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## REED LINK FOR AQUATIC PLANTS OF ARTIFICIAL AND NATURAL POND BODIES

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**Annotation.** This article presents the process of mowing reeds in water bodies using a boat equipped with vertical and horizontal cutting units on a floating reed cutter. The power cable must be insulated and long enough to connect to a nearby electrical panel. The use of electric batteries can also be considered if they are available in large quantities. The working equipment, or unit, is connected to the power grid, and the reeds are mown using a horizontal mower. Since the auxiliary worker is located at the bottom of the reservoir at a depth of 0.4-0.5 m, he easily catches the cut reeds and feeds it to the raft.

**Key words:** cutting device, conical shaft, auger shaft, bracket, circular saw, worm gear.

### INTRODUCTION

Reed, considered an aquatic plant, plays a vital ecological role in water purification, absorbing pollutants and heavy metals. Its thickets act as a natural filter and improve water quality in bodies of water. On the other hand, reeds strengthen the banks of reservoirs, that is, the reed root system prevents bank erosion and stabilizes the soil.

In the wild, near ponds, lakes, and swamps, plants such as reeds, cattails, and bulrushes grow. These are tall plants with characteristic inflorescences, and in appearance they represent a beautiful natural landscape. These crops spread along the coastal zone of artificial reservoirs, absorbing all the nutrients from the soil, quickly taking over new areas, and turning into harmful weeds. While maintaining fertile land around reservoirs, controlling them is quite difficult [1,2]. Due to the fact that chemical methods for combating the overgrowth of water bodies have not yet been sufficiently studied and are used in practice on a small scale, fish farms often practice the use of herbicides in agreement with sanitary supervision and fish protection authorities, using the recommendations and assistance of research organizations.

In reservoirs, bottom sediments in the form of silt accumulate over time in the lower part of the pool, polluting the water and hindering the development of ornamental plants and the normal development of fish.

Aquatic plants help enrich the water with oxygen during the day. They also provide habitat and breeding grounds for animals. They harbor various insects, which



feed fish, crustaceans, mollusks, and other organisms. However, in a small body of water and a shallow depth of no more than 20-25%, vegetation is considered beneficial. The most common species of aquatic plants accelerate their daily growth and development at water temperatures of 17-24°C [11,13].

Excessive vegetation has a detrimental effect on the quality of pond fish farms, reducing their water surface area and thereby worsening fish living conditions, preventing water warming, and leading to oxygen starvation in the morning hours. Aquatic plants consume large amounts of oxygen as they die and decompose. Therefore, it is necessary to monitor the development of aquatic plants, prevent their spread, and remove overgrowths. Currently, the main measures for controlling aquatic plants are weeding and the use of chemicals such as herbicides [1, 2, 5].

In fish farms, when mixing dry concentrated feed with water, pastes from collected plants are used as additional feed rich in vitamins. Aquatic plants contain all the necessary nutrients: proteins, fats, carbohydrates, and, most importantly, vitamins (B, C, K, E), as well as carotene, mineral salts, and trace elements. Furthermore, harvested aquatic plants are used to prepare organic and organomineral fertilizers for ponds.

Mowing reeds is an effective method of control, requiring multiple applications throughout the season, starting in spring and continuing through fall, before the plant blooms. After mowing, the area should be mulched with black material or herbicides should be used to completely eradicate the reeds. It is also important to address the problem of waterlogging in the area, which promotes the growth of reeds, and, if necessary, to drain the area.

Experiments using aquatic plants as an additional feed component have shown that in ponds where fish were fed concentrated feed mixed with aquatic plants, fish productivity increased by 20% compared to ponds where plants were not added to the feed. At the same time, the costs of imported feed per unit of fish growth are reduced, and up to 16% of concentrated feed is saved [7,15,16].

## **MATERIALS AND METHODS**

Harvesting and collecting aquatic plants is a complex and labor-intensive process, so aquaculture farms place great emphasis on mechanization. Currently, most fish farms use the Czechoslovakian-made Ezoks reed harvesting machines, the Russian-made Kazanka, and in recent years the large Biber reed harvester, the Erpel amphibious reed harvester, and the German-made Libella reed harvester [9,11].

