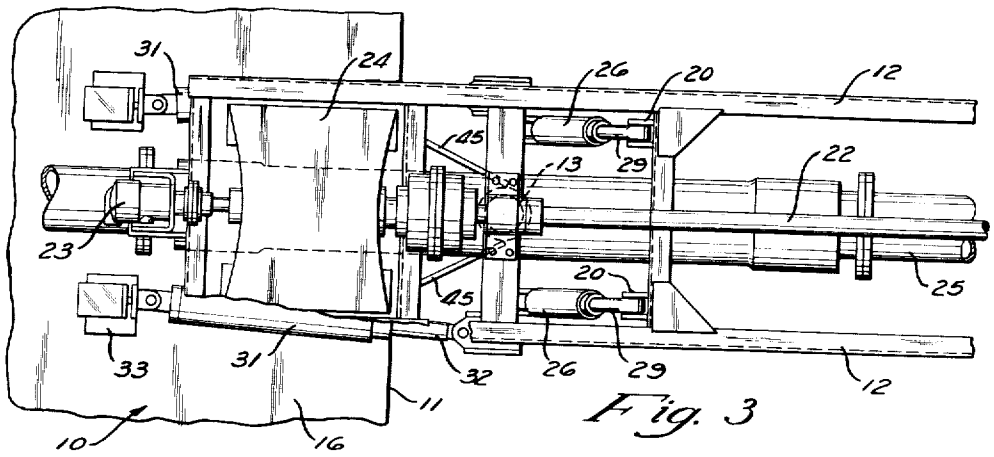

Fig. 3

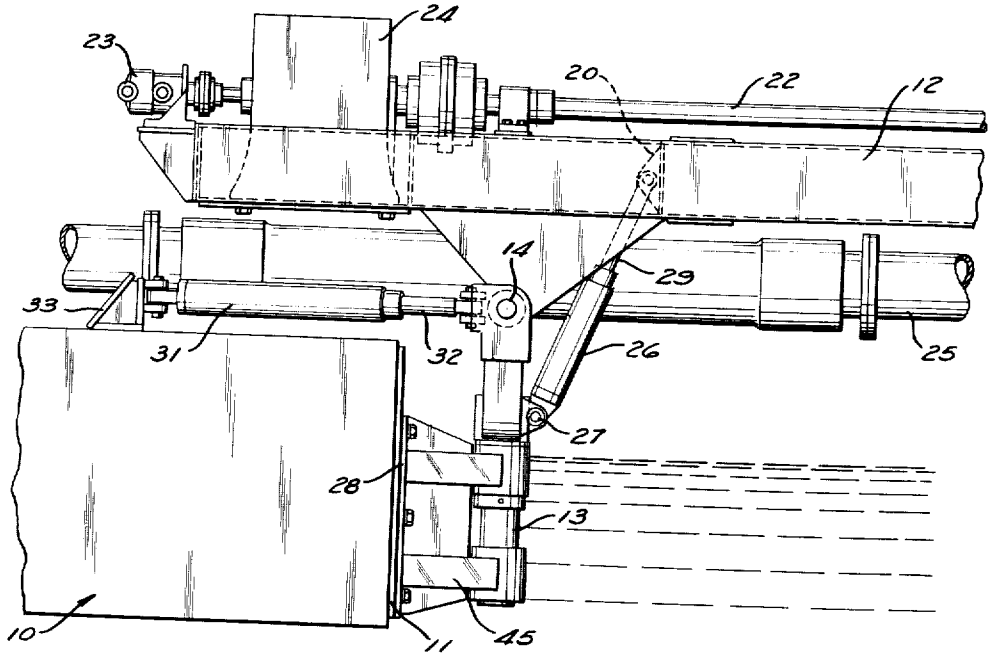

Fig. 4

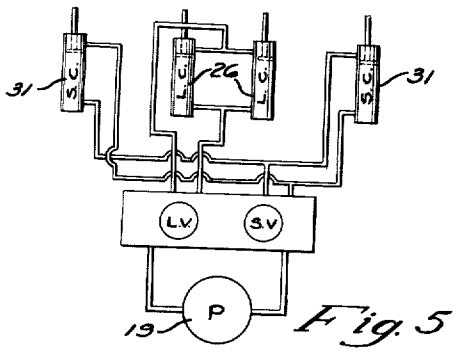

Fig. 5

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DREDGE LADDER

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Filed Dec. 3, 1956, Ser. No. 625,933

2 Claims. (Cl. 37—67)

This invention relates to dredges, and more particularly, to a dredge ladder and hydraulic controls for operating the same and associated parts.

