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STUDY OF RIVER HARVESTING & TRASH CLEANING MACHINE

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ABSTRACT

Mechanical control methods involve the complete or partial removal of plants by mechanical means, including: harvesting, shredding, mowing, rototilling, rotovating, and chaining. Mechanical control methods can also be used to expedite manual harvesting activities, including hand harvesting, raking, and cut stump control, with the use of motor-driven machinery (Haller 2009; Lembi 2009). These management techniques for plants rarely result in localized eradication of the species, but rather, reduce target plant abundance to non-nuisance levels. A range of machinery for managing and controlling aquatic vegetation is in use today, designed for specific plant types (floating,submersed, and emergent vegetation) and for operation in specific aquatic habitats (open water, canals, shorelines, and wetlands).

A mechanical aquatic harvester (harvester) is a type of barge used for a variety of tasks, including aquatic plant management and trash removal in rivers, lakes, bays, and harbors. Harvesters are designed to collect and unload vegetation and debris using a conveyor system on a boom, adjustable to the appropriate cutting height, up to 6 feet below the surface of the water.

Cutter bars collect material and bring it aboard the vessel using the conveyor; when the barge has reached capacity, cut material is transported to a disposal site and offloaded using the conveyor.

I.INTRODUCTION

This invention relates to skimmer boats, i.e., work boats for collecting and disposing of floating solid waste materials in harbors and waterways. The invention is more specifically directed to highly maneuverable vessels equipped with means for picking up floating debris, means for storing the debris on the vessel, and means for discharging the debris from the vessel to a storage area, which may be ashore or which may be another vesselsuch asabarge.

Many work boats and vessels have been proposed for collection of floating solid waste and other debris. These may typically be formed as a catamaran-type hull, i.e., a pair of pontoons or sponsons, or as a monohull, with paddle wheel or screw drive propulsion, and an operator station. In one typical trash skimmer design, one or more hydraulically powered open mesh conveyors are positioned between the pontoons of a catamaran-type twin-hull vessel. Twin over-the-rear propellers are used to propel and maneuver the vessel, and these can be tipped up for cleaning weeds and debris from the propeller blades. A main pickup conveyor extends off the front end, and extends into the water to catch the floatables, which it picks up and carries back to a main storage conveyor. When the storage conveyor is completely loaded, the boat is taken to a discharge position where the debris can be transferred to a truck or barge or other facility. A rear conveyor at the stern of the craft carries the debris from the storage conveyor up and back to drop it into the barge or on-shore storage facility. In some cases, a separate, on-shore conveyor can be used to pick up the trash discharged vessel

II. COMPONENTS AND ITS DESCRIPTION

The use of mechanical control equipment is limited by environmental and site conditions. Mechanical control activities are non-selective. When operating mechanical control equipment near water intake structures or flood control channels, the direction and velocity of flow must be considered to prevent vegetative debris from blocking the structure or channel. In addition to potentially preventing the downstream establishment of plant ANS, collecting vegetative fragments generated by mechanical control methods prevents the accumulation of decaying plant material in the channel, which may pose water quality issues.

Mechanical Harvesting

Most harvesting equipment needs approximately 36 inches of water (for a loaded barge) to operate, and enough room to maneuver a barge 30 feet long by 10 feet wide. The control mechanism is highly effective for controlling vegetation, but cannot selectively remove target plant or animal species from weed infestations. Harvesting is traditionally used for emergent vegetation and SAV in lake or riverine systems. The equipment is not as effective at managing shoreline or marsh vegetation in shallow or seasonal water systems.

Shredding

Shredding is used throughout the world to manage weeds that impede navigation, or for flood control functions. These tools are also common tools used tomanage vegetation in lakes, rivers, and waterways. Cutters are used in Florida to manage floating mats of Cuban bulrush as well as other floating and emergent vegetationThe primary operational considerations for cookie cutters are water depth and maneuvering room. Operation of these machines requires less water and little maneuvering room relative to mechanical harvesters. The cookie cutter does not have any type of harvest capability; it only cuts mats of vegetation. As such, biomass is still present in the water system and there is often a need for a harvesting machine to support this type of operation (USACE).

Mowing and Rototilling

Mowing and rototilling require site conditions with firm enough soil to operate a rubber-tired piece of equipment; this may be possible in standing water, but water depth and soil types must be evaluated before starting work. Significant ecosystem damage may occur if the operation is not carried out properly, including soil disturbance that may allow for ANS establishment. Special consideration should be given to suspension of sediment and sediment management when using this technology to control invasive vegetation in wetland or aquatic habitats.

