Single-Wire And Wireless Electric Power Transmission

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Single-Wire Electric Power Transmission

The idea of single-wire electric power transmission has become especially attractive to many researchers after a demonstration of single-wire AC transmission made by S.V. Avramenko [1] at the Moscow Scientific-Research Institute of Electrical Engineering. *Editor's: We have already written about similar investigations in our previous issues. The story began more than 100 years ago with Tesla's experiments.*

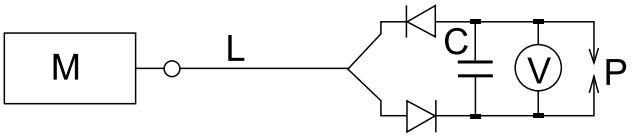

Fig. 1

Single-wire power transmission circuit by Avramenko[1]

At the heart of the device there is "Avramenko plug" representing two sequence semiconductor diodes (Fig.1). If the plug is connected to a wire under AC voltage, then after a time in a discharger **P** there is observed a run of sparks. The time gap from connection to discharging depends on the values of capacity (**C**), voltage, frequency of pulsation and the size of the air gap (**P**). The connection of a resistor (**L**) of 2~5 MOhm to the transmission line does not cause any considerable changes in operation of the circuit [1]. In the article [2] the authors assume that the efficiency of the device depends on the material which is used for the windings of a generator (**M**). Therefore they believe it is necessary to check expediency of using nickel, iron, lead, etc. wires to make the windings. At the same time, one of the authors of the article [2] considers their line to be superconducting [3, 4].

Our Experiments on Single-Wire Electric Power Transmission

The authors of this article carried out a number of experiments on power transmission using single-wire lines. To that end we developed a new single-wire power transmission circuit. In our circuit there was no "Avramenko plug". Instead of an "Avramenko plug" we used an ordinary bridge circuit. In our experiments the bridge circuit turned out to be much more efficient than "Avramenko plug". Moreover, we made some other changes into Abramenko's circuit. Our circuit is presented in Fig.2. The transmitting unit consists of a generator and a transformer. The circuit diagram of the transmitting unit is shown in Fig.2 (to the right of the transformer).

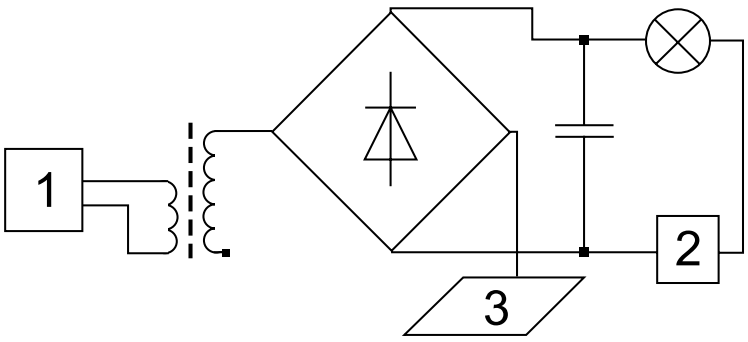

Fig. 2

Single-wire power transmission by a new circuit

Figures in the circuit diagram (Fig.2) denote the following: 1 – Generator, 2 – Extender of spectrum, 3 – "Antenna". The general view of the device is shown in Fig.3.

Fig. 3

General view of the device to demonstrate single-wire power transmission

Electric energy is supplied to the device from a DC power source B5-47 providing voltage of 0-30 V. An incandescent lamp of 220 V, 25Wt serves as load. The generator and transformer are enclosed into a dielectric casing. The components of a power receiver (diodes, capacitor, lamp, elements 2 and 3) are placed in a plastic casing under the lamp (Fig.3). The power receiver is connected to the transformer with one wire.

The intensity of glow of the lamp depends on the generator power. The lamp of 220 V, 25Wt is almost fully incandesced when high output voltage of the power supply is within the range of 16~ 18 V (Fig.4).