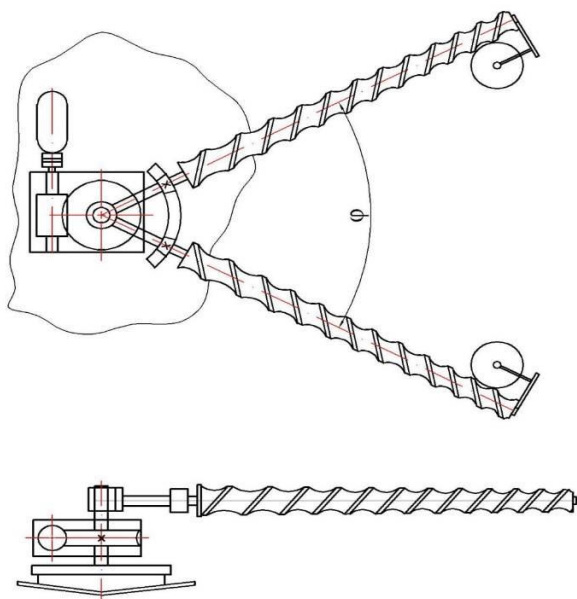
Research is currently underway on devices for collecting floating reeds for fish farms. During the summer, plants are collected from the bottom of ponds. Mounted and trailed tractor-mounted mowers are used for this purpose. After plowing the land,



it is advisable to plant cultivated grasses for further use [5, 14]. Seeded grasses are also removed using various mowers and other agricultural equipment. The use of chemical compounds—herbicides—is considered a promising method for controlling the overgrowth of water bodies.

The shallow depth and surface area of fish farms, coupled with the presence of several ponds on the farm, place specific demands on reed harvesting equipment. While achieving sufficient productivity (approximately 0.5 - 1.0 hectares/hour), the reed cutter must have a shallow draft (0.3 - 0.2 m or less) for shallow water operation, while also requiring a cutting depth of at least 1.5 m. To work in several ponds, the reed harvesting machine must be moved from pond to pond, for which it must be small in size and weight and designed as an amphibian, capable of moving independently both in water and on land. In addition to destroying aquatic plants, it is also advisable to remove the mown material to the shore with a reed picker, and in some cases, to crush it [2,15]. To perform these operations, the drive motor must be sufficiently powerful.

Based on the results of many years of experience and research conducted during the design and operation of floating reed harvesting machines, with a reed diameter of 15 - 30 mm, the cutting resistance should be 0.18 - 0.25 kg/mm<sup>2</sup>, the density of crushed wet reed 350 - 375 kg/s<sup>3</sup>, with a reed yield of 8 - 10 t/ha, the total gripping force and front shear resistance of the knife at a distance of 1 m should be 120 - 150 kg, the bulk density of the crushed reed 50 kg/m<sup>3</sup>.



*Figure 1. Location of cutting parts of the reed-cutting apparatus*

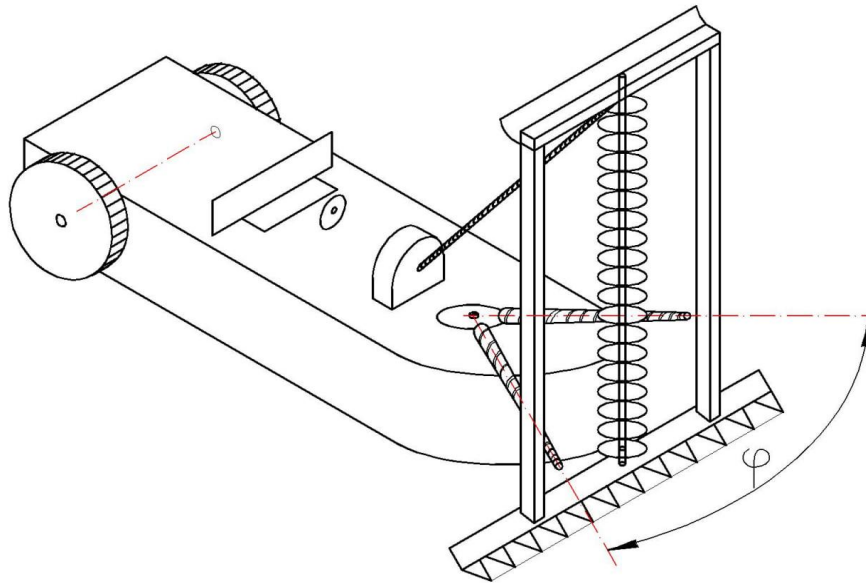
Also, in addition to the destruction of aquatic plants, it is necessary to provide for the removal of the mown mass to the shore using a reed picker, and in some cases, crushing it. In addition to the horizontal blade, the Ezoks reed harvesting machine has a vertical blade, which consists of the cutting parts of the device, a two-stroke gasoline engine with a transmission mechanism, and a pair of paddle wheels covered with shields (casings) [8,11]. The reed-cutting machine is equipped with a device for immersing the cutting device to various water depths.