Rotovating –

Rotovating requires enough depth to float and operate the piece of equipment (which issimilar in size to a harvester), but also cannot be too deep, as the rotovating head has limited reach. Special consideration should be given for suspension of sediment, and sediment management, when using this technology to control invasive vegetation.

Chaining

Chaining has been used to non-selectively control vegetation in flood control and water supply canals throughout the United States.Chaining requires unobstructed paths on both sides of a canal, so that trucks or tractors canbe operated with minimal downtime over long distances. Chaining stirs sediment causes turbidity and disturbs aquatic species that live in the targeted area

III. WORKING OF MACHINE

Harvesting starts when plants have neared or approached the water surface. The harvester's cutting head is lowered into the water and the harvester moves forward, cutting and collecting plants as it advances. Harvesters vary in size and capability. Most cut plants about five feet below the water and in a swath between five and ten feet wide. Bigger, faster machines with larger cutting heads and holding capacities may be more efficient, but are also less manoeuvrable. Depending on time of year, weather, and depth of cut, the same area may need to be harvested again in a few weeks.

The cuttings are collected on a conveyer belt and deposited in a holding area on board. Although the harvester collects most plant materials as it operates, inevitably some fragments are missed. Not overloading the carrying capacity of the harvester helps to keep plant fragments to a minimum. Along with plants, the harvester also inadvertently collects small fish (some are able to escape from the conveyer belt) and invertebrates.

When the plant storage area is filled, the harvester must off-load the cut plants. Plants can be off-loaded to either a barge stationed offshore or to a trailer or dump truck. These plants may be used as compost or disposed of in a land fill. As the distance from the work area to the off-loading site increases, the time spent on plant disposal activities can exceed the time spent cutting. This can add greatly to the duration and expense of the project and is a critical limitation to some harvesting projects. The plant density and machine specifications will also determine how often the harvester needs to off-load the cut plants.

Delays in the harvesting schedule can result from high winds, thunderstorms, and mechanical failure. Unscheduled maintenance or machine breakdowns can also result in lost harvesting time.Complaints about harvesting have included reports by homeowners that plant fragments wash up more frequently on their beaches after harvesting. Homeowners may also report that their neighbor's property was harvested sooner or the job done more thoroughly than at their own property. It is important to establish some clear guidelines and policies to help make decisions and to settle dispute

IV. METHODOLOGY

Methodology used for whole processing of pump is given below; this methodology gives way about how work is to be carried out in systematic way. It is standard process of describing process, how it is done in simplest manner.

4.1 DESIGN Design consists of application of scientific principle, technical information, and imagination for development of new mechanism to perform specific function with maximum economy and efficiency. Hence careful design approach has to be adopted. The total design work has been split into two parts.

1. System design
2. Mechanical design

4.2 System Design:

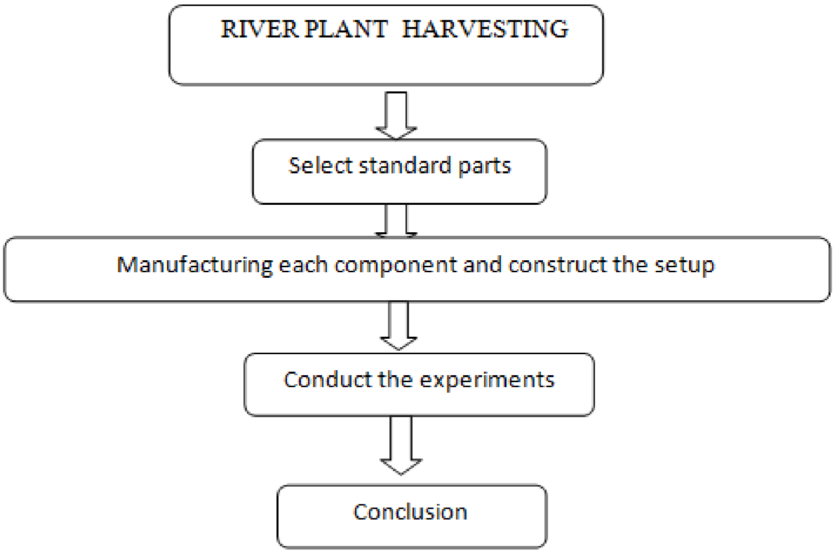
System design is mainly concerns the various physical constraints and ergonomics, space requirements, arrangement of various components on frame at system, man-machine interaction, no. of controls, position of controls, working environments, of maintenance, scope of improvement, weight if machine from ground level, total weight of machine and a lot more. In system design we mainly concentrated on the following parameter:-