Conventional hydraulic dredges are provided with overhead supporting structure, rigging and other apparatus between the operator and the work which obstructs the view of the operator of the ladder and cutter, so that when the cutter is operating under the surface of the water but near the surface so as to undercut a bank, the operator is not able to observe branches, underbrush and the like on the surface of the ground which is being cut.

I have discovered that by mounting the trunnion-yoke forward of the bow of the dredge with the swing cylinders parallel of the deck and adjacent the bow, and spacing of the swing cylinders to accommodate the suction water line under the rear of the ladder, it permits the operator to have clear and unobstructed view of the ladder and cutter, thus facilitating rapid swinging and adjustment of the ladder to accommodate various changes in operating conditions and also provides for accuracy and control of the cutting depths.

Therefore, objects of this invention are to provide a construction permitting the operator of the ladder and cutter to have a clear and unobstructed view of such parts from his control position, whereby the ladder may be quickly and accurately moved laterally and vertically with relatively greater accuracy and control of the cutting operation and depths can be accomplished, than by previously constructed dredges.

Another object is to dispose the rotary power unit for the cutter on the ladder to the rear or inboard of the center of the trunnion, whereby the effective weight of the ladder for holding it down is relatively much less than for the conventional dredge construction, whereby when the ladder is in extreme side position, port or starboard, the overturning moment tending to tip the hull is relatively low, and the dredge is safely stable without depending on supporting spuds even under extreme operating conditions when the discharge pipe is full and both the pipe and ladder are at extreme side operating positions.

Still another object is to provide a dredge having the trunnion and ladder forming a package or unit which is pivoted or journaled at the front edge of the dredge.

These and other objects and advantages will be apparent in the course of the following description taken in conjunction with the drawings wherein:

Fig. 1 is a side elevational view of a dredge, mounted in a body of water, illustrating an embodiment of this invention;

Fig. 2 is a plan view of the dredge illustrated in Fig. 1;

Fig. 3 is an enlarged plan view of the rear portion of the ladder and a part of the bow of the dredge illustrating the ladder in raised position on the dredge;

Fig. 4 is an elevational view of the structure shown in Fig. 3 illustrating the ladder in its raised position; while

Fig. 5 is a schematic view of the hydraulic system for operating the dredge ladder hoist and swing cylinders.

The dredge disclosed herein utilizes a single source of power, preferably a diesel engine, mounted on the dredge hull to supply required power for the dredge suction pump, the control of the various operations of the dredge itself and the cutter drive. The ladder is mounted on the bow of the hull in such manner as to permit both lateral and vertical motion relative to the hull so that sweeps, within the range of the ladder, may be made without swinging the hull. The ladder and supporting trunnion form a package or unit pivoted at the front edge of the bow. The swing and lift cylinders are positioned underneath the ladder so that the reaction in the lift cylinders is taken by the trunnion. The swing cylinders are connected directly to the ladder and the action of the swing cylinders is horizontal at the deck line in order that all cable and rigging structure may be dispensed with. Hydraulic motor means are provided to control the lateral and vertical movements of the ladder. Such means may be pistons, hydraulic motors or other hydraulically operated motor means, but in this embodiment hydraulic pistons are used.

Referring to the drawings, the numeral **10** refers to the hull of a floating structure such as a dredge or barge having its bow indicated by the numeral **11**. A ladder **12**, supporting a cutter at its lower end and supporting a suction pipe throughout its length, is mounted on vertical pivot or trunnion **13** mounted on brackets **45** connected to and disposed forwardly of the bow **11** of the hull **10** for permitting lateral or swinging movement of the ladder **12**. Horizontally disposed pivot or trunnion **14**, disposed above the vertical pivot or trunnion **13** at the forward end of the ladder **12**, permits the raising and lowering of the ladder **12**. Power for the dredge **16**, which is self-contained, is furnished by a prime mover **15**, preferably a diesel engine, mounted on the deck of the hull, which provides suitable power for operating all the devices of the dredge **16**. Various other types of engines, adapted to supply requisite power, may be used when desired.

