SPECIFICATIONS

FOR

ELLICOTT

SERIES 1870 "DRAGON" CUTTER TYPE

TRANSPORTABLE HYDRAULIC PIPELINE

DREDGE

TABLE OF CONTENTS

INTRODUCTION

The following pages include the specifications of Ellicott's Series **1870 "DRAGON"**.

Of prime importance is the fact that Ellicott dredges are designed and manufactured under single responsibility. Design and construction of the working dredge is all one concept at Ellicott Dredges, LLC. The main dredging components are designed and manufactured to complement one another and to provide balance to the total dredge, assuring high quality and efficiency and low cost of operation and maintenance. It is noteworthy that replacement parts for those components most subject to wear are always procurable from Ellicott Dredges, LLC. Components that are not manufactured by Ellicott Dredges, LLC have been chosen for their reliability and worldwide distribution.

1. GENERAL DESCRIPTION

This Series, non-self-propelled, transportable hydraulic pipeline dredge has been designed so that the entire operating cycle is controlled by one man from the control center in the control room. Design engineering has focused on high performance, dependability and low maintenance cost to insure high return on the investment.

Wearing parts which require accessibility for replacement or repair are designed and built for ease of assembly and economic replacement cost. Wearing parts are independent of the structural components of the dredge in order to maintain correct alignment of the machinery after installation and replacement.

The sectional pontoon type rectangular hull has been sized to meet the requirements for strength and flotation and also provides the versatility that is inherent in transportable equipment. The dredge is designed to be partially field assembled on land and launched with final assembly afloat. Disassembly is accomplished partially afloat and partially on land.

The main dredging plant is installed in the center hull pontoon and has been designed for rugged use and durability.

The tubular steel dredging ladder mounted on the forward end of the center hull pontoon carries the revolving cutter for excavating the materials to be dredged.

The variable speed, constant torque cutter is hydraulically driven and the cutter drive assembly is mounted on the forward section of the ladder. The suction pipe is mounted underneath and secured to the tubular ladder. A flexible connection is provided between the ladder suction pipe and the hull.

A diesel driven, centrifugal dredging pump discharges materials to a floating pipeline connected at the stern of the dredge.

1. GENERAL DESCRIPTION (Continued)

When operating, the dredge swings across the cut, pivoting on the large cross section working spud. The swing operation is accomplished with individual Ellicott direct line winches. The ladder hoisting operation is done by an individual hydraulic winch. The spuds are single-part wire rope bottom-lift type actuated by individual winches with provision for freefall.

Ample diesel power drives hydraulic pumps which supply hydraulic fluid through separate circuits to the respective hydraulic motors driving the cutter, the swing and spud winches plus the ladder winch.

An electrical generator, belt driven from the auxiliary engine, is included to provide AC power for lighting for around-the-clock operation.

A fully enclosed control center with windows on all sides and operator's console for fingertip control is included.

2. STRUCTURAL COMPONENTS

HULL:

The hull is made up of rectangular welded steel pontoons which are rigidly connected to provide stability and ample freeboard. The hull components are generally transversely framed, but also have longitudinal stiffeners. Foundations are provided under all machinery and the hull structure is reinforced in the way of these foundations.

The removable, watertight side pontoons are compartmented and attached to the center section by special watertight connections that are accessible from the exterior of the hull.

The assembled hull provides for a ladder-well at the forward end to accommodate the assembled ladder and to insure proper flotation and trim.

Each of the side pontoons has built-in fuel oil storage and water ballast tanks provided with limbers and vents to prevent formation of air pockets.

Suitable manholes with vertical ladders are provided in the side pontoon, water or oil tight as required. Deck cleats are suitably located on the hull.

The hull shell plating thickness and stiffener sizes meet or exceed the requirements of the American Bureau of Shipping Rules for Rivers and Intracoastal Waterways.

2. STRUCTURAL COMPONENTS (Continued)

DECKHOUSE AND CONTROL CENTER:

The deckhouse side panels are fabricated from 5/16 inch thick steel and the overhead panels and control center are fabricated from 12 gauge steel. Steel hatches in the overhead panels are provided for equipment access. Full head room and adequate, safe and weatherproof working space around all machinery is provided to facilitate maintenance. The deckhouse has sliding windows for light, a side entrance doorway for access and two (2) ventilating fans.