System selection based on constraints Our machine is used in small-scale so space is major constrain. The system is to be very compact so that it can be adjusted in small space

Arrangement of various components

Keeping into view the space restrictions all components should be laid such that their easy removal or servicing is possible. Every possible space is utilized in component arrangements.

Man machine interaction :-Friendliness of machine with the operated that is operating is an important criterion of design.



(Fig no Flow diagram)

Chances of failure

Losses incurred by owner in case of any failure are important criterion of design. Factor of safety while doing design should be kept high so that there are less chances of failure. Moreover periodic maintenance is required to keep unit healthy.

Servicing facility

Layout of components should be such that easy servicing is possible. Those which require frequent servicing can be easily disassembled.

Scope of future improvement

Arrangement should be provided in such way that if any changes have to be done for future scope for improving efficiency of machine.

Height of machine elements from ground

All the elements of the machine should be arranged to the height from where it is simple to operate by operator. Machine should be slightly higher than the waist level, also enough clearance should be provided from the ground for cleaning purpose.

Weight of machine

Total weight depends on the selection of material of all components as well as their dimensions. Higher weight will result in difficulty in transportation; it is difficult to take it to workshop because of more weight.

V. MECHANICAL DESIGN

In mechanical design the components are listed down and stored on the basis of their procurement, design in two categories namely.

1. Designed parts
2. Parts to be purchased

Mechanical design phase is very important from the view of designer as whole success of project depends on the correct design analysis of the problem.Many preliminary alternatives are eliminated during this phase. Designer should have adequate knowledge about physical properties of material, load stresses and failure. He should identify all internal and external forces acting on machine parts.

These forces may be classified as,

a) Dead weight forces

b) Friction forces

c) Inertia forces

d) Centrifugal forces

e) Forces generated during power transmission etc.

Designer should estimate these forces very accurately by using design equations. If he does not have sufficient information to estimate them he should make certain practical assumptions based on similar conditions which will almost satisfy the functional needs. Assumptions must always be on the safer side. Selection of factors of safety to find working or design stress is another important step in design of working dimensions of machine elements. The correction in the theoretical stress values are to be made according in the kind of loads, shape of parts & service requirements Selection of material should be made according to the condition of loading shapes of products environment conditions & desirable properties of material provision should be made to minimize nearly adopting proper lubrications method.

VI. DESIGN OF SHAFT

A shaft is a rotating element which is used to transmit power from one place to another. The power is delivered to the shaft by some tangential force and the resultant torque set up within the shaft permits the power to be transferred to various machines linked up to the shaft. In order to transfer the power from one shaft to other, the various members such as pulleys, gears, etc are mounted on it. These members along with the forces exerted upon them causes the shaft bending.

The shaft usually cylindrical, but may be square or cross shaped in section. They are solid in cross section but sometimes hollow shafts are also used.

Material used for shaft

- It should have high strength.
- It should have good machineability.

- It should have good heat treatment properties.
- It should have high wear resistance properties.

The material used for ordinary shafts is carbon steel of grades 40C8, 45C8, 50C4 & 50C12. Also M.S. & En8 can be used.

Stresses in shafts

1) Shear stress due to transmission of torque. (i.e. due to tort tonal load.)
2) Bending stresses (tensile or compressive) due to the forces acting on the machine elements like gears, pulleys etc. as well as due to the self-weight of the shaft.The shafts are designed on the following basis.

STRENGTH & RIGIDITY:

The following cases may be considered.

a) Shaft subjected to twisting moment or torque only.
b) Shaft subjected to bending moment only.
c) Shaft subjected to combined bending twisting moment.
d) Shaft subjected to axial loads in addition to combined torsional& bending.

VII. MAINTENANCE

Operation and maintenance costs would include monitoring effectiveness of the Control method, modifying application parameters if necessary, and scheduling and completing periodic reapplications.

