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DEVICE FOR INCREASED WATER TEMPERATURE IN FISH CARE CONTAINERS AND RESERVOIRS

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Annotation. The device contains a heat storage chamber, covered with selective glass and consisting of a set of thin-walled copper tubes, between which are filled with heat storage material, which is sodium dihydrogen phosphate crystal hydrate. Radiators in the form of metal plates are located along the entire outer surface of the heat pipes, and spiral swirlers are located inside.

Key words. Accumulator, sodium dihydrogen phosphate crystal hydrate, heat exchanger, spiral, thermal insulation, swirler, solar radiation.

Introduction. The water temperature in pond fish farming is not regulated. For fish, water is a permanent habitat; it affects all life processes occurring in the body of fish: breathing, nutrition, hematopoiesis and blood circulation, nervous activity, reproduction, growth and development. All biological characteristics of fish, from external signs and behavior to productive qualities, are inextricably linked with the characteristics of natural waters, their physical and chemical properties. Therefore, for the normal functioning of fish and maintaining physiological processes in the body at the proper level, it is necessary to create optimal veterinary, hygienic and sanitary conditions in water bodies, especially in ponds, to ensure an increase in the overall resistance of the fish body to diseases [1].

In pond fish farming, a planned general hydrochemical analysis is carried out at least 2 times a year; forced analysis is carried out if there is a suspicion of a sharp change in the hydrochemical regime, as well as in the event of fish death. Measuring water temperature is an integral part of the analysis. To determine the water temperature at various depths of ponds and cages, a scoop thermometer is used [3].

Today, the fishing industry is of great interest to entrepreneurs. This direction is in demand and promising, although it requires considerable investment and is associated with certain risks. Both natural and artificial (pond) reservoirs are suitable for fish farming.

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Domestic fish and their hybrids are grown in them. Pond fish farming is the cultivation of fish using intensive technologies and is characterized by a high degree of use of all components of the food supply of reservoirs plus additional feed. The main goals of pond fish farming are natural and artificial fish breeding, selection and breeding work and acclimatization of new fish species [1].

Under natural conditions, the water temperature in freshwater bodies varies from 0.1 to 30°C throughout the year and depends on the geographical area, various weather conditions, time of year and day. If the water is highly mineralized, it can be cooled to minus 7°C and remain non-freezing [5].

Not only the growth and development of fish, but also the nature of the manifestation and course of various diseases depends on the temperature of the water in the reservoir.

Since fish do not have their own constant body temperature and are poikilothermic animals, their body temperature differs only by tenths of a degree from the water temperature. However, as an exception, tuna have a body temperature that is 10 degrees higher than the water temperature (the special structure of the circulatory system).

Fish can live at different water temperatures; some species of fish can withstand significant fluctuations in water temperature. Thus, pike, perch, carp, crucian carp, bream, carp, tench live in reservoirs in which the water temperature varies widely throughout the year, while other species - cod, flounder, fish of polar and tropical latitudes - tolerate only small temperature fluctuations, no more than 5-7°C.

Conditions under which all life processes in the body proceed normally are usually called optimal. Based on optimal temperature conditions, all types of fish are conventionally divided into cold-water and warm-water [2].

Warm-water fish include the following types of fish: the families of carp, sturgeon, etc. Some types of warm-water fish spawn at a temperature of 13-20°C, and others at a water temperature within 17-22°C. The feeding and growth of warm-water fish occurs most intensively at water temperatures in the range of 18-25°C and above. At a temperature of 22-28°C, the warm-water fish carp accepts food and assimilates food much better than at a temperature of 18°C [7].

Thus, carp, which is a warm-water fish, at a temperature of 12°C loses the ability to reproduce and reluctantly consumes food. At a temperature of 10°C, activity decreases even

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more, food is poorly digested and fish grow slowly. When the water temperature is below 2-4°C, the carp does not accept food.

Sudden changes in water temperature (difference of 5-6°C) in fish can cause temperature shock, which often leads to death. This factor is very important to consider when transporting and transplanting fish.

Materials and research method. The negative impact of high temperatures in summer is especially noticeable in shallow, well-heated ponds, which is partially eliminated by creating flow. For this purpose, it is necessary to have a supply of water in the head ponds. The negative effect of high temperatures on fish can be reduced by regulating aquatic vegetation, since in thickets the water temperature is lower than in the absence of plants.

Thus, water temperature is one of the most important hydrological factors when breeding fish, therefore, control of the thermal regime of the reservoir must be carried out daily in accordance with the requirements of pond fish farming technology [5].