A control center is mounted forward of the deckhouse. The low profile design includes windows on all four sides for full view of the dredging operation, ventilation and lighting. The front windows are sloped to minimize reflections and all windows are tinted to minimize daytime glare. The control room is fabricated in one piece with disconnect fittings on all piping and controls and can be removed intact for shipping. A door on each side is provided for access from the control room to the machinery space.

Functional design and construction provides comfort and conditions favorable to increased operator efficiency.

3. DREDGING COMPONENTS

CUTTER-EXCAVATING UNIT:

The compact cutter-excavating unit, with direct hydraulic power drive, is an exclusive Ellicott design and is complete with cutter. The construction facilities adjusting the angle of the cutter unit for shallow digging by means of rotating the wedge-shaped structural tubular insert. The cutter is suitable for general dredging.

The cutter is driven by a radial piston type, watertight hydraulic motor through a planetary speed reducer. This assembly is an integral part of the forward ladder section, with the motor, gears and bearings protected by a positive oil pressure maintained inside the oiltight and watertight assembly. Constant torque available at each digging speed is a unique design feature. Speed and reversing are controlled at the operator's console in the control center. The entire system is protected from overloads by relief valves.

The short main cutter shaft is of high tensile steel, machined all over, operating on tapered roller bearings in an oiltight housing. The shaft is driven by the hydraulic motor through the planetary gear reducer. All connections to the gear reducer are splined.

3. DREDGING COMPONENTS (Continuted)

PIPE AND ACCESSORIES:

The cast steel suction hood is connected to the ladder under the cutter shaft hub to reduce water dilution from above the suction hood and thereby obtain a greater concentration of slurry feeding into the suction pipe. The hood is joined to the suction piping and the suction pipe is attached to the underside of the ladder.

The suction pipe is equipped with a cast steel cleanout just ahead of the dredge pump to allow for removal of oversized material obstructing the pump.

An enclosed cast steel flap valve is included for installation in the discharge pipeline immediately aft of the discharge elbow. When the pump is stopped, the flap valve acts as a retaining valve and obstructs the slurry in the discharge pipe from returning to the pump. Additionally, the flap valve assists in the pump priming operation by effectively obstructing the discharge line.

A flanged flexible hose is available as an extra cost option to connect the hull mounted discharge piping to the floating discharge pipeline. The flanged flexible hose requires a JIB crane for support; also available as an extra cost option.

An optional swivel elbow available at extra cost can be located at the stern of the dredge, adjacent to the digging spud and serves as a flexible connection between the hull mounted discharge pipe and the floating discharge pipeline. This unit consists of two (2) cast steel 90 degree elbows fixed together with a watertight connection so as to allow approximately 60 degree angular movement to the port and starboard of the centerline of the hull mounted discharge pipe.

LADDER AND SUPPORTS:

The ladder has been designed to meet the strength requirements of dredging service and to provide reliability and durability under rugged and severe conditions. The aft section of the ladder is fabricated from structural steel plates for bending and torsional strength. The forward section of the ladder is constructed from large diameter structural steel pipe. Together they insure the necessary rigidity for stabilizing the cutting action so as to be able to exert full cutter force on the material being dredged.

An A-frame with rigid backstays is provided at the forward end of the hull which in conjunction with the ladder hoist winch provides for hoisting, lowering and holding the dredging ladder. The ladder winch is actuated by means of fingertip controls on the control console.

Steel safety straps for fixing the ladder in a raised position for towing or maintenance are included.

3. DREDGING COMPONENTS (Continued)

LADDER AND SUPPORTS:

Fabricated steel trunnions with replaceable bushings are fitted to the aft end of the ladder. A connection for the ladder is provided by pins through the steel trunnions and trunnion bearing brackets on the main hull.

The ladder suction pipe is connected to the suction pipe in the center hull pontoon by means of a flexible reinforced rubber hose, permitting ladder inclination to designed digging depth.