Fig. 4

Glow of the lamp at high voltage of power supply B5-47 in the single-wire power transmission line

The key points in increasing the efficiency of our circuit in comparison with Avramenko's circuit are that we used an entire standard bridge circuit and not just a half of it. Besides there was used a spectrum expander. The load does not impede full charging of the capacitor since the spectrum expander was used in the circuit. Neither connection of a resistor to the transmission line nor using a conductor of high specific resistance as a transmission line can considerably affect the degree of glow of the lamp. Our circuit of single-wire power transmission has two independent lines with different frequency spectra. The first line has a narrow-band frequency spectrum and the second line – a wideband one. In the first line the circuit closes at the free end of the secondary winding of the transformer through an antenna (3) (Fig.2). The capacitor, spectrum expander and incandescent lamp form the second line.

Experiments with Burnt-Out Incandescent Lamps

Both good and burnt-out lamps glow in the above-described experiments on single-wire power transmission. Results of the experiments with the burnt-out lamps are presented below.

There is a break of a filament of the incandescent lamp (Fig. 5). This photo was taken while the device was switched off.

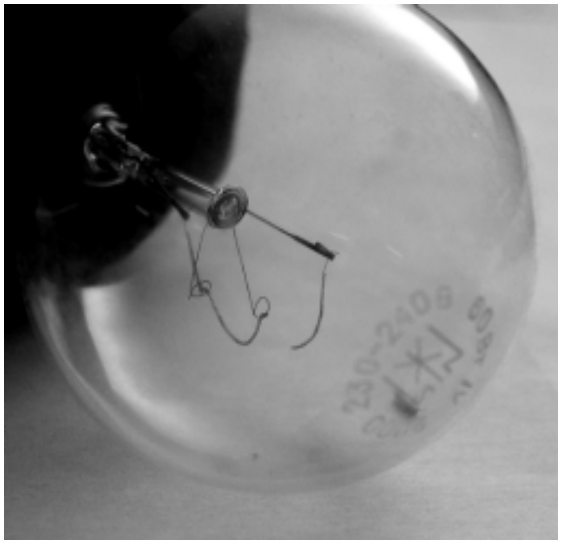

Fig. 5

A burnt-out lamp of 220 V, 60 Wt before the experiment

Fig. 6 is a photo taken during the experiment. You can see a glowing filament and a bright spark in the break point of the filament. Neither connection of a resistor to the transmission line nor using a conductor of high specific resistance as the transmission line could considerably reduce the incandescence of the filament. The degree of incandescence of the filament depends substantially on the size of a gap in the break point of the filament. The experiments revealed that there was an optimal size of the burnt-out section when the incandescence of the

residual filament was maximal

Fig. 6

Glow of a burnt-out incandescent lamp of 220 V, 60 Wt

Practically each of us meets the glow of burnt-out lamps even without knowing it. For that it will be enough just to examine a burned-out lamp closely. Rather often you can notice that the internal circuit of an incandescent lamp burns out in more than one point. It is obvious that probability of burnout of the filament of a lamp in several points at a time is negligible. It means that on losing the integrity of the filament the lamp had been glowing on before the circuit broke in one more point. This phenomenon occurs in most cases when incandescent lamps burn out in the circuit of 220V and 50Hz.

For one of the experiments we connected standard incandescent lamps of 220V, 60Wt to the secondary winding of a step-up transformer. At idle running voltage of the transformer was about 300V. In the experiment there were used 20 incandescent lamps. It turned out that the incandescent lamps burn out mostly in two or more points. Moreover, not only the filament, but also the conductive wires inside of the lamp were burnt out. In addition, after the first break in circuit the lamps went on glowing for a long time and even more intensively than before the burnout. A lamp had been glowing on up to the moment when one more subcircuit burnt out. The internal circuit of one of the lamps in our experiment was broken in four points! Moreover, the filament burnt out in two points and, in addition to the filament, the both electrodes inside the lamps were burnt out as well. Results of the experiment are presented in Table 1.

Table 1

Quantity of lamps used in the experiment	Quantity of lamps with one burned-out point	Quantity of lamps with two burned-out points	Quantity of lamps with three burned-out points	Quantity of lamps with four burned-out points	Quantity of lamps with five burned-out points
20	8	8	3	1	0

Experiments on Wireless Electric Power Transmission

Many scientists all over the world work at solution of the problem of wireless power transmission. Mostly there are studied microwave fields used for the purpose of wireless power transmission. However, the applied microwave systems are not harmless to the man [5]. We present the information on our experiments on realization of wireless power transmission without using the microwave field. We studied probability to transmit power to an electric motor without use of wires.

