MATERIÁLY
XIII MEZINÁRODNÍ VĚDECKO - PRAKTICKÁ KONFERENCE

VĚDECKÝ PRŮMYSL EVROPSKÉHO

22 - 30 listopadu 2017 roku

Volume 9

Praha
Publishing House «Education and Science»
2017

Vydáno Publishing House «Education and Science»,
Frýdlanská 15/1314, Praha 8
Spolu s DSP SHID, Berdianskaja 61 B, Dnepropetrovsk

Materiály XIII Mezinárodní vědecko - praktická konference «Vědecký průmysl evropského kontinentu - 2017», Volume 9 : Praha. Publishing House «Education and Science» -92 s.

Šéfredaktor: Prof. JUDr Zdenák Černák

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Materiály XIII Mezinárodní vědecko - praktická konference , «Vědecký průmysl evropského kontinentu - 2017»

Pro studentů, aspirantů a vždeckách pracovníků

Cena 50 kč

ISBN 978-966-8736-05-6

Aerospace

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INSTRUMENTS USED FOR THE VISUAL DETERMINATION OF THE PARAMETERS FOR COLOR CHANGE

Abstract: The paper presents the block diagrams of devices that provide quality control helicopter engine oil, fuel level measurement level, the thrust of aircraft engines, the temperature of the heated bodies, the level of the two media

***Keywords*:** color sensors, helicopters, light-emitting diodes, aircraft, temperature, thrust aircraft engines, fuel gauge, level gauges, optical pyrometer, optical fiber, the quality of oil, bearings, hardening products from iron.

The last 25 - 35 years are increasing the quantity of publications and inventions in the methods of manufacture color sensor - semiconductor devices, the maximum sensitivity which is visible to the human eye. These color sensors can be used in such cases where the operator must visually by a color change to determine or measure certain parameters. For instance, quality of the oil in the tank on helicopters, which contains the main bearings of the screw is determined every 50 or 100 flight hours. Herewith technician takes the oil into the tube from tank in which are located bearings, through which the helicopter's screw rotates , and compares it with a butter color reference oil stored in the cockpit of the helicopter. The fact is that the misalignment of the helicopter propeller and shaft of engine, occurs the oil clouding, which is a signal to the fact that the helicopter must be put on the overhaul. In principle, this is a very important parameter. For continuous determination of the oil quality in helicopter engines, has been proposed, "A method for controlling the quality of oil helicopter engines and device for its realization" [7], in which the definition of the oil transparency occurs by using color sensor, which are placed outside the engine, but receiving information about the oil color through fiber, which are inside the tank motor, which, in which are bearings. In this case one fiber is connected to the LED, and the other - with color sensor. Picture 1 shows an exemplary scheme of the device

for monitoring the quality of the oil helicopter engines. In principle, the fiber can be glued to the wall of the oil tank - it will not be, practically, hold its scope.

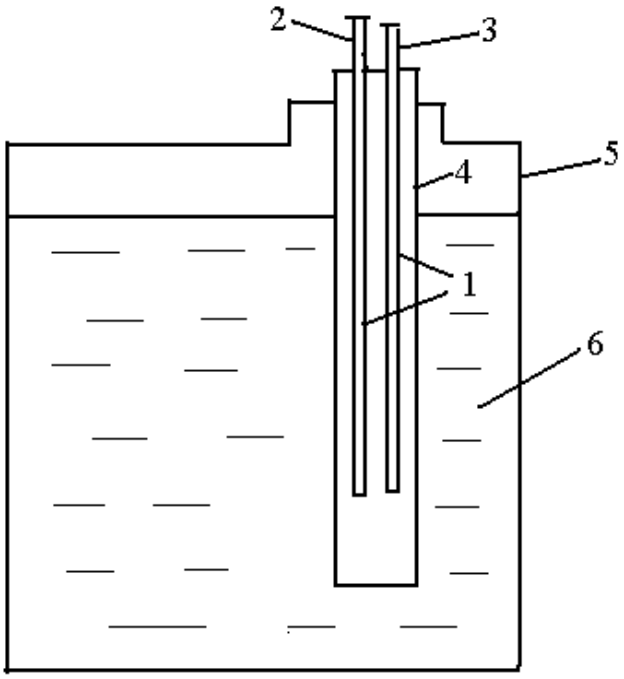

Figure 1. An exemplary scheme of the device for monitoring the quality of the oil helicopter engines.

1 – fiber; 2 – fiber coming from the LEDs; 3 – fiber connected to color sensor; 4 – flat probe with reinforced fiber; 5 – oil tank with oil 6

Note that color sensors [1] in the visible spectrum are more sensitive than the human eye. The use of optical fibers allows to reduce the fire risk on board the helicopter. Similarly, the same device can be used for continuous monitoring of the transparency oils in aircraft engines of aircraft, in which it is important to oversee wear of the bearings . It should be noted that last is doing by a technician as well as on helicopters, visually through a certain number of flying hours On airplanes installs electric sensor that is triggered when into a small space between its contacts appears dust from worn bearings: it is usually a signal to put the aircraft for overhaul. It should be noted that, apparently monitoring the quality of the oil in the helicopter engines more important, because its opacity connected with change of alignment in the alignment of the main propeller, of the proper operation of which depends flight safety.

For aircraft in the fuel gauge commonly used capacitive sensors, which determine the level of fuel in the tanks. However, it is known that such fuel gauges

have drawbacks, chief among which are addiction of the temperature of their testimony, because the dielectric constant of the medium depends on the fuel vapor between the facings of the capacitive sensor, from which respectively depend on the indexes of devices, as well as the grade of kerosene. In addition, a significant disadvantage is the large size of the facings of the capacitive sensor, which occupy a lot of space in the fuel tanks. In the proposed device for controlling the level of fuel in aircrafts use color sensors, which connected to optical fibers of different lengths, which allows to determine the fuel level. Figure 2 shows an exemplary diagram of the installation of optical fibers in a device for measuring the level of fuel in aircraft.