A device is known for increasing the temperature of water in fish-breeding reservoirs, which as a heat source contains a chamber for heating air due to absorbed solar heat, installed on the surface of the water, having an upper transparent outer surface that transmits the sun's rays and an opposite inner surface made of absorbing solar heat material, and the means of transferring heat into the water column is a heat exchanger installed on the shore of the pond.

The heat exchanger is connected to the heating chamber by a hot air exhaust piping and includes a piping system for supplying water from the pond and returning water from the heat exchanger to the pond. The air heated in the chamber is pumped into a heat exchanger, through which water supplied by the pump from the cultivation pond circulates. Water, in contact with heated air, is heated to the required temperature and returned through the pipeline back to the pond[9].

To maximize the efficiency of a heat exchange device through constructive and technological reconstruction of the device being developed to increase the water temperature in open fish ponds.

The task of the device is to maximize the efficiency of the heat exchange device through the constructive and technological reconstruction of the device being developed to increase the water temperature in open fish ponds.

To accomplish the task in the known device for increasing the temperature of water in fish tanks and reservoirs, a heat-containing storage device using solar heat, having an external

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light-transmitting surface, a heat-absorbing surface and a means of transferring heat into the water column, sodium dihydrogen phosphate crystal hydrate, a frame, is used as a heat-storing material The collector is made of a set of thin-walled copper tubes, sealed on the side, and the heat pipes are looped to form an O-shape located in four vertical planes, while along the entire length of the pipe they are equipped with swirlers located spirally inside.

The proposed device for increasing the temperature of water in fish tanks and reservoirs consists of a chamber 1 filled with heat-accumulating material 2. The outer surface of the chamber 1 is made of selective glass 3, installed at an angle α = 360 to the horizon, and the chamber itself is located in the direction of movement of the sun, i.e. east to west [1].

The heat-absorbing surface is made in the form of a collector 4 made of thin-walled copper tubes 5, the outer surface of which is treated with a selective “black copper to honey” coating. Tubes 5 are sealed at both ends with a plug 6. The means for transferring heat into the water column are heat pipes 7, designed in the form of located around the housing 8 of the chamber 1 in four vertical planes, closed circuits 8, the upper 9 and lower 10 ends built with the housing 11 of the camera 1. Heat pipes are equipped with a radiator 12 on the outside in the form of metal plates, and swirlers 13 are arranged in a spiral pattern on the inside. The body 11 of chamber 1 is made of heat-resistant material with thermal insulation 14. The chamber is equipped with a float 15 and an anchor 16.

The proposed device for increasing the water temperature in fish ponds works as follows. The device is installed in the water area of a fish pond. Float 15 keeps it

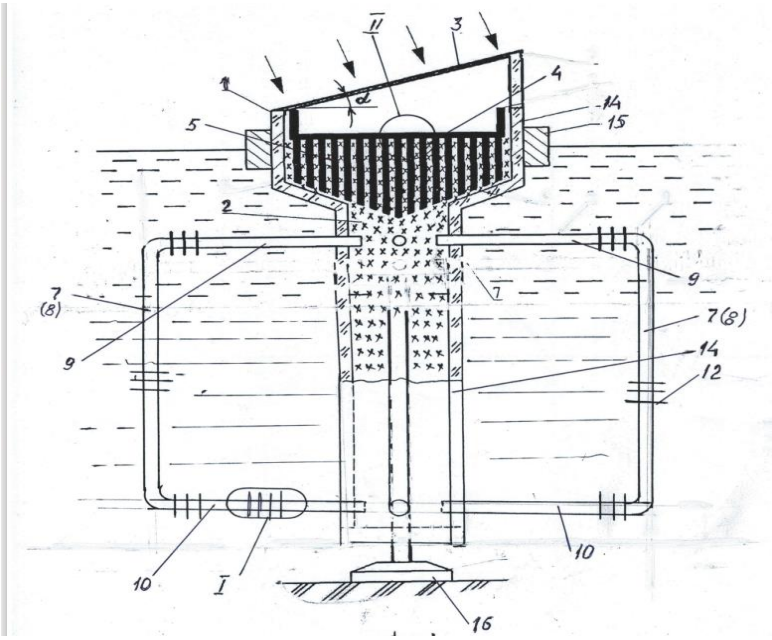

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Fig.1. Longitudinal section of the device.

afloat, and anchor 16 prevents it from moving. Selective glass 3 transmits solar rays and blocks solar energy, while the collector 4, treated with a selective coating of the "black copper on honey" type, absorbs solar radiation as much as possible and transfers it in the form of heat to heat-storing material 2, which is sodium dihydrogen phosphate crystal hydrate [3].

