European Scholar Journal (ESJ)
Available Online at: https://www.scholarzest.com
Vol. 3 No.5, May 2022
ISSN: 2660-5562

SCHEME OF HIGH VOLTAGE GENERATION USING SEMICONDUCTOR TRANSISTORS

Olimov Lutfiddin Omanovich
DcS, Professor of " Alternative energy sources" Andijan Machine-Building
Akhmedov Alisher Khamidovich
Teacher of Andijan district 56 school specializing in physics and mathematics
Yusupov Abdurashid Khamidillaevich
Head teacher of "Physics and chemistry" Andijan Machine-Building Institute.

Article history:

Received: 8th March 2022
Accepted: 8th April 2022
Published: 17th May 2022

Abstract:
In the development of the agricultural sector, it is important to take effective measures to control pests. Devices for the control of agricultural pests are based on the destruction of pests by means of pest control. Devices for the control of agricultural pests are based on the destruction of pests by means of pest control. In such an electrical circuit, the power supply voltage of the transformer is 220 V, which leads to an increase in energy consumption. Today, semiconductor transistors designed to amplify electrical signals are competitive with such electrical circuits with high precision performance, energy saving, and other physical properties. In this regard, this article examines the characteristics of semiconductor transistors, analyzes the current state of their use, in particular, the study of the characteristics of semiconductor transistors designed to amplify electrical signals, based on which to develop technology for generating high voltages the results of the research are described.

Keywords: Optoelectronic Devices, Signal Amplification, Semiconductor Transistor, Temperature, Current And Voltage, Emitter, Collector, Base, Charge Carriers, Differential Resistance, Reverse Mode, Electron-Hollow Pair.

INTRODUCTION

In traditional technologies, high voltage generation is performed using transformers (Figure 1). Depending on the structure of the transformers, they consist of primary and secondary windings, which can be amplified or reduced depending on the number of windings in the coil [1]. In this study, amplifier transformers are used for the device. It should be noted that iron-based transformers are used in electrical circuits in existing biophysical devices today [2÷4, 8÷12]. They work mainly at the expense of alternating voltage. The industrial frequency is 50 Gts, at which frequency the duration of one clock is 10 milliseconds. During this time, the primary coil does not have time to move the magnetic field. If the magnetic field inductance in the primary coil is too low, the reactive resistance is lost due to the saturation of the magnetic field for 10 milliseconds per second, and a direct current flows, causing the coil to heat up. Excessive energy consumption occurs due to the heating of the boiler [5, 13÷15].

Material and Methods

There are basically three ways to solve the problem: Put a fan to prevent overheating without changing the number of coils. However, this leads to an increase in energy consumption and the inability to use the transformer for a long time; the next method is to increase the inductance in the coil by increasing the number of coils and the size of the core. If you need to increase the power of the transformer, you should choose a thicker surface of the wires in the coil. This will incur excessive costs, as well as increase the size and cost of the transformer; the third method is to reduce the transition time of a clock. In this way, the magnetic field does not reach saturation at low inductance and the reactive resistance is not lost. This requires increasing the frequency of the alternating current [6].

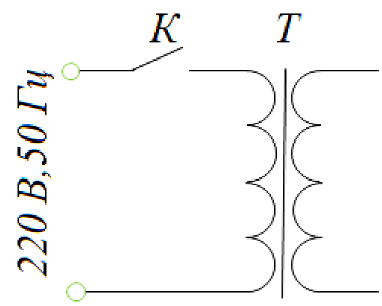

Figure 1. Simplified circuit diagram of high voltage reception

The mentioned disadvantages can be overcome by using semiconductor transistors designed to amplify electrical signals. Today, amplification of electrical signals using semiconductor transistors is widely used in electronics and radio electronics. However, this study has not been used in grounded devices that have destroyed pests in accordance with their goals and objectives. In the present study, the following circuit diagram was assembled to form a high energy-efficient circuit based on a combination of an amplifier transformer and semiconductor transistors designed to amplify electrical signals in the proposed device.