A suction pump **17**, suitably coupled to the diesel motor **15** through a coupling **18** or other suitable means, is operable to draw sand and dirt up through the lower end of the suction pipe **25**. A hydraulic pump **19**, mounted on the deck of the dredge **16**, is driven by the diesel motor **15** through a drive shaft **20** and supplies hydraulic pressure to operate the various cylinders and motors through a hydraulic system, shown only schematically for the purposes of clarity in the drawings. A cutter **21**, rotatably mounted at the lower end of ladder **12**, and driven by an elongated shaft **22**, rotatably driven by a small high speed hydraulic motor **23** through a gear box **24** while suction pipe **25**, supported by the ladder **12**, is provided with an inlet adjacent the cutter **21**. The motor **23** being hydraulic does not have much weight, however, the gear box **24** is heavy and massive and the disposition and arrangement of these parts in the rear of the ladder **12** to the rear of or inboard of the trunnion, provide a counter weight which minimizes the power required to lower and raise the ladder **12**.

Two hydraulic lift cylinders **26**, each connected to one side of the ladder **12** near its inner end, are mounted on a horizontal pivot **27** supported by brackets **28** suitably mounted at the bow of the dredge **16** near the water line. Piston **29** of the hydraulic cylinders **26** are secured to a member **20** connected to the ladder **12**. A pair of swing cylinders **31** horizontally disposed on the deck of the hull at the front thereof and provided with cooperating piston **32** are connected to the ladder **12**, the swing cylinders **31** being connected at their inner end to brackets **33** mounted on the deck. These cylinders are double acting and are positioned in such manner that hydraulic fluid is admitted at the top end of the one cylinder and at the bottom end

of the other cylinder for lateral swinging of the ladder **12**. The swing cylinders **31** and cooperating parts are disposed and arranged in such manner that the ladder **12** may be swung 33° to the right or to the left from its center forward position.

The cutter **21** is powered by the variable speed hydraulic motor **23** through gear box **24**, the hydraulic motor **23** being operatively connected in the pressure system of the hydraulic pump **19**. By providing hydraulic power for the cutter **21**, it is possible to utilize the single source of power and still provide for speed adjustment of the cutter. The speed of the cutter **21** may be varied for different types of materials to be dredged.

The outlet of the suction pump **17** is coupled to a discharge pipe **34**, which at the stern of the dredge **16** is provided with a sprocket **35** rotated on a vertical pivot by chain **36** operatively connected to the pistons **37** of two swivel cylinders **38**, whereby to swing the overhanging portion of the pipe to the right or left in order to deposit the material at the desired location which may be the bank of a canal or body of water being dredged. If desired, the discharge pipe **34** may be located to deposit the dredged material at the rear of the dredge **16**. In order to raise and lower the position of discharge pipe **34**, a discharge pipe hoist cylinder **39** is provided, the same being mounted on a tripod or frame structure **40** which is removable since it is attached to the deck by pin connections **41**. The discharge pipe hoist cylinder **39** has a piston **42** operatively connected to a cable **43** which, operating through sheaves **44**, extends and retracts the cable **43** supporting the rearwardly projecting end of the discharge pipe **34**. The details of the apparatus for raising and lowering as well as laterally swinging the discharge end of the discharge pipe **34** are shown in my copending application, Ser. No. 625,932, filed December 3, 1956, now Patent No. 2,926,437.

In order to supply hydraulic pressure required to actuate the various motors and pistons, a hydraulic system is utilized which is now described schematically. The flow of hydraulic fluid under pressure from the hydraulic pump **19** to the hydraulic swing cylinders **31** is directed as illustrated in Fig. 5, said swing cylinders being indicated therein by the letters SC, while the controls therefor are indicated by the letters SV. It will be noted that a conduit connects the forward end of one swing cylinder to the rear end of the other swing cylinder, in order that the swinging movement of the cylinders and the ladder **12** is synchronized. The controls for controlling the flow of hydraulic fluid from the hydraulic pump **19** to the lift cylinders **26**, indicated by the letters LC are indicated by the letters LV. The hydraulic pump **19** is indicated by the letter P. Suitable controls, not shown herein, are used for operating the discharge pipe hoist cylinder **39** for raising and lowering the discharge end of the discharge pipe **34** in an obvious manner while, swivel elbow cylinders **38** are controllable for selectively swinging the discharge pipe **34** to the right or to the left.

