

Design of the draw roller mechanism for amphibious *Enteromorpha prolifera*

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Abstract

To eliminate the influence of the outbreak of *Enteromorpha prolifera*, we must solve the problem of large area interception and salvage of *Enteromorpha prolifera*. For this purpose, amphibian *Enteromorpha prolifera* was designed to control the unmanned boat to clean *Enteromorpha prolifera*. The unmanned vessel contains four parts. tapping roller mechanism, winch amphibious propulsion mechanism, water quality monitoring sampling feedback mechanism and *Enteromorpha prolifera* compression filter mechanism. This paper focuses on the analysis of the drawing mechanism of the comb roller and proposes the design plan. Finally, we will make further prospects.

Keywords

Enteromorpha, unmanned ship, Draw mechanism of comb roller.

1. Introduction

Enteromorpha prolifera is a large-scale green algaen the world, marine disasters caused by the outbreak of green algae are called "green tides". The outbreak of "green tide" is common in all parts of the world, and has become a global marine ecological disaster. The comprehensive management of *Enteromorpha prolifera* has become a hot research topic. The outbreak scenario is shown in Fig 1

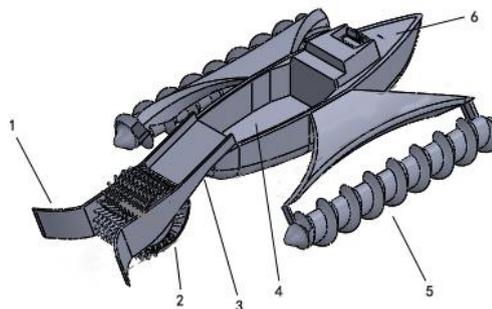


Fig. 1 Cleaning and shooting of *Enteromorpha* outbreak

Because the outbreak of *Enteromorpha prolifera* is short, numerous, affected and covered. In order to eliminate the impact of the outbreak of *Enteromorpha prolifera*, it is necessary to solve the problem of large-scale interception and salvage of *Enteromorpha prolifera* in a relatively short period of time. For this purpose, an environmentally friendly unmanned marine engineering fleet is needed, which can intercept and salvage large areas of the floating and growing *Enteromorpha prolifera* at sea. At the same time, the function of separating and reducing the quantity of *Enteromorpha prolifera* from seawater can be accomplished, and the large-area interception and salvage of *Enteromorpha prolifera* on the sea can be realized, which has the advantages of unmanned, fast and high efficiency, and can quickly eliminate or even avoid the impact of the outbreak of *Enteromorpha prolifera*, so as to meet the needs of the actual situation.

2. Main body design of unmanned ship

The main purpose of this unmanned vessel is to clean up the water surface and intertidal residual *Enteromorpha prolifera* or phytoplankton similar to *Enteromorpha prolifera*. Some of the data were fed back to the tower by radio, and samples were taken back to provide data reference for controlling large-scale outbreaks of *Enteromorpha prolifera*. The main structure of an unmanned ship is similar to that of a trimaran. The unmanned vessel consists of four parts: tapping roller mechanism, winch amphibious propulsion mechanism, water quality monitoring sampling feedback mechanism and *Enteromorpha prolifera* compression filter mechanism. As shown in Fig2. The key part of the unmanned ship is the comb roller mechanism and the amphibious propulsion mechanism. This paper mainly analyzes the drawing mechanism of the comb roller. And make further prospects.

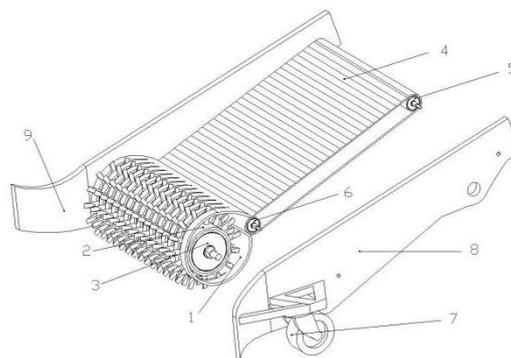


1. Collecting Plate 2. Drawing Mechanism of Tapping Roller 3. Conveyor Belt 4. Temporary Storage 5. Amphibious Propulsion Mechanism 6. Central Control Unit

Fig. 2 Structure of main body of an unmanned ship

3. draw mechanism of comb roller

The structure of the roller is shown in Fig 3. The structure of the needle roller is divided into three parts: the thorn roller, the comb roller and the guide wheel. The taker roll is rotated around a fixed shaft. The taker roll has the function of separating the spur and the entomorpha. The taker roll is covered in the outer ring of the taker roll.