Figure 2 shows a simplified circuit diagram of high voltage generation based on a combination of an amplifier transformer and a semiconductor transistor. The use of energy-saving rechargeable batteries as an energy source was envisaged.

In the circuit, the structure of the transformer and the connection diagrams of the transistor are important. In particular, a transformer with the same number of primary windings, 50 two windings (1, 2, 3) and a copper wire diameter ∅50 mm^2, and a secondary winding number 2000 copper wire diameter ∅30 mm^2 was used. It should be noted that the transformer generates an unchanging magnetic field when a pulsed alternating current is applied to the primary coil. The constant magnetic field reduces the magnetic properties of the ferrite core [7]. To prevent this, a pole (1) is formed by attaching the middle of the primary poles. This divides the number of primary packages into two equal parts of 50.

The positive pole of the source is connected to the middle (1) part of the first winding, while the negative pole is connected to the emitter pole of the transistor. The base and collector poles of the transistor are connected to the remaining two (2, 3) parts of the primary coil. As a result, the transistor supplies the transformer with two parts of the primary winding in series, and an alternating current is generated using an alternating current. The disadvantage of this type of transformer is that it forms two parts with the same number of turns in the primary winding. If the transformer is a step-down, the cost will increase due to the large number of primary windings, the amplifier does not require an overhead due to the low voltage supplied to the primary winding in transformers.

Considering these factors, the selection of a suitable transistor is also important when obtaining an energy-saving circuit for biophysical devices. Based on these and the results and considerations obtained in the study of the operating characteristics of the transistor in the previous paragraphs, a transistor of the n-p-n structure, Si-based, KTD718 was selected. The maximum power consumption of the semiconductor KTD718 transistor is 80 W, the maximum allowable voltage of the collector-emitter junction is 120 V, the maximum constant ioc power of the collector is 10 A, the temperature limit of the pn-junction is 175° C, the statistical coefficient of transmission current is 55.

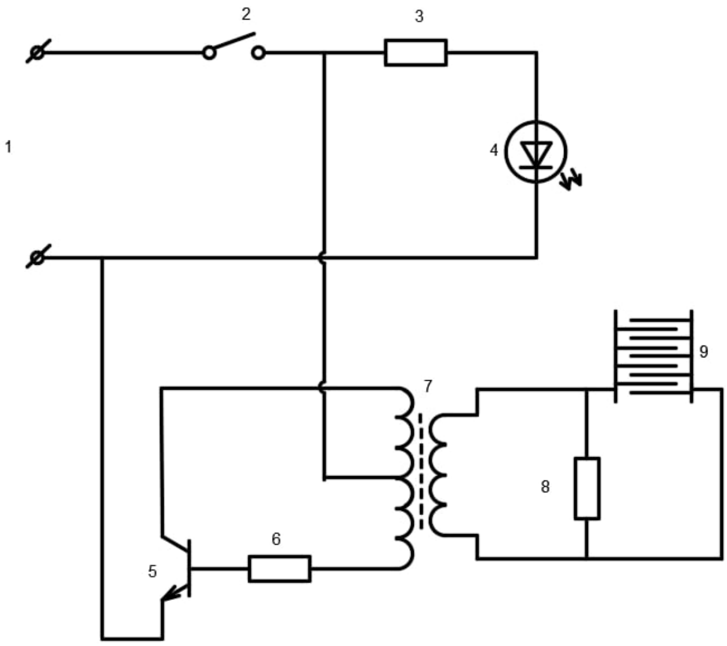

Figure 2. Electrical circuit for generating high voltages using a semiconductor transistor that amplifies electrical signals. 1 alternating current supply, 2 off switch, 4 semiconductor light emitting diodes, 3 active resistors, 5 bipolar transistors, 6 active resistors, 7 amplifier transformers, 8 active resistors, 9 faulting means

The on-off switch turns on the device, the semiconductor diode lights up and an alternating current flows through the KTD 718 n-p-n bipolar transistor. The active resistor R1 is connected to the base of the bipolar transistor and its value is 680Ω. The alternating current passing through the bipolar transistor is pulsating. The pulsating voltage passes through the amplifier transformer and a high alternating voltage is generated in the secondary winding of the transformer. A high alternating voltage is transmitted to the damage medium.