Mitigation:

Design and cost for mitigation measures required to address impacts as a result of implementation of this Control cannot be determined at this time. Mitigation factors will be based on site-specific and project-specific requirements that will be addressed in subsequent, more detailed, evaluations.Harvesting starts when plants have neared or approached the water surface. The harvester's cutting head is lowered into the water and the harvester moves forward, cutting and collecting plants as it advances. Harvesters vary in size and capability. Most cut plants about five feet below the water and in a swath between five and ten feet wide. Bigger, faster machines with larger cutting heads and holding capacities may be more efficient, but are also less maneuverable. Depending on time of year, weather, and depth of cut, the same area may need to be harvested again in a few weeks.

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Fig..photo copy of river plants harvesting mahine

VIII. SPECIFICATIONS

All standard Marina Cleaners are featured and equipped with the following :

• A complete Hydraulic System for all skimming, load handling, and propulsion functions, with variable speed control at the operator's fingertips.

• A Air CooledDiesel Hydraulic Power Unit, placed into a noise proofed,lockableeengi room .

• Lockable Hydraulic Oil Tank, Filtration, Hydraulic Oil Cooler, Hydraulic Directional Valves.Stainless Steel Hydraulic CylinderRods.

• Operator's platform with a seat and console with engine controls monitoring system including warning lights, tachometer and hour meter, and hydraulic controls with pressure gauge.

• Conveyor Belt System made of heavy duty Stainless Steel supported by UHMD plastic tracks and interchangeable floors. Articulated Skimmer Wings

• Front Conveyor with adjustable depth setting and cleats mounted to belts.

• Storage Conveyor with load indexing and height adjustable discharge

• Twin Pontoon Steel Hull "hydro-dynamically" shaped, including multiple compartments, inner ribbing, tie and lift cleats, drains and vents, anti-skid deck, bottom skids rub rails, gunnels.

• Two independent, bi-directional Hydraulic Propulsion Units with variable speed controls, bronze propellers, stainless steel shafts, drop arms, and hydraulic connections, as well a tunnel guards, and power tilt.

•Railings and Guards

•Stainless Steel Fasteners

• Marine Coating, following sandblast preparation, includes priming and finishing coats. Standard colors are Safety Orange and Blue

• Fire extinguishers, life jacket and life ring with 50 Ft. (15M) of rope

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• Operators Manual, Parts Catalog and One Year Warranty

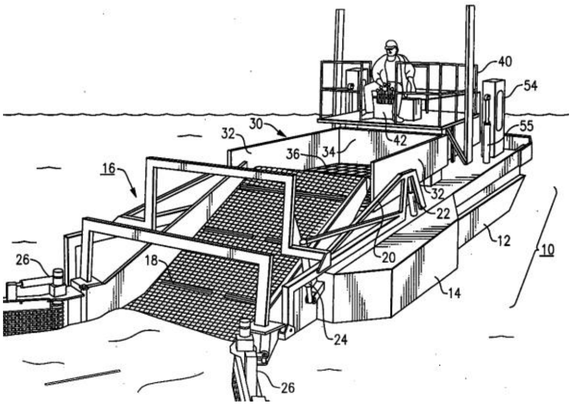

Fig .of dig.of river plants harvesting machine

IX. COST CONSIDERATION

Implementation

Implementation costs would include planning, equipment, and labor for initial application of mechanical control activities. Mechanical control methods for aquatic plants are

usually priced per acre, based on a variety of environmental conditions and site-specific ogistics, as well as equipment types and quantities required. Harvesting of floating aquatic plants is also priced per acre, based on density of vegetation and travel distance between collection and disposal sites. Other cost considerations can include decontamination of equipment to prevent spread of ANS and construction or development of an existing disposal site near the harvest area. Large volumes of harvested vegetation require significant amount of temporary storage; after the material dries, its volume is reduced and can then be left on the nearby disposal site to compost (if permitted), or hauled to a permitted compost facility or

landfill. The cost of hauling material is dependent on distance, volume, and level of difficulty required to access the disposal site. Planning and design activities in this phase may include research and development of this Control, modeling, site selection, site-specific regulatory approval, plans and specifications,and real estate acquisition. Design will also include analysis of this Control's impact to existing waterway uses including, but not limited to, flood risk management, natural resources, navigation, recreation, water users and dischargers, and required mitigation measures.

