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Further development of innovative applications based on the inverse piezoelectric effect

Application of special composite materials in the processes of further development of innovative applications based on the inverse piezoelectric effect;

Abstract

As practice has shown, piezoelectric motors based on the principles of the inverse piezoelectric effect can become the basis for the latest automation systems and precision mechanics, as well as innovative lighting technology;

The main interest of developers of our company is the possibility of building on the basis of the inverse piezoelectric effect of systems and configurations related to the systems of precision and small-sized stepper motors

As the requirements for accuracy and weight reduction of such engines become stricter, including by reducing overall dimensions, more and more variants and technical solutions based on the complex application of special composite materials are offered as a base material for building elements and structures of such engines.

In modern electronic equipment, especially mass-produced, it is extremely important to correctly determine the initial technical requirements for the product, which in the process of production and operation should allow to carry out innovative modification of the product without changing the fundamental basis of its design, circuit solutions and combination of materials and component parts

It is most difficult to predict the main possible trends and ways of further development and improvement of the technology underlying the product, so that the product would acquire new innovative properties and characteristics without losing the positive qualities and characteristics laid down in the development process.

To analyze the author proposes to consider a group of products for non-contact control of the state and parameters of liquids in pipelines, highlighting the most important node - the system of shielding of the working area of the impedance-resonance sensor - the heart and foundations of such a device

For more detailed consideration of all aspects of possible ways to optimize the technical characteristics of devices with impedance-resonant sensor blocks and corresponding shielding units, the author considers the most productive in today's conditions the use of computer simulation of technical characteristic parameters, performed according to the methodology proposed in his promising developments, books and publications by Igor Panarin.

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This is especially true for assemblies that provide shielding of the measurement area and eliminate distortion of measurement results due to electronic noise.

The three-dimensional model shows such a shielding assembly based on a combination of the latest composite materials and innovative electrolytic coatings, which determine the level of efficiency and quality of the shielding system

In order to be able to use the general system recommendations in real developments, we propose the main variants of initial technical requirements for such products, formulated according to the results of computer modeling and software simulation of all impedance-resonance phenomena in the working zone of the module, protected from electronic noise by a shielding system , performed all in combination and harmonic matching in accordance and according to the methodology and programs of modeling and simulation in accordance with the developments and publications of Igor Panarin

To begin with, Igor Panarin in his developments considers it necessary to generalize and specify the Technical requirements related in general to the process and technological principle of the measurement process by using the principles of impedance-resonance metrology.

At realization of technological principle of impedance-resonance metrology, the following conditions should be provided:

- relatively low unit cost of the measurement process;
- high reliability of the measurement process;
- simplicity of the measurement process, which makes it possible to use low-skilled personnel or to use the measurement technology at home for monitoring or assessing drinking water quality;
- small size of monitoring equipment;
- possibility of integration into existing technological schemes and equipment complexes;

- high performance;
- continuous operation throughout the day;
- high process efficiency and high repeatability of results;
- the possibility of easy and reliable process automation;
- the possibility of using disposable technologies and materials;
- Ability to monitor and use the results of the monitoring process remotely;
- possibility of comparative assessment of the process quality level and quality of any liquid or water by a minimum number of process indicators;

It is necessary to dwell on this requirement in more detail, as it is an example of a combinatorial system of forming the future technical characteristics of an innovatively modified product and related products This principle of forecasting allows, at minimum cost, to create several parallel products with a single and equivalent element base at all stages and stages of development.

Implementation of this principle of systemic predictive analysis proposed by Igor Panarin allows any innovative development to obtain several real results for several products similar in properties and characteristics

Preparation of the production and sales program for the period of adaptation to market conditions; elaboration of the warranty service system; search for a strategic partner; the first phase of active marketing; Thus, as readers have noticed, at all stages the system follows the basic principle outlined in the developments and publications of Igor Panarin, namely the principle of horizontal and vertical combinatorial integration.