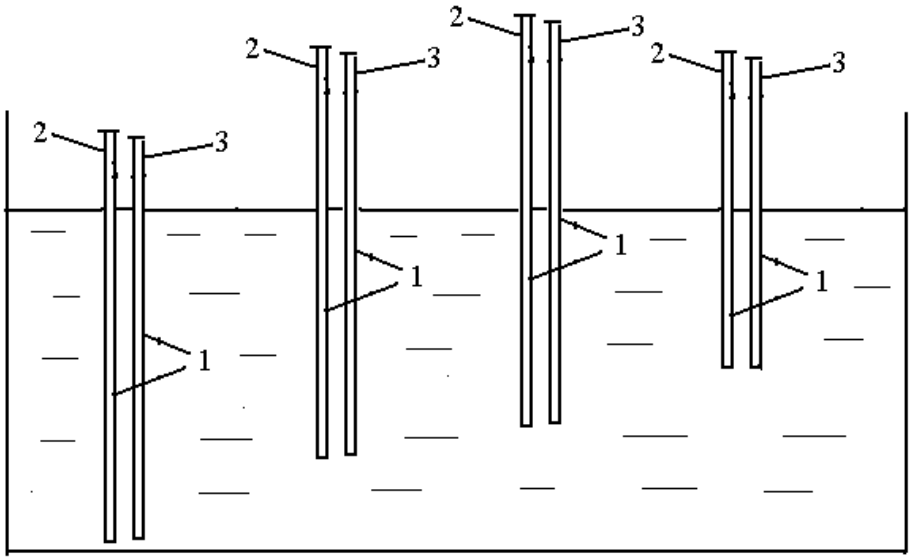

Figure 2. An exemplary diagram of the installation of optical fibers in a device for measuring the level of fuel in the aircrafts:

1 – the optical fibers; 2 – the optical fiber that comes from LEDs; 3 – the optical fiber connected with color sensor

Herewith these color sensors connected to difference amplifiers (Figure 3), the second inputs of which are connected to the output of the standard color sensor, the optical fiber which is at the bottom of the tank, and the outputs of difference amplifiers via comparators or Schmitt's triggers connected to a display unit or to a computer.

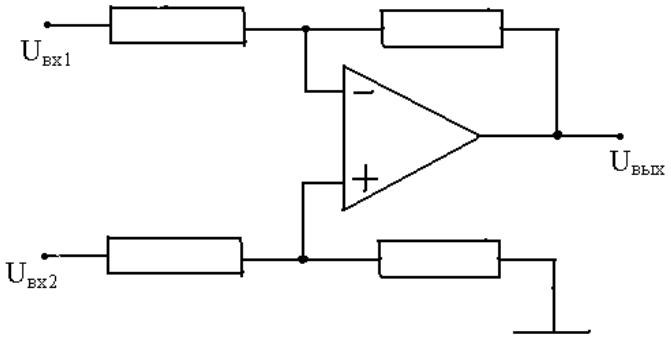

Figure 3. Scheme of difference amplifier:

$U_{вх1}$ – signal from color sensor; $U_{вх2}$ – signal from standard color sensor

Critics may say that the system is obtained optical and so it will be polluted. But in the case of aviation fuel gauge where the medium is a jet fuel, such a system would be operational.

For aircraft, there is another problem associated with the measurement of aircraft engine thrust, which values are usually determined by measuring the temperature of exhaust gases using thermocouples [2, p. 7-28]. This method has the disadvantage of relatively low precision instrumental error is caused by thermocouples. The disadvantage of this method can also be considered that the thermocouple should be in contact with the medium whose temperature is measured. When it comes to high temperatures, typically use optical pyrometers [3, p. 86-92]. However, the latter have the disadvantages, in particular an optical pyrometer readings disappearing filament depends on the quality of eyesight, a particular operator. Therefore, the high sensitivity of color sensors can be used for measurement of aircraft engine thrust and ,in principle, for the temperature of any heated body [4] in a contactless manner, as long as it has changed the color of the body. You can also use color sensors in installations for hardening products of iron [5].

An important parameter in the production of yellow phosphorus is determining his level under a layer of water. The fact that, as is known, white or yellow phosphorus must always be under a layer of water, as the in contact with air it ignites spontaneously. At the same time by the phosphorus level in the tank usually determine the amount of phosphorus - this is very important, because the company needs to know how much phosphorus it sells. In actual production, this parameter is usually determined with a ruler at the tip of which is attached a small scoop, by which is captured a small amount of phosphorus, which ignites in the air and on the basis of it the operator concludes that it reached the level of the phosphorus by using the ruler. It should be noted that for the

combustion of phosphorus is released harmful gases, among which is considered detrimental phosphine. It is clear that all this is very inconvenient. For this case, it was proposed "Device for measuring the level of the two media" [6], wherein two color sensors being disposed at a small distance from each other in a tube of transparent material and separated by two light-proof partitions, between which there is a light source. In this case, the signals from these color sensors fed to the inputs of a differential amplifier which provides at its output a signal equal to zero, if color sensor in one environment and a stronger signal, if the lower color sensor enters the medium with another color, and the signal of this sensor will be different from the upper signal of color sensor.

As a result, modern color sensors having spectral sensitivity of the human eye, can be used when creating new instrumentation.

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