Swing sheaves with anti-friction bearings are of steel construction. These swing sheaves are mounted on the ladder just aft of the cutterhead module and are so designed as to reduce wear and jamming of the swing wires and provides a direct fairlead to the swing drums. Bronze bushed cast steel fleeting sheaves mounted just forward of swing drums provide a fairlead for the swing ropes onto the drums.

DREDGE PUMP AND ACCESSORIES:

The dredge pump has been designed and built by Ellicott Dredges, LLC for high hydraulic efficiency for the desired range of dredging conditions. The pump is so placed in the dredge hull as to insure minimum friction in the suction and discharge piping by avoiding all unnecessary bends, elbows, fittings and other restrictions to flow.

The pump is of the centrifugal, single suction, volute type, directly driven by diesel power through an Ellicott designed close-coupled totally enclosed, oil lubricated, speed reduction gear. The direct mechanical connection, from crankshaft to impeller, features high torsional strength through all pump operation speeds. A manually operated, multiplate clutch is provided between the engine and reduction gear. The coupling that connects the engine clutch shaft to the dredge pump reduction gear input shaft is a “falk” flexible type coupling.

The pump case, impeller and head liners are made of high chrome-carbide or Ni-Hard IV alloy cast iron with a minimum Brinell hardness of 500. The impeller is of the latest Ellicott design with three (3) blades and an 10.8 inches (274mm) theoretical particle clearance. Patented* recessed expeller vanes are an Ellicott feature on the impeller shrouds for low wear and high efficiency. The suction side head and the entrance to the impeller are protected from wear by means of a renewable throat piece of alloy cast iron with a minimum Brinell hardness of 500.

The impeller shaft is of high tensile steel. A stainless steel sleeve is provided on the shaft where it passes through the pump stuffing box. The impeller shaft is an integral part of the totally enclosed reduction gear. The radial and thrust loads on the pump shaft are carried by anti-friction bearings completely enclosed in the reduction gear assembly.

A pump priming system with required piping is provided.

*U.S. Patent No. 3,535,051

3. DREDGING COMPONENTS (Continued)

SPUDS:

Two (2) tubular spuds with heavy steel points are furnished for dredging to designed depth. The spuds are designed for single-part wire rope bottom lift and are raised by individual, single-drum winches with freefall clutches for good penetration. Lever controls are provided on the control console for raising and lowering the spuds. The entire system is protected from overload by relief valves.

Four (4) spud keepers, two (2) for each spud, are attached at the stern to the top and bottom of each side hull tank. Gates are provided in each keeper with pin connections to facilitate insertion and removal of spuds.

SWING WINCHES:

The Ellicott Series 1870 direct line winches for swinging of the dredge, are arranged for efficient power transmission. The winch units are mounted on the ladder to eliminate unnecessary sheaves and blocks, thus increasing efficiency while reducing cable wear. They are in view of the operator and readily accessible for maintenance.

The winches are driven by radial piston hydraulic motors through open steel gearing. Motor speed control and reversing are by means of fingertip controls at the operator's control console. The motors are protected from overload by relief valves. The winches are designed to provide safe, smooth operation under all conditions of speed and power from the driving hydraulic motors.

The two (2) winch drums are of steel and are supported by anti-friction bearings. The drive gear is bolted directly to the winch drum while the pinion gear is supported by anti-friction bearings and splined to the hydraulic motor. Provision is made for hydraulic braking during operation and a pawl locking device is provided.

LADDER HOIST AND SPUD WINCHES:

The ladder hoist and spud winches are individual units each driven by a hydraulic motor through totally enclosed planetary reduction gearing. Each winch has an automatic, hydraulically operated, totally enclosed, disc type brake for holding the load and, in addition, the spud winches incorporate totally enclosed, disc type, freefall clutches for good spud penetration.

Each winch is arranged for control by fingertip levers at the operator's console.