Curved mesh plate 2. Taker roller 3. Electric roller 4. Conveyor belt 5. Active shaft 6. Follower shaft 7. Guiding wheel 8. Frame 9. Collecting plate

Fig. 3 Theoretical drawing of comb roller

Because the taker and the comb taker are installed at opposite positions of different axes, the surface protrusion of the taker will gradually extend out the hook of *Enteromorpha prolifera*, the protrusion and *Enteromorpha prolifera* move together, and the taker will gradually separate *Enteromorpha prolifera* and the protrusion from each other, so as to realize the three steps of *Enteromorpha prolifera* *prolifera* *prolifera* and *Enteromorpha prolifera* *prolifera* *prolifera* *prolifera* *prolifera*. The exact separation function of the existing environment. The needle roller is suitable for two working environments of waterway and land, as shown in Fig 4.

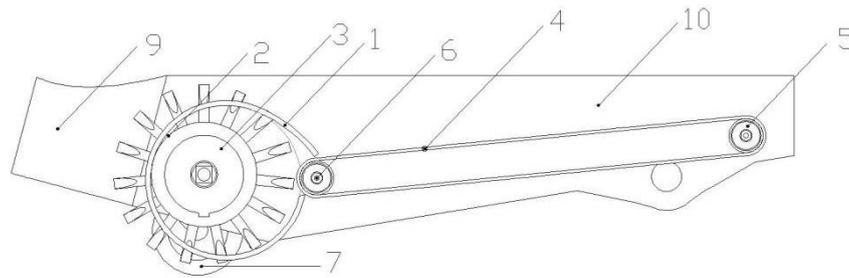
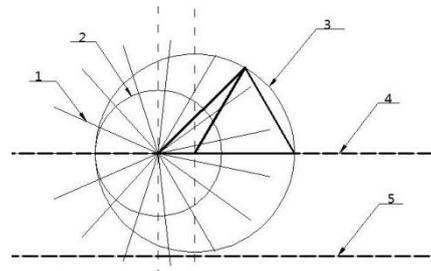


Fig. 4 Theoretical drawing of comb roller

In waterway conditions, the tapping roller has its own buoyancy to keep the horizontal plane at 4 positions, which better separates Enteromorpha prolifera from the natural environment in the water, as shown in Fig 5.



spike 2. thorn roller 3. comb roller 4. horizontal plane 5. ground.

Fig. 5 Theoretical drawing of comb roller

On land, the guide wheels on both sides of the taker roll contact the ground, driven by the winch amphibious drive mechanism to the entire hull and driven by the undulating profile of the beach floor, thus maintaining that the taker roll can be in contact with the ground in a fluctuating range of 30-50 mm (as shown in Figure 6). In the vertical direction, some of the protrusions of the nearest comb roll have been protruded out of the ground, which will penetrate the sand and retain quicksand like a comb and carry the moss up.



Fig. 6 Guide wheel

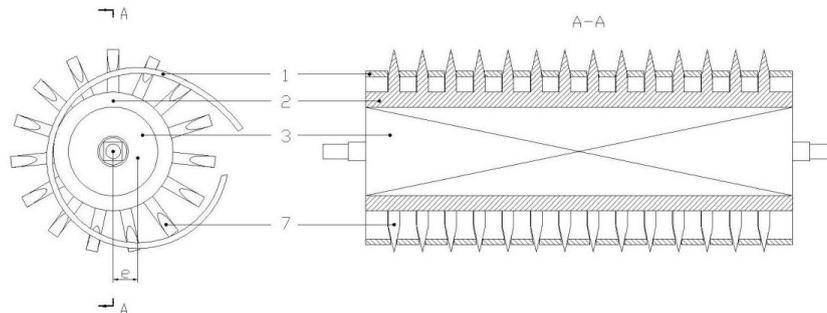
When the unmanned ship is working, the hull moves forward, the taker roll rotates and carries the Enteromorpha prolifera. The taker roll separates the Enteromorpha prolifera and collects it into the conveyor belt.