X. ADVANTAGES

Water can be used immediately following treatment. Some aquatic herbicides have restrictions on use of treated water for drinking, swimming and irrigation. Also, plants are removed during mechanical harvesting and do not decompose slowly in the water column as they do after herbicide application. In addition, oxygen content of the water is generally not affected by mechanical harvesting, although turbidity and water quality may be affected in the short term.

Nutrient removal is usually insignificant because only small areas of lakes (1 to 2%) are typically harvested; however, some nutrients are removed with the harvested vegetation. It has been estimated that aquatic plants contain less than 30% of the annual nutrient loading that occurs in lakes.

The habitat remains intact because most harvesters do not remove submersed plants all the way to the lake bottom. Like mowing a lawn, clipped plants remain rooted in the sediment and regrowth begins soon after the harvesting operation.

Mechanical harvesting is site-specific because plants are removed only where the harvester operates. If a neighbor wants vegetation to remain along his or her lakefront, there is no movement of herbicides out of the intended treatment area to damage the neighbor's site.

Herbicide concerns remain widespread despite extensive research and much-improved application and despite use and registration requirements enforced by local regulatory agencies. Mechanical harvesting, despite some environmental concerns (as outlined below), is perceived to be environmentally neutral by the public.

Utilization of harvested biomass is thought by many to be a means of offsetting the relatively high costs and energy requirements associated with mechanical harvesting. Unfortunately, no cost-effective uses of harvested vegetation have been developed, despite much research

XI. DISADVANTAGES

The demand for aquatic weed harvesters is very small, so the equipment associated with these operations is often custom-made and expensive.

The area that can be harvested in a day depends on the size of the harvester, transport time, distance to the disposal site and density of the weeds being harvested. These factors can result in a wide range of costs. The cost of harvesting is site-specific, but mechanical harvesting is generally more expensive than other weed control methods due **to the variables noted above**

XII. APPLICATION

1. Mechanical removal is used for management of aquatic vegetation in a variety of habitats including streams, rivers, lakes, and canals. The equipment is limited by the depth of water in which it can navigate.

2. Mechanical harvesting has been used throughout the United States to manage a variety of floating, submersed and emergent vegetation problems, as well as to collect organic and inorganic flood debris.

3. Shredding is used throughout the world to manage weeds that impede navigation, or for flood control functions. These tools are also common tools used to manage vegetation in lakes, rivers, and waterways.

4. Cutters are used in floating mats of Cuban bulrush as well as other floating and emergent vegetation.

5.Chaining has been used to non-selectively control vegetation in flood control and water supply canals throughout the United States.

6. General Effectiveness: Mechanical control is an effective method for managing vegetation, but this Control has limited ability to target isolated populations. This trait of non-selectivity does not allow mechanical control methods to be as effective in mixed communities of target and non-target plants, because there is limited area over which the equipment can be used without harming nonmarket plant communities.

7. Proper timing of mechanical control operations can improve control and reduce the spread of propagates.

8.Vegetative debris fragments must be contained onsite, in order to prevent plants that reproduce vegetative from infesting downstream

9. Mechanical control methods can also be used to expedite manual harvesting3 activities, including hand harvesting, raking, and cut stump control, with the use of motor-driven machinery

XIII. CONCLUSION

The Clean Rivers Project and the health of area waterways may be at risk if financing depends solely on D.C. Water's rate structure. The present approach puts the burden to pay for this project on District residents, businesses, and property owners based on the "polluter pays" principle. Such a financing principle could be risky, judging by the projections of costs. What if rate payers' will or ability to pay fails? Using D.C. Water's projections for water and sewer rates and the IAC (which is dedicated to the project), water bills as a share of income for the lowest-income retail customers will more than double by 2019.

Utility payments are the biggest proportionate burden for households at the lowest income levels. Will this project continue through to completion at a cost that can be borne by the District's economic and household base alone? Further, there is no indication of how much more the IAC and water and sewer rates will have to rise between 2019 and 2025 to complete the long-term control plan and meet the stipulated water quality. Over time, there will be pressure to ease rate increases. Any inability to sustain rate and IAC increases may jeopardize project completion. It may also result in deferred maintenance, or the shrinking, delay, and postponement of other basic improvements. To minimize these risks to a project that will be of enormous benefit to the capital region, the time has come to ensure that all the beneficiaries pay their fair share. Water, like transportation, is inherently cross-jurisdictional. The entire region benefits from cleaner water and must be part of planning, implementing, and funding the cleanup strategy

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