4. PRIME MOVERS

The Series **1870 "DRAGON"** is equipped with two (2) engines as follows:

TYPE	RATING	SERVICE	STARTING	COOLING
CAT 3512	1280 HP (955 kW) Cont. @ 1600 RPM	Dredge Pump	Electric	Heat Exchanger
CAT C15	475 HP (354 kW) Intermit. @ 1800 RPM	Hydraulic Pumps	Electric	Heat Exchanger

All engines are equipped with instrument panels with essential instruments. Automatic shutdown for high water temperature and low oil pressure is provided for the hydraulic pump engine while remote reading gauges with warning lights for water temperature and oil pressure are provided at the control center for the dredge pump engine. Engines are warranted at the horsepower rating shown in accordance with the manufacturer's recommendation for the service application.

5. HYDRAULIC POWER SYSTEM

Agitation and feed to the suction inlet in a wide range of materials (soft to compact) is obtained with the Ellicott Series 1870's variable control on both cutter and winch. The cutter and swing winch speeds can be varied independently, thus insuring optimum power balance and utilization for maximum production in the widest range of materials to be dredged. In addition, the ladder hoist winch can be operated simultaneously while swinging and excavating to afford greater flexibility.

The hydraulic system is made up of four (4) independent open loop circuits: one circuit each for the cutter and ladder hoist; for the swing winches; for the spud winches and for control pressure.

Three (3) multiple section gear pumps provide oil pressure for:

a. The piston type hydraulic motor in the cutter circuit. The cutter can be operated at either full, three-quarter or half speed with maximum torque available at each speed.

To operate the ladder hoist a portion of oil flow to the cutter is diverted to the ladder hoist winch. Speed control of one hundred percent (100%) of the speed range of the winches is attainable with maximum torque available at all speeds.

b. The piston type hydraulic motors in the swing winch circuit are in series. Speed control of one hundred percent (100%) of the speed range of the winches is attainable with maximum torque available at all speeds.

c. The gear type hydraulic motor in each spud winch.

5. HYDRAULIC POWER SYSTEM (Continued)

d. The freefall brake release circuit for each spud winch and control pressure.

The pump draws oil directly from the oil reservoir through a strainer and fine filtration is provided on the return lines to the reservoir.

Features of the system include: wide range of speeds by means of flow control; full torque or line pull available at all speeds; reversing control; demand regulated pressure; heat dissipation by means of an efficient oil cooling system and filtration of oil pumped from storage barrels. All of the Ellicott Series 1870 features insure flexible and efficient operation.

6. ELECTRICAL SYSTEM

The electrical system is designed to provide for the following:

a. 24 volt D.C. starting system on the engines.

b. 24 volt D.C. battery recharging systems.

c. 24 volt D.C. dredge pump and auxiliary engine gauges and shutdown.

d. 24 volt D.C. non-glare, variable intensity, indirect dial illumination on the control console.

e. 24 volt D.C. solenoid operated hydraulic control valves.

f. 120 volt, 60 Hertz, single phase A.C. internal and external lighting system with watertight fixtures consisting of incandescent lighting in machinery and control spaces; floodlights for illumination of the forward dredging and spud areas; deck lights; two (2) 3/4 H.P. fans; service outlets. The A.C. lighting is provided by a 12.0 KW alternator belt driven from the auxiliary engine.

7. CONTROL CENTER AND OPERATING CONTROLS

To promote safety in operation, flexibility and efficiency, the controls have been designed and mounted on the console in the control center to provide for one-man operation of the dredging sequence.

The planned built-in comfort features of the control center combat operator fatigue and prolong working efficiency.

The following specific controls and indicating instruments are provided:

7. CONTROL CENTER AND OPERATING CONTROLS (Continued)

Forward - off - reverse controls for cutter

Full, 3/4 and 1/2 speed control for cutter

Forward - off - reverse controls for each swing winch

Speed control for swing winch circuit

Hydraulic braking control for each swing winch

Raise - lower and speed control for ladder

Raise - lower and freefall control for each spud winch

Cutter hydraulic circuit pressure gauge

Swing winch hydraulic circuit pressure gauge

Pump engine throttle

Pump engine tachometer

Pump discharge pressure gauge

Pump vacuum gauge

Service water pressure gauge

Main engine jacket water temperature gauge with warning light

Main engine lube oil pressure gauge with warning light

A dredging depth indicator visible from the control center is mounted at the dredging ladder.