RESULTS

Figure 3 shows a mathematical model of an electrical circuit generating high voltages using a semiconductor transistor that amplifies electrical signals in the MATLAB (SPS) system.

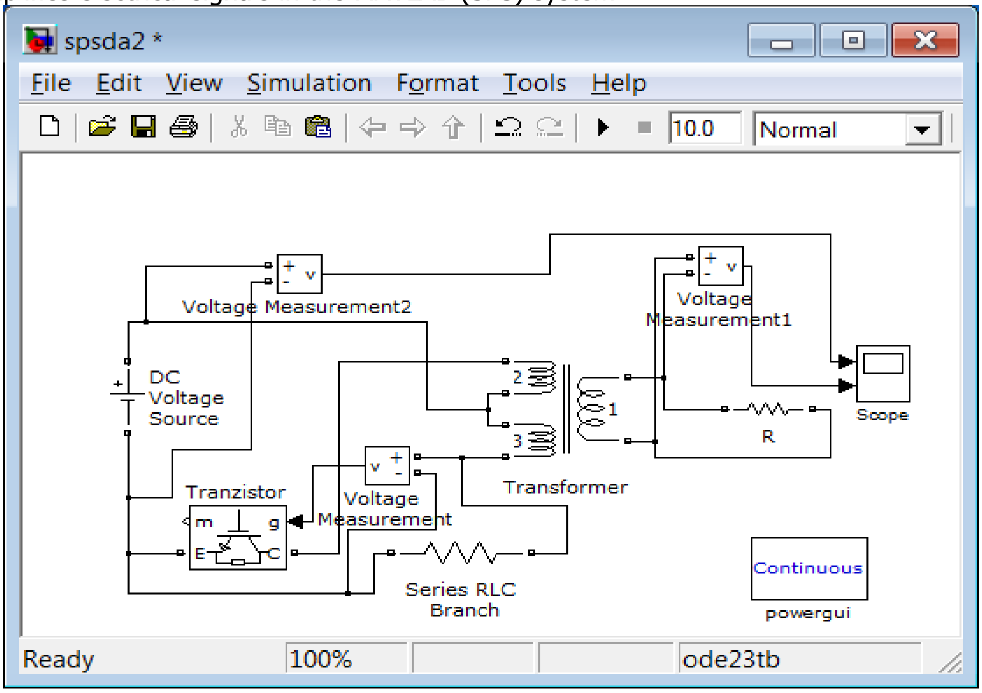

Figure 3. Mathematical model of an electrical circuit for generating high voltages using a semiconductor transistor that amplifies electrical signals in the MATLAB (SPS) system

Figure 4 shows a catalog of a ferrite transformer used in a high-voltage circuit. We can see that according to the parameter of the transformer, the primary winding is divided into two parts and taken from the windings W11 = 50 and W12 = 50, and a constant voltage of 12 V is given. The second winding of the transformer consists of W2 = 2000 windings and is designed for a voltage of 4000 V. We can see the oscillograms of the voltages generated at the input and output of the ionizer in Figure 5.