It is also very important for the systematic coordination of all stages and phases of development in terms of initial requirements for them, to see and identify the minimum necessary state of the device design and its basic technology at the time of the beginning of their systematic development ;

There should be (in accordance with Igor Panarin's recommendations :

The basic constructive and technological principles of the product construction were developed

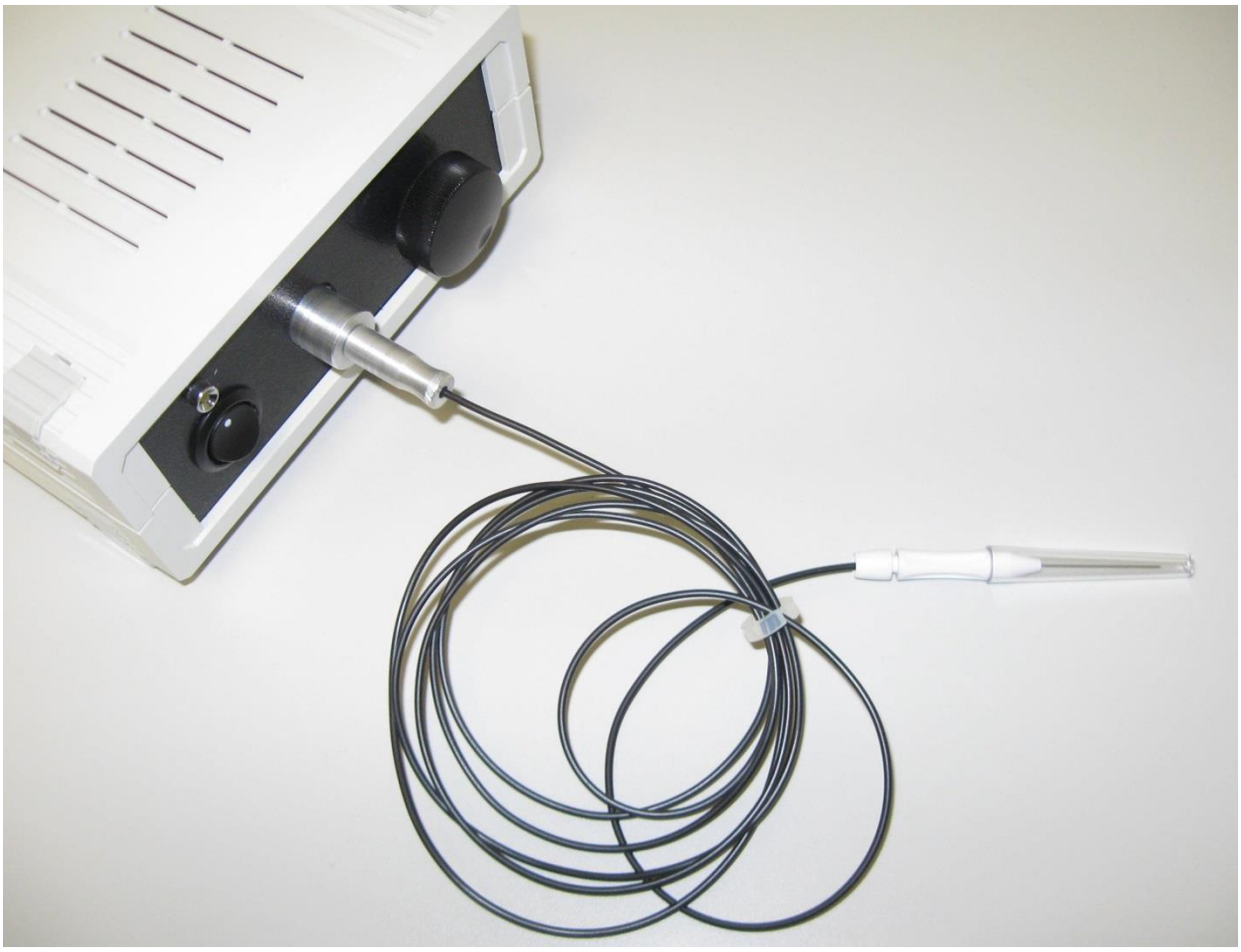
The basic universal prototype of the product was manufactured;

