MOBILE AUTONOMOUS AERATOR

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Abstract: The paper presents the model of an autonomously mobile aerator usable, especially in fish farms, for operative interventions in the incipient phase of the eutrophication phenomenon. The equipment provides oxygen intake, especially in the summer days when the water temperature is rising. The use of the aerator reduces the losses due to the death of the fish by suffocation. The proposed aerator variant can also be used in polluted waters as a result of the spillage of organic substances.

Keywords: aerator, eutrophication, fish

1. INTRODUCTION

The paper refers to an autonomous mobile aerator required especially in fish farms for operative interventions in the event of an early occurrence of the eutrophication phenomenon, in order to ensure oxygen intake of the fish especially during the summer days when the temperature of the water is increasing, avoiding major losses that are caused by the suffocation of fish. This phenomenon of eutrophication can also occur if organic substances are discharged into the lake/pond. Most of the freshwater lakes and wetlands are facing the problem of water quality deterioration and ecological imbalance due to the increasing anthropogenic activities particularly in developing countries (Biswajit, 2018).

Methods for aerating waters, lakes of various uses using motorized boats or rowing are known. A paddle aerator is known to be rotated by internal combustion engines (Sanjib, 2002).

Various equipment is known to introduce ozone in the water used to reduce the microbial flora as well as to enrich the concentration of oxygen in the lake water to survive the fish. There is also known a platform used for recreational tourism and for reducing eutrophication of lakes using ozone-driven air jets.

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These methods and equipment have the following disadvantages: - the use of internal combustion engines pollutes with hydrocarbons from engine cooling circuits; - engine noise or other sources determines the stress of the fish; - the use of ozone for aeration is a method that has high costs and therefore its use by aquaculture farmers is avoided; - the oxygen port for motorboats or rowing is negligible; - the use of large platforms requires high pressure air jets not being able to move in areas with shallow water.

2. OBJECTIVE

The problem solved by the work consists in the realization of a mobile aerator moving remotely on the water of the lake without the use of fossil fuels while at the same time aerating the water which is accomplished by introducing into the water some jets of air simultaneously with the introduction into the air water jets, all at an acceptable price, although this water shift is remote controlled by radio waves.

This mobile aerator has the ability to overcome the above disadvantages in that it contains a floating support which can be a boat, catamaran, etc. of small sizes that are mounted: for example, two photovoltaic panels, and in the back, side and front there are some air turbines and water pumps, which at a programmed time by a microcontroller or remote control on the shore create some jets of air in the lake water and jets of water in the air that provide remote radio scrolling, as shown above from a distance, obstruction of obstacles by infrared sensors, stopping near the shores through a video camera and returning to the starting point performs automatically by using a known remote control by the user.

The device has the following advantages:

- performs rapid intervention in the area where refreshed water is required;
- can operate throughout a sunny day or night due to the electricity accumulated by solar panels;
- it does not create noise of thermal motors, which due to vibrations produce a continuous stress to the fish and does not pollute the water of the lake;
- by using water jets, in addition to the oxygen intake, a decrease in the water temperature is also achieved due to the evaporation phenomenon;
- the operation of the aerator takes place in a stand-alone mode without conventional power consumption;
- the mobile autonomous mobile aerator can move into shallow water areas, the preferred location for algae development, and its great mobility results in increased aeration efficiency.

3. Description

The autonomous mobile mobile aerator is designed for operative interventions in case of oxygen deficiency in the water of some fish lakes and consists of a miniaturized catamaran with two aluminum floats 1 (Fig. 1.a) connected by transversal

aluminum latches 2 and longitudinal latches 3, and at their heads they are tapped: an air turbine 4 for stopping and reversing, and three turbines 5 are used for forward travel, the displacement being possible due to the reaction force of the air jet evacuated in the water through the nozzles 6; to avoid collisions with objects floating in lake water or shoreline, the aerator also contains an infrared sensor 7 and a video camera 8;