Starting, shutdown and clutch controls (as appropriate) are adjacent to or on all engines, in accordance with standard safety practices.

8. MISCELLANEOUS EQUIPMENT

The dredge shall have auxiliary support equipment aboard as follows:

a. Sea chest and strainer

b. One (1) service water pump, belt driven from the dredge pump engine to provide water pressure for: 1) dredge pump gland seal; and 2) dredge pump priming.

8. MISCELLANEOUS EQUIPMENT (Continued)

c. One (1) main engine driven raw water pump for cooling the main engine and dredge pump drive.

d. One (1) belt driven raw water pump for cooling the auxiliary engine and hydraulic system.

e. Starting batteries and cables

f. Main deck hand rail

g. Safety equipment (ABC fire extinguishers, life vests, life rings)

The following miscellaneous equipment is available at extra cost:

a. Portable fire and bilge pump

b. Wire rope

c. Swing anchors

d. Anchor booms

e. Impeller lifting hook

f. Jib crane over pump

g. Stern jib crane

h. Flanged flexible hose or discharge swivel elbow

i. Tool kit

j. Production Metering System

k. 220 Volt - 50 Hertz - single phase lighting

9. INSTRUCTION MANUALS

Two (2) sets of manuals shall be provided. Each set shall include the following:

- Instructions for the operation and maintenance of the dredge with schematic drawings for the electric, hydraulic service water circuits, etc.

- Repair parts information for equipment manufactured by Ellicott Dredges, LLC.

- Operating instructions and parts information for equipment supplied by Ellicott Dredges, LLC subcontractors.

- Field assembly and launching recommendations.

10. PAINTING

The dredge shall be painted according to Ellicott Dredges, LLC's standard schedule. The hull (consisting of the center tank and all side tanks) shall be sandblasted before painting. The hull shall be blasted internally and externally to a commercial grade (SSPC-SP-6). All other steel work shall be wire brushed and thoroughly cleaned of loose mill scale, rust, oil, or other foreign matter before painting.

The hull shall be given one (1) coat of Carbomastic 15 or equal on the interior and exterior of 5 mils thickness and an additional coat of Carboline D890 or equal on the exterior of 5 mils thickness.

All fuel compartments shall receive one (1) coat of a fuel oil resistant elastomer coating (minimum thickness 1.0 mils).

All other surfaces shall receive a primer coat of five (5) mils thickness of Carbomastic 15 or equal and a finish coat of five (5) mils thickness of Carboline D890 or equal.

The primer coat will be allowed to dry thoroughly and harden before application of the finish coat. Carbomastic 15 is a high solids aluminum epoxy mastic. Carboline D890 is a high solids epoxy polyamide.

11. SHOP ASSEMBLY AND TESTING

The shop assembly and testing is necessarily limited to the machinery modules which are assembled in the shop and which shall be tested as far as practical under no-load or simulated load conditions.

The dredge pump, reduction gear and main engine cannot be tested until the dredge hull is completely assembled and launched.

The hull tanks will be individually tested for watertightness.

11. SHOP ASSEMBLY AND TESTING (Continued)

The hydraulic system will be shop tested to insure proper installation and control. Final testing of the complete hydraulic power systems will be done after launching.

12. FIELD ASSEMBLY AND FIELD TESTING

The field assembly of a transportable dredge requires proper preparation of launching and assembly site in the field upon or before the arrival of the dredge components at the site. Complete field assembly and launching instructions will be provided.

A trained Field Engineer is available to assist the Purchaser's crew in the supervision of the field assembly. He can also supervise the following operations:

a. The final check of the dredge pump, reduction gear and main engine after the dredge has been launched and is afloat with all major machinery installed.

b. The testing of the diesel engine driven hydraulic power installed on the center hull tank, including inspection of the piping connections to the cutter drive, the ladder hydraulic winch and operational test of the complete hydraulic system to insure proper functioning and performance.

c. Test operation of dredge pump, cutter, winches and controls.

These operations can be completed quickly and at a minimum cost provided the Purchaser has adequate tools and a sufficient crew of the appropriate skills available.