The cycle of preliminary tests of the product was carried out;

The adjustment of the universal prototype of the product was carried out according to the results of preliminary tests;

The materials for patent application were prepared;

The strategy of patent and license protection of the technology was developed;



Based on Laser Diode Light emitting module with integrated light converter

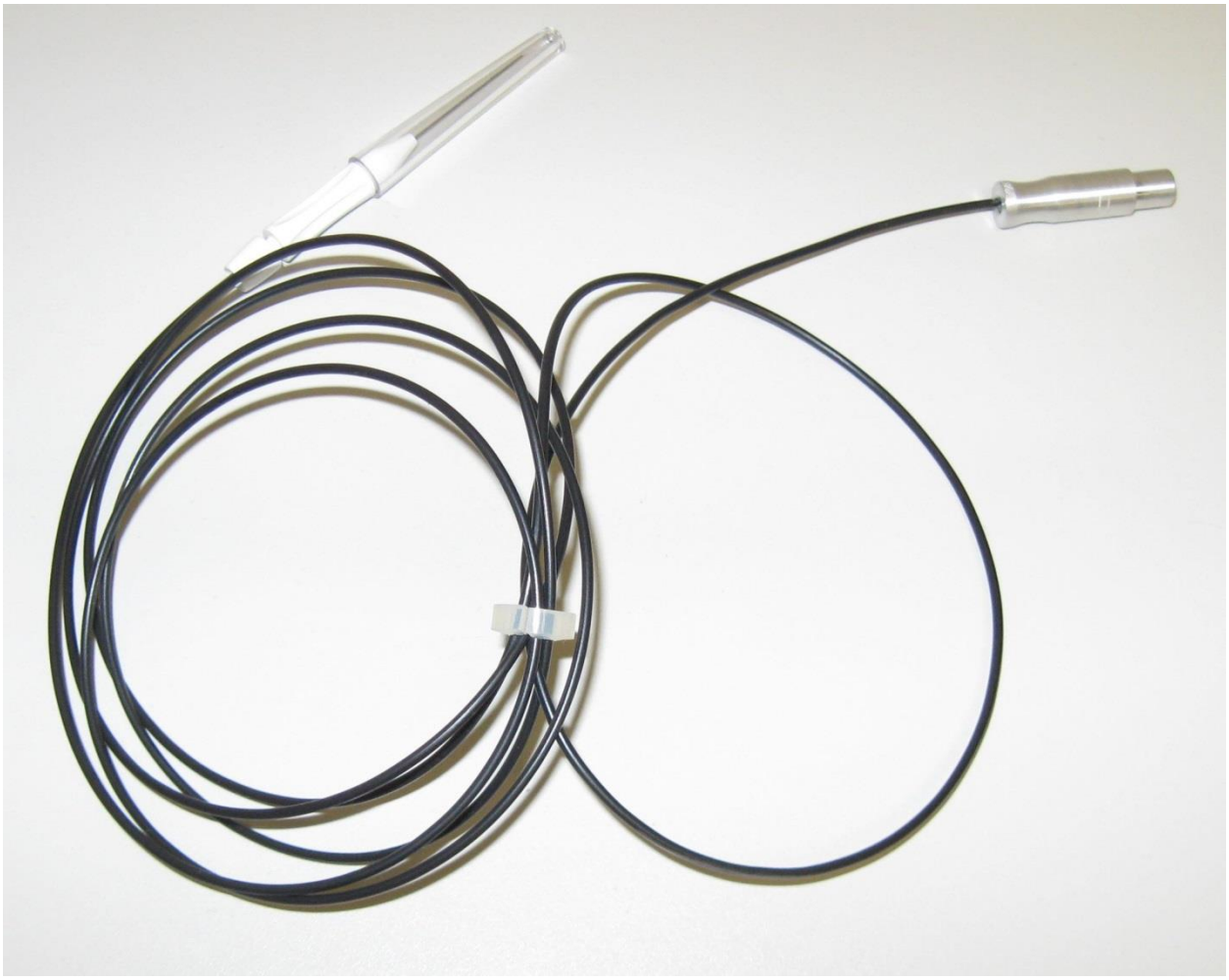
A compact light source is proposed , in which a laser diode is used as the primary initiator of the light flux ; In the proposed device, the power of the laser diode can be from 50 milliwatts to 10 watts;