The system, which consisted of a power supply B5-47, a generator and a transformer, was used in our experiments as a transmitter. A special receiving unit for wireless power transmission served as a power receiver and contained an electronic unit and a DC electric motor IDR-6. In Fig. 7 you can see the general view of our wireless power transmission device.

Fig. 7

General view of the device for demonstration of wireless power transmission

The electric motor is mounted onto a conductive platform, which in its turn stands on a casing made of insulating material (Fig. 8). There is an electronic unit inside the casing.

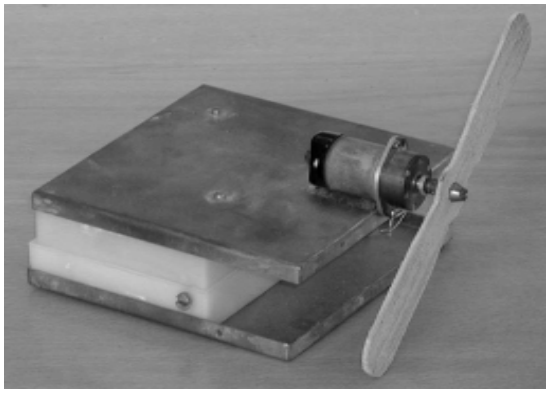

Fig. 8

Receiver for demonstration of wireless power transmission

The electronic unit fills little space inside the casing of the receiver and it is made on a printed board. In Fig. 9 there is presented the interior part of the receiver. It is designed for wireless power transmission.

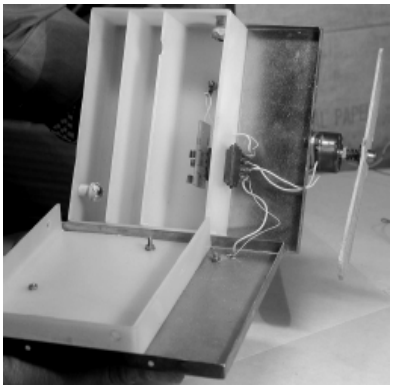

Fig. 9

Interior part of the receiver for demonstration of wireless power transmission

When the transmitter switched on there was observed rotation of the electric motor, which the experimenter held in his hands. Neither the electric motor nor platform was connected to the transmitter. And there were no power supplies inside the casing where the platform and motor were enclosed. When the distance between the receiver and transmitter diminished the speed of rotation of the electric motor increased. In Fig.10 you can see a fragment of the experiment when the frequency of rotation of the motor was sharply rising, if the electric motor was in hands of two experimenters.

Fig. 10

Acceleration of rotation of the motor

Experiments that demonstrate how an incandescence lamp can glowin the experimenter's hand

It is a common phenomenon when a gas-discharge lamp glows in the researcher's hand at using of alternating electromagnetic field. It is unusual that an incandescent lamp can glow in the investigator's hand when only one wire is connected to the lamp. Undoubtedly, a glowing filament of the lamp, which an experimenter holds in hands, can excite interest only in the case when there are no two wires connected to the lamp. It is known that Nicola Tesla demonstrated a glowing lamp that he was holding in his hand. We have not managed to find a description of that experiment, so we have developed our own designs. We have carried out experiments that show how an incandescence lamp can glow in the experimenter's hand. The results of these experiments are presented below. In Fig.11a and Fig.11b you can see variants of the device for demonstration of glow of a 220V incandescent lamp.