The speed of the cutter **21** may be varied by changing the speed of the cutter motor **23** through the motor **15**. It should be noted that by disposing the variable speed hydraulic motor **23** and gear box **24** to the rear of, or inboard of the trunnion, the effective weight of the ladder for the purpose of holding it down is much less than the conventional design, such gravity effect being so small that the ladder will not operate satisfactorily unless the ladder hoist cylinders will positively hold the ladder and keep it down for work, which results in accurately locating the depth of the cutter which provides for accuracy of operation at pre-determined depths. Another advantage of the foregoing distributions of weight of the ladder forward and aft of the trunnion is, that when the ladder is in its extreme position at either side, port or starboard, the overturning moment tending to tip the hull is very much less than if all the weight were outboard of the trunnion.

In operation, the operator may control all of the necessary elements of the dredge at a control box **46** conveniently located at the bow of the dredge, where he has an unobstructed view of the ladder at all operating positions. The hydraulic system herein described provides requisite hydraulic pressure to operate the swing and lift cylinders as well as the hydraulic motor which operates the cutter, the hydraulic fluid being forced through the system by the hydraulic pump **19** operated by diesel motor **15**.

The disposition and arrangement of the ladder **12** and associated parts permits the operator to have a clear and unobstructed view of the ladder **12** and cutter **21** which is convenient in rapidly moving the ladder to accommodate changes in operation. For example, when the cutter **21** is operating under the surface of the water, but near the surface so as to undercut a bank, the operator may observe branches, underbrush and the like on the surface of the ground to be undercut, so that the undercutting operation may be quickly interrupted, the ladder raised and quickly swept from one side to the other in order to clear away the brush from the surface.

Although the foregoing description is necessarily of a detailed character, in order that the invention may be completely set forth, it is to be understood that the specific terminology is not intended to be restrictive or confining, and that various rearrangements of parts and modifications of detail may be resorted to without departing from the scope or spirit of the invention as herein claimed.

What is claimed is:

1. A dredge comprising an elongated generally rectangular hull, a dredge ladder trunnion mounted for pivotal movement about a vertical axis at the bow of the hull, said trunnion having spaced ladder pivot supports extending upwardly with respect to the trunnion mounting, a dredge ladder mounted intermediate its ends on said ladder pivot supports for pivotal movement on said trunnion about a horizontal axis, said ladder having a major portion of its length extending forwardly of said horizontal pivotal axis away from the hull and having a minor portion of its length extending rearwardly of said horizontal pivot axis to be disposed over the hull, a cutter mounted at the forward end of the ladder, cutter drive means including a power unit and gear box mounted on said minor portion of the ladder rearwardly of said horizontal pivot axis, a drive shaft extending from said gear box to said cutter to rotate the same, a suction pipe supported by the ladder at the underside thereof, said suction pipe comprising a rigid pipe section adjacent the cutter and a flexible pipe section extending on both sides of said horizontal pivot axis in the space between said ladder pivot supports, hydraulic cylinder means interposed between said trunnion and the ladder below the ladder to swing the ladder about its horizontal pivot and hydraulic cylinder means between the trunnion and the hull to swing the trunnion about its vertical pivot whereby the cutter may be lowered with respect to the hull and the minor portion of the ladder swings upwardly away from said flexible pipe section.

2. A dredge comprising an elongated hull having an engine and suction pump carried thereby, a dredge ladder trunnion support mounted at the bow of the hull having vertically disposed bearings to receive a trunnion, a dredge ladder trunnion pivotally mounted in said bearings for rotation about a vertical axis, said trunnion having spaced upwardly extending ladder pivot arms, an elongated rigid dredge ladder pivotally mounted on said trunnion ladder pivot arms intermediate the ends of the ladder for swinging movement about a horizontal axis, a major portion of said dredge ladder extending forwardly from the hull and the horizontal pivot axis, the minor portion of said dredge ladder projecting rearwardly with respect to said horizontal pivot axis and being disposed over the hull, a rotary cutter mounted at the forward end of said dredge ladder, a power unit and gear box for driving said cutter mounted on said minor portion of the dredge ladder and a shaft

connecting said gear box and cutter for driving the cutter, a suction pipe leading from said cutter to said suction pipe, said pipe comprising at least three sections, the first section of said suction pipe being a rigid pipe section adjacent the cutter, the intermediate section of said pipe being a flexible pipe joint section to accommodate horizontal and vertical ladder movements and the third pipe section being a rigid pipe section adjacent the pump, said flexible pipe joint section being disposed beneath the ladder in the space between said pivot arms, double acting hydraulic cylinder means to move the ladder about said horizontal pivots whereby the cutter is lowered with respect

to the hull against the material to be dredged by hydraulic fluid pressure in said hydraulic cylinder means.

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