There are no technical and technological limitations on increasing the power of the laser diode if necessary;

The proposed device contains an integrated micro-converter of light and a magnetoresonance encoder , eliminating the unauthorized use of extraneous peripheral optical tools;

Any type of laser diode control and pumping systems can be used in the proposed light source, including pulsed and radio-frequency systems;

The following types of optical fibers can be used to transmit radiation from the module to peripheral instruments:



1. POF large numerical aperture fibers or glass fibers are suitable for use with the module. In the plug design variant, multiple fibers can be used at the same time. The specifics of the design will be determined by the specifics of the application.

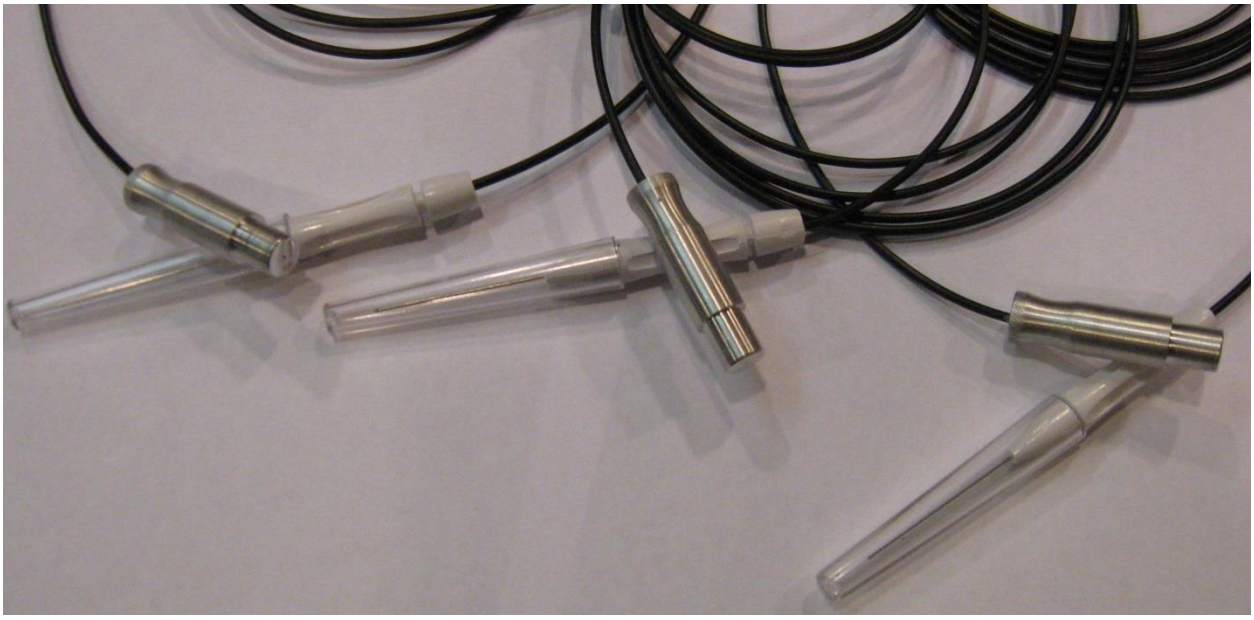
2. POF fibers are available in diameters of 250, 700, 1000, 1500, 1500, 2000, 3000 μm.

3. With a plug-in design, 80% of the laser power can be injected into the fiber. By using lasers with lower divergence, the percentage of input power can be brought to values close to 100%.