Fig. 7 Physical diagram of stab roller Theoretical Prototype

3.1 Design of the needle roller

The side view of the thorn roll is shown in Figure 8. The total length is 720 mm, the outer tube diameter $D = 200$ mm, the inner tube diameter $D = 180$ mm, the total length of the protrusion is 100 mm, exposed to the outside 80 mm, remaining in the interior 20 mm. The gap between the outer cylinder of the inner cylinder needs to be filled with a material to keep the stab more stable. The cured epoxy resin has good physical and chemical properties. It has excellent bonding strength to the surface of metal and non-metal materials, small variable shrinkage, good dimensional stability, high hardness and good flexibility. It is widely used in national defense and national economy departments for pouring. The use of impregnation, laminates, adhesives, paints and so on. So we choose to use epoxy resin casting materials.



1. Curved mesh plate 2. Taker roller 3. Electric roller 4. Conveyor belt 5. Active shaft 6. Follower shaft 7. Guiding wheel 8. Frame 9. Collecting plate

Fig. 8 Side view of stab roller design

3.2 Design scheme of comb roller

The design drawing of the comb roller is shown in Fig 9. The diameter is 315mm, the groove width is 10mm, the spacing between the grooves and the grooves is 20mm, and the total length is 720mm.

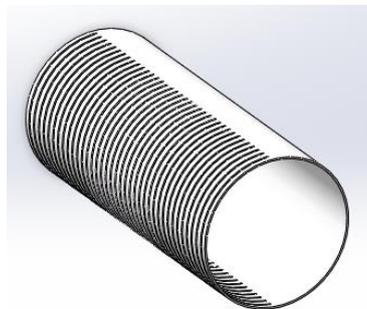


Fig. 9 Axis diagram of comb roller

The triangle in the graph is separated as shown in the following figure. After many discussions and experiments, the best scheme is obtained, in which a, B are the center of taker and comber, r, R are the radius of taker and comber, L is the length of spur, and $\angle DBC$ is $\pi/3$. At present, $R=157.5$, $r=100$, $\angle abc = \angle dbc = \pi/3$ are known. According to cosine theorem, in triangular abd, $\angle abd = 2\pi/3$, $AB = R-r = 57.5$, $DB = R = 157.5$, L is the spur length, unknown. L is required by formula, $L=80$. As shown in Figure 10.

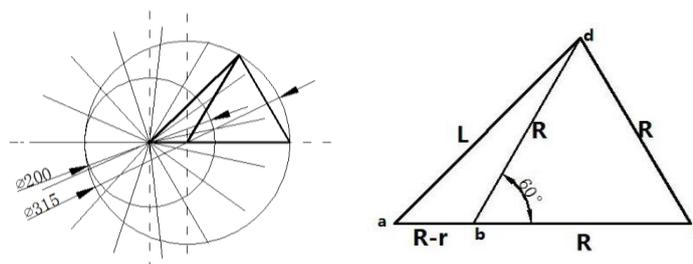


Fig. 10 The relative position of the assembly of the thorn roller and the comb roller.

4. Conclusion

This paper introduces the harm brought by *Enteromorpha prolifera* and puts forward the overall design plan. The unmanned vessel consists of four parts: tapping roller mechanism, winch amphibious propulsion mechanism, water quality monitoring sampling feedback mechanism and *Enteromorpha prolifera* compression filter mechanism. This paper mainly designs the picking mechanism of combing roller, in order to better absorb *Enteromorpha prolifera*, realize the effective separation of *Enteromorpha prolifera* and sand, thus improving the efficiency of operation.

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