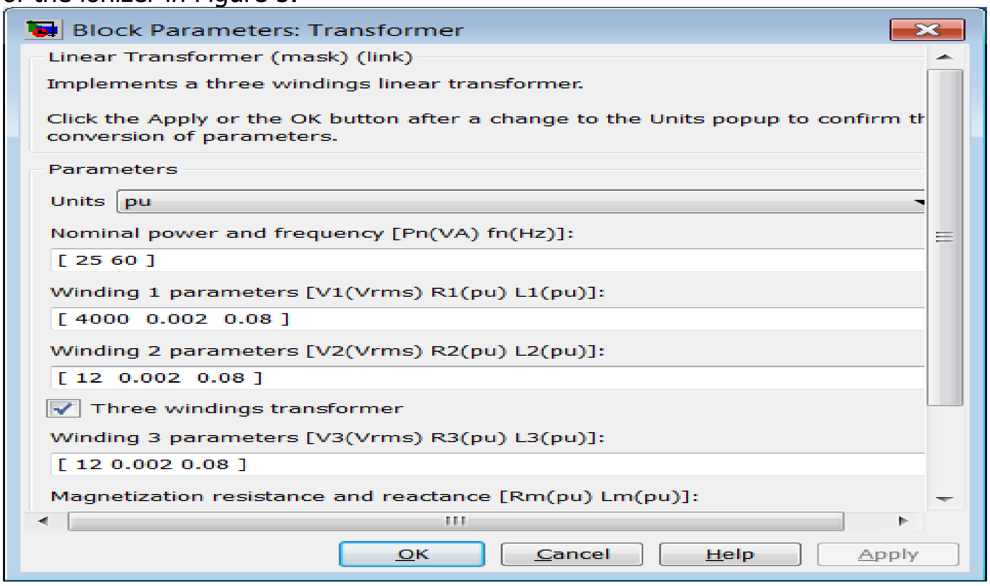

Figure 4. Parameters of a ferrite transformer used in a high-voltage circuit

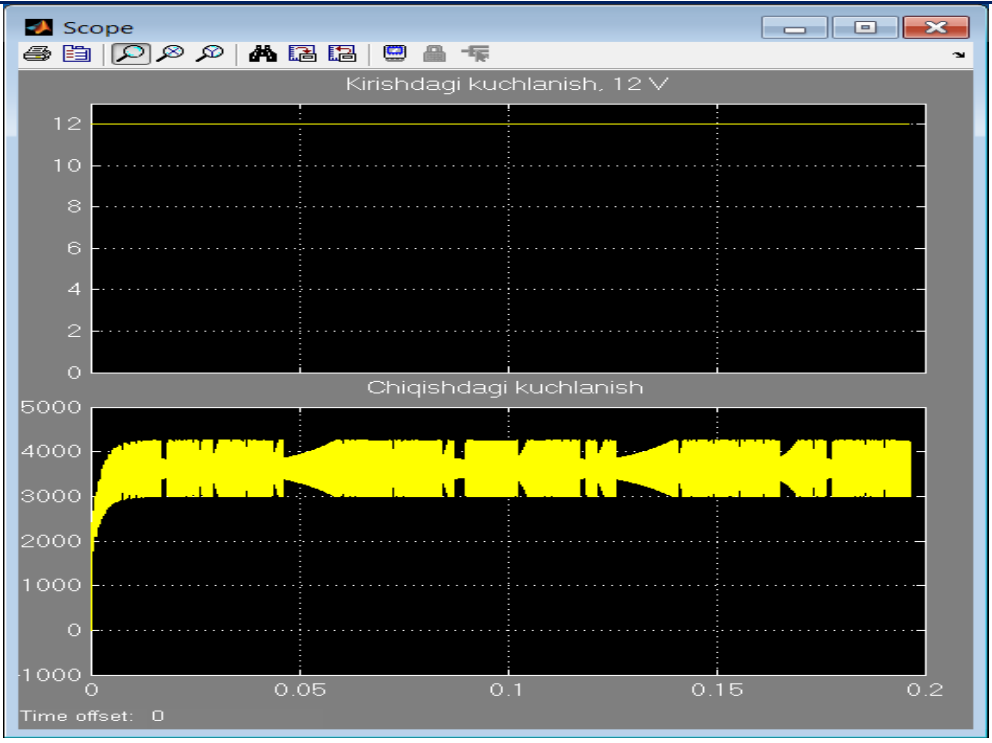

Figure 5. Ocylograms of the voltages generated at the input and output of the ionizer

Figure 6 shows the oscillograms of the voltages generated at the input and output of the ionizer (when the resistance is R=10^5 Ω).