4. When glass optical fibers are used with the module, very high apertures up to 0.6 - 0.7 and even higher are obtained. The diameter of currently available fibers is up to 250 μm, so the plug-in design without removing the diode cover gives 45-50% input of laser radiation power

5. Glass fibers are especially promising for introducing spontaneous converter radiation into them because they are insensitive to heating of the phosphor by pump light. They are especially effective in creating 27G and 32G illuminator probes

The use of the proposed module allows to obtain several variants of light flux output from optical fiber:



1. Laser emission from the fiber.
2. Spontaneous emission from fiber.
3. Spontaneous emission from a remote phosphor.

Sequence of steps or stages of the controlled and regulated end-to-end operation process of the proposed module

1 Process step : Generation of laser radiation. The generation intensity is regulated and controlled by the pump current.

2 Process step : Introduction of radiation into the fiber. Controlled and regulated during the manufacturing stage. Not adjustable during operation.

3 Process step : Transmission of light through the fiber. Not regulated or controlled.

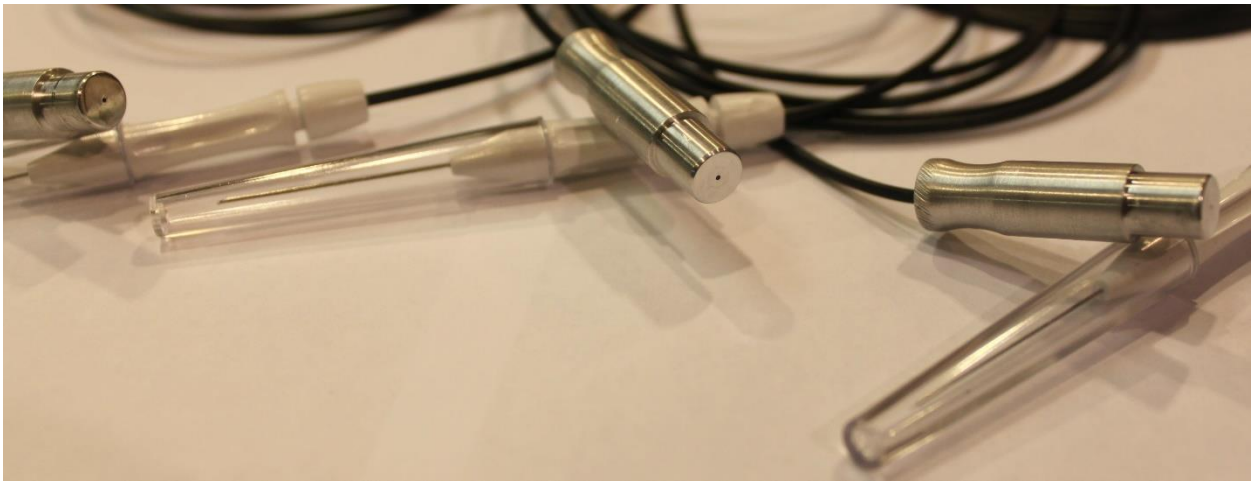
4 Process step : Pump light output from the fiber to the integrated converter. The light power density at the converter is controlled at the fabrication and design stage by varying the distance from the fiber end to the converter, the converter design, the presence of focusing optical elements, and the fiber aperture.