The costs for the Field Engineer plus all other costs and charges in connection with field assembly, alignment and testing in the field shall be for the expense of the Purchaser and are not included in the contract price unless otherwise agreed.

13. SUMMARY

All machinery described in these specifications is coordinated to form a balanced operating unit. All materials and machinery components will be new and the workmanship shall be of high order. It is the policy of the manufacturer to make continual improvements in the design and manufacture of our products; therefore, the right is reserved to modify these specifications to provide for the use of any such improvements which may have been developed prior to the time of actual manufacture.

ELLICOTT SERIES 1870 "DRAGON"

GENERAL PURPOSE MODEL 0187D2018050H

14. PRINCIPAL DIMENSIONS AND PARTICULARS

HULL:

Length, feet (m))	82	(25)
Width, feet (m)) moulded	27	(8.23)
Depth, feet (m))	6	(1.83)
Weight, approximate pounds including deckhouse (Kg)	170,000	(77,100)
Shell plate thickness, inches (mm) min.	5/16	(7.9)
Basic frame spacing, feet (m)	4	(1.22)

PRIME MOVERS:

Dredge pump engine (CAT 3512)		
continuous @ 1600 RPM - SHP (kw)	1280	(955)
Auxiliary engine (CAT C15)		
intermittent @ 1800 RPM - SHP (kw)	475	(354)
Total connected SHP (kw)	1755	(1309)

CUTTER-BASKET TYPE: (Pinned Tooth)

Shaft horsepower (kw)	250	(186)
Speed range, RPM	36, 27 & 18	
Cutting force:		
Total pounds (Kg)	14,900 (6759)	
Pounds per linear inch (kg/cm)	400	(71)
Head mean diameter, inches (mm)	54	(1372)
Number of blades		6
Shaft diameter, inches (mm)	5.875	(149.2)
Number of motors	1	
Head weight, pounds	2,700	(1225)

14. PRINCIPAL DIMENSIONS AND PARTICULARS (Continued)

SWING WINCH: (Two)

Shaft horsepower (kw)		60	(45)
Line speed - ft/min (m/min)	)on second	88	(27)
Line pull - pounds (Kg)	)layer	21,000	(9525)
Wire size - inches (mm)		3/4	(19)
Drum capacities - feet of wire (m)		450	(137.2)

LADDER HOIST WINCH:

Shaft horsepower (kw)		102	(76)
Line speed - ft/min (m/min)	)on second	100	(30.5)
Line pull - pounds (Kg)	)layer	25,500	(11,566)
Ladder hoisting speed - ft/min - (max. m/min.)		46.0	(14.0)
Wire size - inches (mm)		7/8	(22)

SPUD WINCHES: (Two)

Shaft horsepower (kw)		30	(22.4)
Line speed - ft/min (m/min)	)on second	26	(7.9)
Line pull - pounds (Kg)	)layer	30,000	(13,600)
Wire size - inches (mm)		1	(25.4)

GENERAL:

Mean draft, operating condition - approximate ft. (m)	4	(1.22)
Digging depth, feet (m)	50	(15.2)
Fuel oil tank capacity gallons (liters)	7,900	(29,900)
Suction Pipe		
I.D. Inches (mm)	20	(508)
O.D. Inches (mm)	20-3/4	(527)
Discharge Pipe		
I.D. Inches (mm)	20	(508)
O.D. Inches (mm)	20-3/4	(527)
Ladder length, feet approximate	63.7	(19.4)

14. PRINCIPAL DIMENSIONS AND PARTICULARS (Continued)

WEIGHTS, POUNDS (Approximate) (KG):

Total assembly dry weight	410,000	(186,000)
Center tank (without main machinery)	78,000	(35,000)
Ladder	49,700	(22,545)
Spuds (each)	14,400	(6,530)
Control room	3,700	(1,678)
Dredge pump casing	7,800	(3,538)
Dredge pump engine, including clutch	17,400	(7,900)
Dredge pump reduction gear	8,100	(3,674)

The above specifications are preliminary and subject to modification due to improvements in the design, modifications required during design and construction or addition of equipment not described in these specifications.