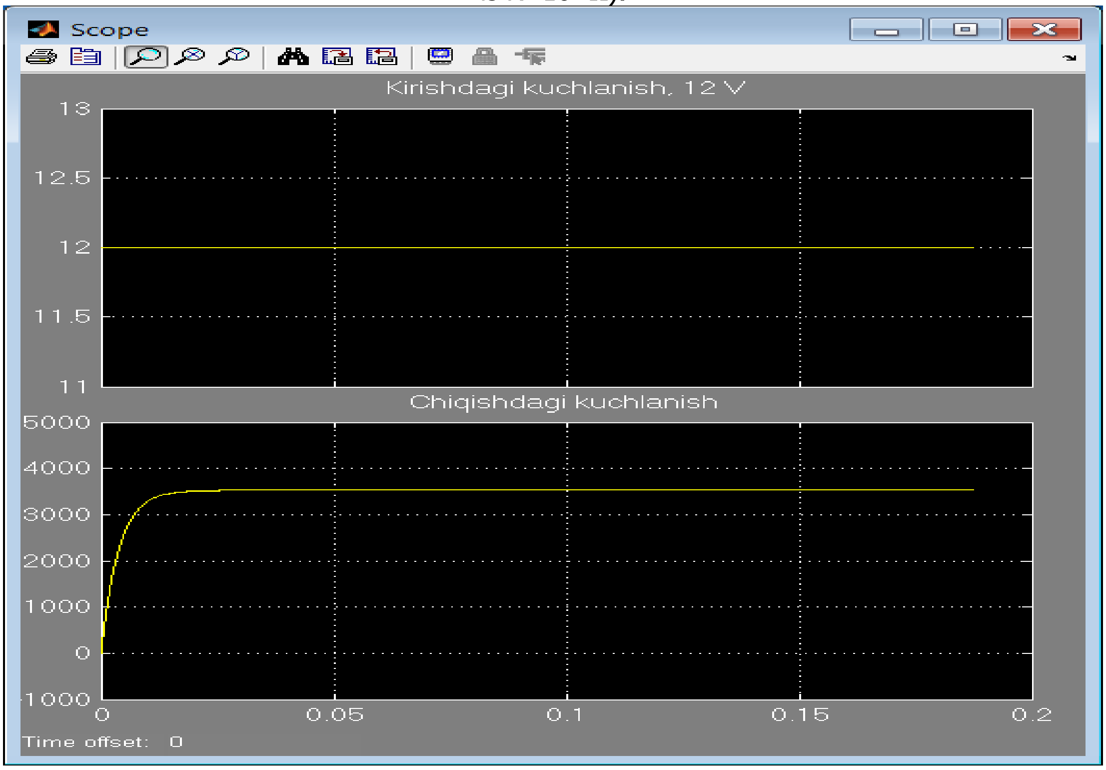

Figure 6. Otsilograms of the voltages generated at the input and output of the ionizer (R=10^5 Ω).

The results of this model obtained using the MATLAB Simscape program can be seen in Figures 7 and 8.