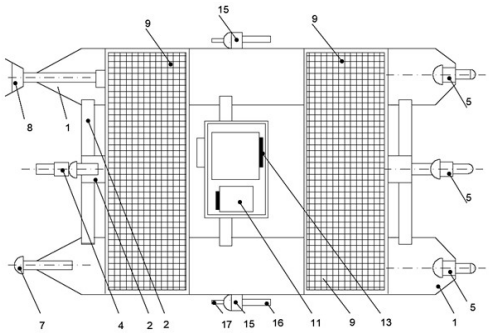

Fig. 1.a. Above seeing of the aerator

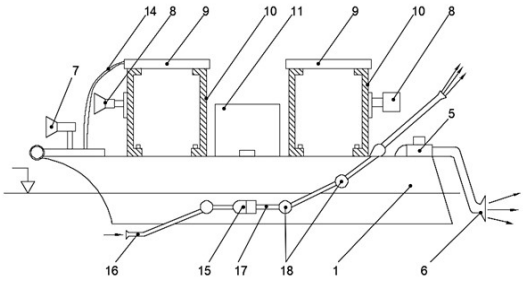

Fig. 1.b. Transversal section of the aerator

For autonomous operation of the aerator, two photovoltaic panels are located above the deck of the catamaran 9 attached to the deck by some aluminum supports 10 between which an enclosure is centrally located 11 of the polycarbonate in which the electronic circuits for controlling the remote operation are located, the photovoltaic panel regulator relays and the emulsion battery 12 (Fig. 1.a) caught firmly with the breech 13, and in order to reduce the drag force due to the air flow, a polycarbonate windscreen 14; to increase aeration efficiency, the self-contained mobile aerator also contains two pumps immersed in water 15 (Fig. 1.b) with the sorb 16 and the evacuation nozzle 17 through known plastic rotors 18 necessary to determine the height of the water jet (max 14 m).

To increase visibility at night, the aerator is equipped with a headlight 19 which works with a built-in twilight sensor; the electric circuit diagram of the aerator operation contains two photovoltaic panels PS by means of which the solar radiation RS via a regulator relay R_G is converted into continuous electric current stored in an emulsion battery A, current which is used for the operation of the following circuits at the receiver, namely: the air turbine power supply circuit T_1, T_2, T_3, T_4 through normally open contacts $1R_1$, $1R_2$, $1R_3$, $1R_4$ of some relays R_1, R_2, R_3, R_4, the supply circuit of the two medium power submersible pumps (throws water up to the height of 14 m) P_1, P_2, through contacts $1R_5$, $1R_6$ of some relays R_5, R_6, circuits that come into operation when in accordance with commands received by radio from the known remote transmitter, wich is located on the lake shore, the microcontroller on board the aerator distributes the on-board power supply for turbines and pumps; because the state of the water glare can change by the appearance of floats and the operator on the shore that has the transmitter does not notice, because of distance or other phenomena that impede visibility, the aerator is equipped with sensors whose circuits coupled to a

microcontroller on the aerator are: the sensor circuit S_F (Fig. 2) that senses the front obstruction, S_s – optional rear obstacle, video camera – front view C_{VF}, optional rear view camera C_{VS}, increasing the intensity of the headlight L_F, and if there is a fault in the electrical circuits through the sensor S_A an alarm signal is triggered, to take remedial action, requiring for this purpose the movement to the place where the aerator is located and its recovery.

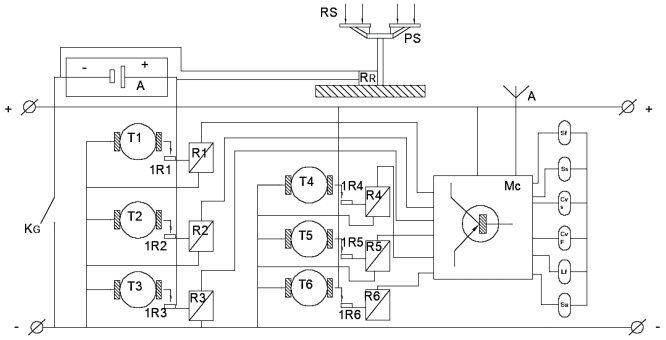

Fig. 2. Electric scheme of the aerator

4. CONCLUSION

Mobile energy autonomous aerator required especially in farms for operative interventions in case of an early occurrence of the eutrophication phenomenon, using for this purpose a catamaran that uses for its autonomous displacement on the lake surfaces the effect of the reaction of some jets of air emitted in water by some turbines and some jets of water thrown under a certain angle into the air by some submersible pumps, these being operated by radio remote control by a shore operator, the required energy being obtained by two photovoltaic panels and stored in a battery accumulated by decks, air jets in the water, and water jets in the air contributing to the increase of the oxygen concentration in the water, which results in eradication of the eutrophication phenomenon, the whole operation is possible due to programming of the two microcontrollers themselves known, one on broadcast and one on l reception, operation that can last both day and night due to the unconventional energy stored.

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