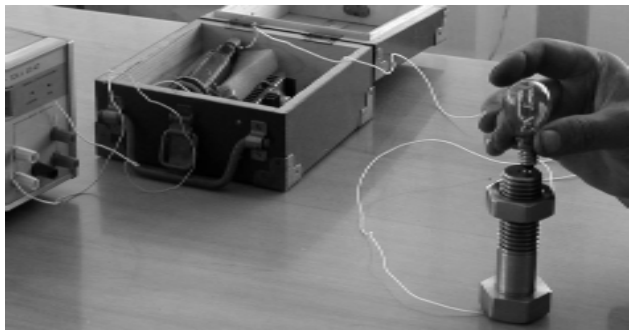

Fig. 11 a

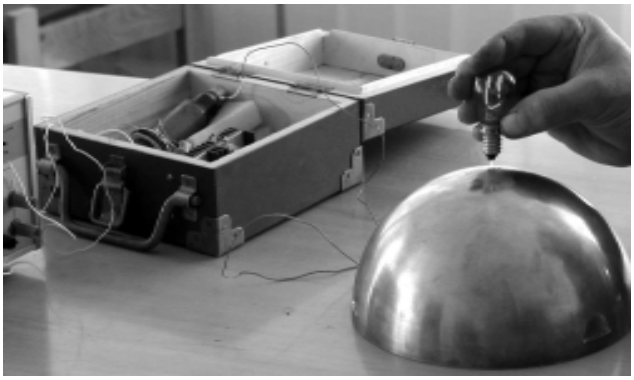

Fig. 11 b

In the experiments demonstrating how an incandescent lamp glows in the researcher's hand we used neither "Avramenko plug" nor receiving units for demonstration of single-wire and wireless power transmission. The lamp in the experimenter's hand glows due to applying electronic units and due to design philosophy of the devices.

Fig. 12 and 13 represent close-up photographs where you can see glowing of the lamps of 220V, 15Wt and of 220V, 25Wt that the experimenter holds in his hands. At that the lamps are not connected to the closed circuit. The higher voltage supplied to the generator, the more intensive was the glow. For the sake of the experiment's safety we supplied to the generator voltage that made lamps glow at about their half incandescence.

Fig. 12

Glow of an incandescence lamp of 220V, 15Wt

Fig. 13

Glow of an incandescence lamp of 220V, 25Wt

In the lower part of the photos (Fig. 12 and Fig. 13) you can see a conductor, which is connected to the generator with one wire. Only one contact of the lamp cap touches the conductor. The other contact remains non-connected. Thus the lamp and the generator are connected with a single wire.

Fig. 14

Authors while making ready their experiment on single-wire power transmission

Fig. 15

Authors while making ready their experiment on wireless power transmission

Perhaps experiments on power transmission by Nicola Tesla were somehow similar to the experiments carried out by us. At any rate the experiments prove that single-wire and wireless power transmission has real perspectives.

In Fig. 14 you can see a photograph of the authors while making ready the experiment on single-wire power transmission.

In Fig. 15 you can see a photograph of the authors while making ready the experiment on wireless power transmission.

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The Possibility of Almost Complete Transformation of Thermal Energy into Mechanical One

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There is a description of thermodynamic cycle of a heat motor with heterogeneous working body. This cycle allows completely transforming a thermal energy into mechanical one. The proof of existence of the cycle and its characteristics is a logic consequence of the first law of thermodynamics. By means of realizing of the cycle it will be possible to create new types of heat motors, which have qualitative advantages in comparison with the known ones. The said advantages are possibilities either to almost completely transform high-temperature heat, which appears as a result of combustion of fuel, to the useful work or to do such work by transforming free heat, which is taken off the matter of environment.

Introduction

The main method to transform thermal energy into energy of other types is using of heat motors (engines), which implement any of closed thermodynamic processes (cycles). For functioning of such devices the presence of two thermal vessels with different temperatures of the heater and the cooler of a working body of a heat motor is required.

In all known heat motors ambient matter is used as a cooler. Therefore the doing of a useful work by known methods is possible only as a result of transformation of high-temperature heat which is created by combustion of fuel.

The main features of known thermodynamic processes, used for the transformation of heat into other types of energy are as follows:

- efficiency of these processes is less than that of Carno cycle for a used temperature interval;
- these processes can not be applied for transformation of free heat, which is contained in the ambient matter.

Use of the invention under the Russian Federation patent [1] will allow to implement the process of transformation of heat, which is free from specified restriction. Federal Institute of the industrial property (FIIP) has included the invention in the list of prospective Russian projects [2].

There is offered the method to do useful work by means of realization of the closed thermodynamic cycle, wherein at some stages matter of the working body changes its aggregative state creating heterogeneous system, consisting of