A relative simplification of a floating these designs consists of craft (boat), vertical and horizontal cutting devices and horizontal cutting devices installed on it, as well as devices on which a boat propeller is installed, additionally equipped with a cutting reed former. It is located in the bow of the boat and mounted on a worm gear with the ability to horizontally rotate two screw shafts, forming an angular sector  $\varphi$  between the axes of their rotation, while the shafts have a conical shape, from the center of rotation to the free end, turns with different pitches are cut.

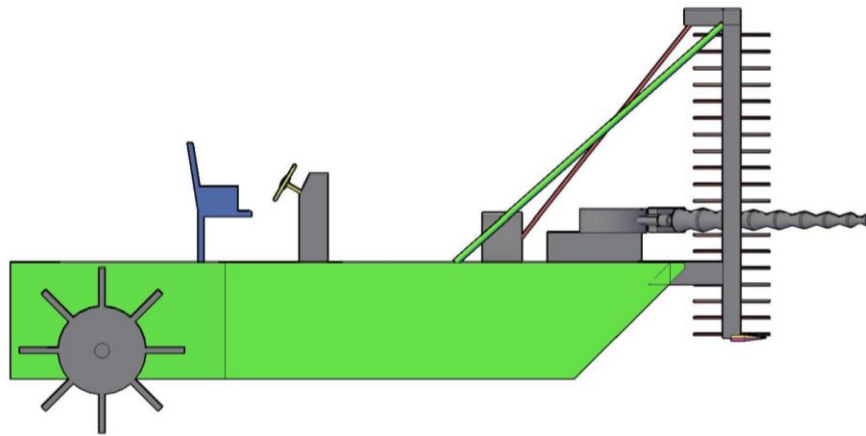
The floating reed cutter includes a comprehensive system designed for mechanically mowing aquatic plants such as reeds, sedges, and other tall plants, housed in a motorboat. Given the shallow depth of the water bodies (0.4-0.5 m), the boat is designed as a flat-bottomed floating craft equipped with paddle wheels and a steering system. The bow of the boat houses the drives for the vertical and horizontal cutting units and a welded frame. The horizontal cutting unit (6) is a two-bar semi-mower, model KDP-4.

The boat is also additionally equipped with a former for cutting reed bundles, made in the form of two screw shafts that form an angular sector  $\varphi$ .



*Figure 2. General diagram of a reed cutting machine*

The reed bunch former consists of a horizontal worm gear mounted on the bottom of the boat, which is mechanically connected to the electric motor and worm shaft via a clutch. This gear meshes with the worm gear, which is attached to the shaft via a pinion, which is connected to the auger shaft's tail. A bevel gear is attached to the end of each auger shaft, which engages a circular gear sector. The auger shafts are conical in shape, with the cross-section of the threads decreasing from the center of rotation to the free end. A bracket is attached to the end of each shaft, on which a circular saw is mounted [13,14].



*Figure 3. Schematic diagram of a floating reed cutter*

### RESULTS OBTAINED

A boat with vertical and horizontal cutting devices mounted on a floating reed cutter is driven into the reed beds from the open water surface, i.e., the open field. The power cable must be insulated and long enough to connect to a nearby electrical panel. The use of electric batteries can also be considered if they are available in large quantities. The working equipment, or unit, is connected to the power grid, and the reeds are mown using a horizontal mower. Since the auxiliary worker is at the bottom of the reservoir at a depth of 0.4-0.5 m, he easily catches the cut reeds and feeds them to the raft [14,15].

In the forward working position, the vertically moving apparatus rises and the reed former is activated. To achieve this, the engine control drives the worm gear, and the auger shafts move through the calculated angle  $\varphi$ , forming an angular sector. In this position, the boat moves forward, that is, toward the shoreline of the reservoir. The worker immediately ties the bundle of mown cane with a rope and loads it onto an accompanying floating raft or leaves it to float, taking into account the subsequent harvesting.

### CONCLUSION

The proposed reed former design allows for rapid sector-by-sector clearing of reed beds in the coastal areas of a reservoir. This mechanized reed clearing improves the quality of fish feeding in artificial fish farms.

To increase the efficiency of this reed cutting device, by using hybrid solar panels as an electric battery and power source, it is possible to reduce electricity consumption by 4-5 times.

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