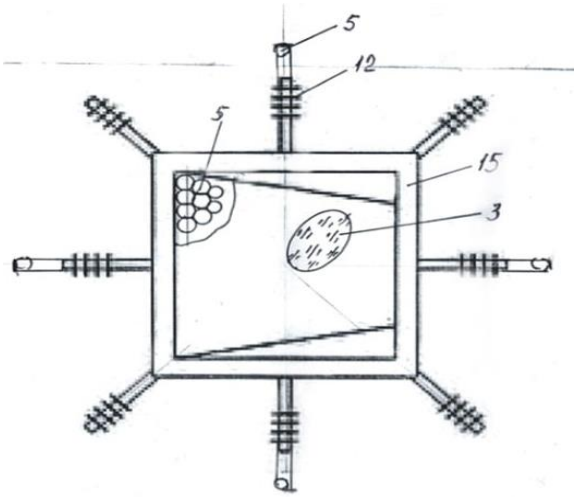

Fig.2. View from above

The resulting heat is transferred without loss through heat pipes to 7 cold layers of water in the reservoir. Since the heat pipe is made in the form of a closed circuit 8, the upper 9 and lower 10 ends of which are built into the housing 11 of the chamber 1, a circulation circuit of heat distribution around the housing is formed, uniformly heating the water in the reservoir in the direction from the bottom to the top. Availability of Fig.2. View from above. 12 radiators installed on the surface of the heat pipes, as well as 13 swirlers located inside the pipes, contribute to the uniform distribution of heat in the water column of the reservoir. A number of devices are known for increasing the temperature in fish ponds using solar heat. A device is known for increasing the temperature of water in fish-breeding reservoirs, which as a heat source contains a chamber for heating air due to

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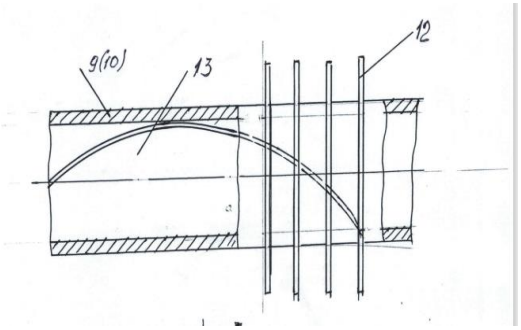

Fig.3. Node I in Fig.1.

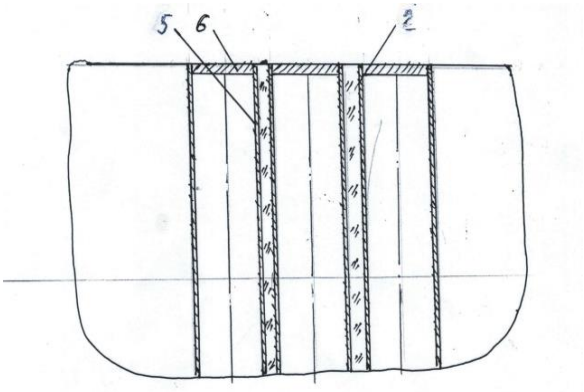

Fig.4. node II in Fig.1.

absorbed solar heat, installed on the surface of the water, having an upper transparent outer surface that transmits the sun's rays and an opposite inner surface made of absorbing solar heat material, and the means of transferring heat into the water column is a heat exchanger installed on the shore of the pond. The heat exchanger is connected to the heating chamber by a hot air exhaust piping and includes a piping system for supplying water from the pond and returning water from the heat exchanger to the pond.

The design features of the device ensure uniform distribution of heat into the water column while simultaneously reducing energy costs. The device has a high efficiency and does not require additional pumping devices and air supply pipes, because Water circulation in the pond occurs naturally[8].

Results. The device can be used when growing herbivorous fish (herbivorous fish are fish that feed on higher aquatic plants and phytoplankton. These fish include grass carp, silver carp, rudd, partially roach, etc.) in order to achieve the most optimal water temperatures for their growth.

Such a device can operate regardless of the time of day, does not require additional technical devices for heating water for maintaining thermal feed and other aquaculture objects, and increases the growing season for growing fish and feeding them in industrial conditions.

The device can operate regardless of the time of day and climate zones. However, heating a large amount of water to the optimal temperature for growing fish will require high fuel consumption, which makes this device unprofitable and practically inapplicable in zones 1 and 2 of fish farming. Uniform heating of the entire thickness of water in a reservoir using

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this device is also difficult to achieve, because The air supply pipes are located at the bottom and mainly heat the bottom layers of water. In addition, the pipes mounted on the air supply pipes and the culverts through which water circulates become overgrown with lime and other deposits over time, which requires additional energy costs when operating the device.

The use of a device for heating water in fish ponds ensures an increase in the growing season of heat-loving fish species, in particular herbivores, when they are grown in any fish farming zones.

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