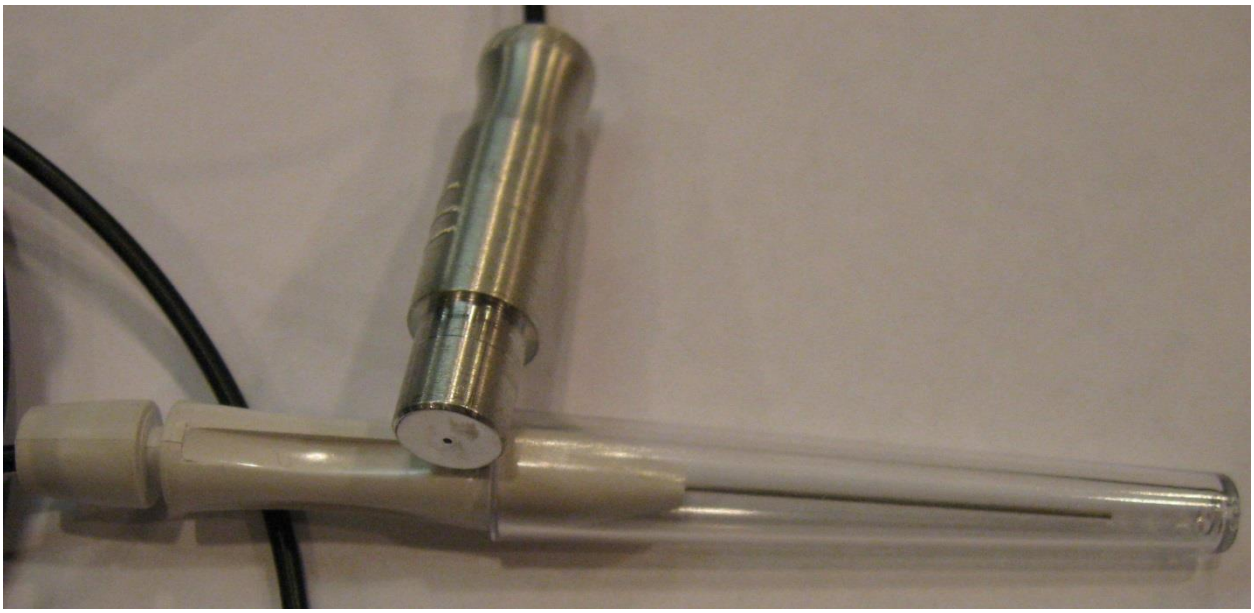
5 Process step : Light conversion. Controlled by phosphor thickness, phosphor concentration, phosphor impurity concentration, quantum yield, and phosphor type..

6 Process step : Input of converter radiation into the fiber. It is determined by the distance from the converter to the end of the output fiber, the input aperture of the fiber, including the diameter, the reflection losses from surfaces. It is not adjustable during operation

Advantages of laser module with integral light converter over LED module of the same type, purpose and power output:

1. Due to the fact that the active element of the light converter has an extremely small size compared to the elements of LEDs for the same purpose, a light source of the highest brightness is realized.
2. In the proposed module it is possible to bring the receiving optical fiber directly to the light converter, since this is not hindered by the thermocompression wire of the contacts..
3. In the proposed module there is a possibility of supplying to the converter of light pumping radiation of several wavelengths of light and, accordingly, there is a possibility of using multi-component composite phosphor, which allows you to change the color rendering index and light temperature of the converter radiation. This determines the possibility of obtaining from one converter light of several colors.
4. The design and principle of operation of the proposed module allow to eliminate the need for a system of conductive parts at a considerable distance from the pump laser source (up to several hundred meters).





Appendices and list of references used:

Appendix 1

United States Patent Application	**20120040166**
Kind Code	**A1**
	February 16, 2012

Composite Material, Method of Manufacturing and Device for Moldable Calibration

Abstract

Composite materials and methods and systems for their manufacture are provided. According to one aspect, a composite material includes a collection of molded together multilayer capsules, each capsule originally formed of a core and shell. The shell, after a plastic deformation process, forms a pseudo-porous structure, with pores locations containing the capsule cores. The cores are made of a material, e.g., synthetic diamond, which is harder than the external shell, which can be formed of, e.g., a ductile metal such as copper. The composite material has high thermal and/or electrical conductivity and/or dissipation.

Appendix 2

United States Patent Application **20100224497**
Kind Code **A1**
September 9, 2010

DEVICE AND METHOD FOR THE EXTRACTION OF METALS FROM LIQUIDS

Abstract

A volume-porous electrode is provided which increases effectiveness and production of electrochemical processes. The electrode is formed of a carbon, graphitic cotton wool, or from carbon composites configured to permit fluid flow through a volume of the electrode in three orthogonal directions. The electrode conducts an electrical charge directly from a power source, and also includes a conductive band connected to a surface of the electrode volume, whereby a high charge density is applied uniformly across the electrode volume. Apparatus and methods which employ the volume-porous electrode are disclosed for removal of metals from liquid solutions using electroextraction and electro-coagulation techniques, and for electrochemical modification of the pH level of a liquid