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DEVELOPMENT OF FIBER OPTIC SENSOR FOR FLUID FLOW OF ASTRONAUTS’ LIFE-SUPPORT SYSTEM

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Abstract. This paper proposes a fiber optic sensor consumption (volume, speed) of liquids in life-support systems of astronauts, as well as offers a simple method and apparatus for reproducing the parameters of fluid flow needed in research, yustiovke and adjusting the optical sensor system.

1. Introduction

Space medicine in its historical development has gone from a simulation of space flight in the laboratory and during the flights animals on rockets and satellites to research related to the long flight of space stations and international flight crews. The main problem in the early stages of development of space medicine has focused on the question of the principal possibility of human space flight and problem solving creating systems that ensure the presence of man in the cabin of the spacecraft during orbital flight [1].

In unusual conditions of space flight (vacuum, radiant heat, ionizing radiation), a person must be in a closed sealed compartment of the spacecraft. In the habitable compartments is necessary to create conditions for normal life and work of man. These conditions must be maintained during the entire flight, feeding into the bay substances for human consumption and removing the products of its life. The onboard systems of the spacecraft (spacecraft) that solve these problems, called life-support systems (LSS) (Figure 1) [2].

Currently, we are talking about improving the life support systems of astronauts in an increasingly hard impact of external factors on the astronaut on a long flight.

2. Materials and methods

The authors propose new methods and apparatus for measuring fluid flow and reproduction based on the use of fiber optic elements.

The proposed method for reproducing liquid flow parameters is known that through the pipe cross-section is passed the liquid flow parameters are determined by the change in liquid level in the containers at the inlet or outlet pipe for a fixed period of time.

Figure 1 shows a simplified structural diagram of the device for the implementation of the process parameters of liquid media playback.

The apparatus includes the following elements for playback parameters pumped liquid conduit 1 through which flows a liquid container 2 with a scale calibrated with the height of the liquid level in the values of capacity to drain the scale 3 is also calibrated with the height of the liquid level in the
values of hoses 4 and 5, a pump 6, a timer 7 is connected to the starter pump. The pump 6 is placed at the bottom of a transparent container with a liquid 2, the level of which is determined by the scale. The ends of the hoses 4 and 5 are omitted in the container 2 and 3, respectively. The other ends of the hoses 4 and 5 are sealed with different angles to the conduit 1.

Figure 1. Simplified structural diagram of the device for playback and measurement of liquid media

The apparatus includes the following elements for measuring parameters of fluid flow: receptive element 8 having one end secured to the blind end 9 inside the bellows, and the other free end - located in the conduit 1 in the liquid flow zone; plate 10 with two reflecting surfaces, one end of which is also fixed to the outside of the blind end of the bellows 9 and the other free end - located at a certain distance with respect of lead 11 and outlet 12 of optical fiber [5] (Figure 1).

The device works as follows: when the pump 6, the timer starts counting time \( t_1 = 0 \), when you turn off stops at time \( t_2 \), operation time is defined as \( \Delta t = t_2 - t_1 \). Before the measurements is fixed liquid \( H_1 \) level in the tank 2. At the end of measurement is fixed at the time level \( H_2 \).

3. Conclusion
The proposed method and apparatus for reproducing and measurement of fluid flows (volume, velocity, flow rate) will simplify the adjustment and adjustment of the optical system of optical fiber flow sensor used in life support systems of astronauts, to improve their performance.

4. References