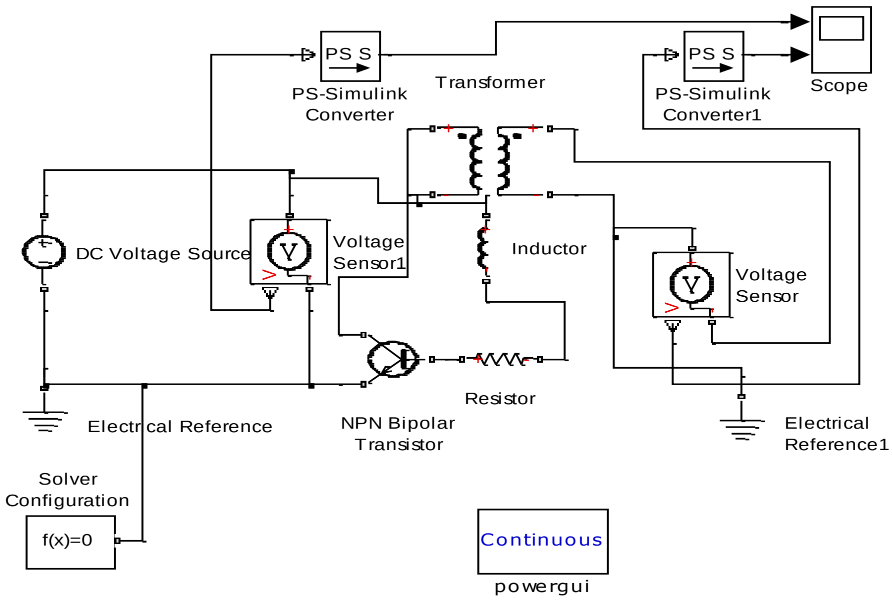

Figure 7. Mathematical model of high voltage generation circuit in MATLAB Simscape system

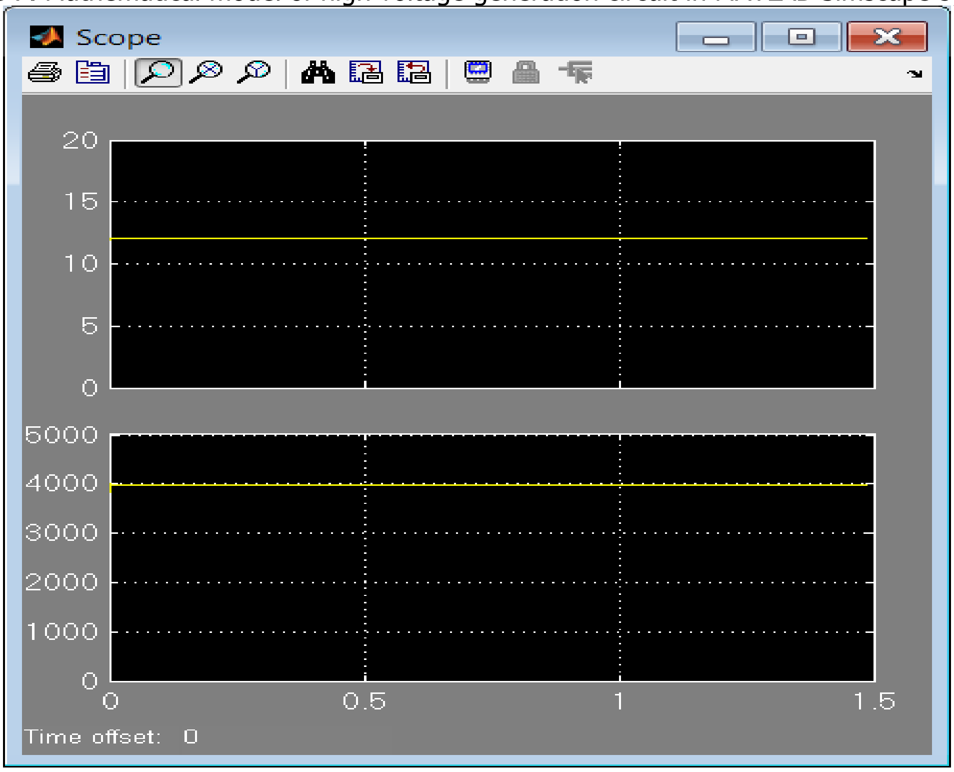

Figure 8. Otsilograms of the voltages generated at the input and output of the ionizer in the MATLAB Simscape program.

Figures 9-10 show the oscillograms of the base-collector and emitter-collector input and output frequencies of the MATLAB (SPS) system of the KTD718 transistor used in the circuit for high voltage generation.

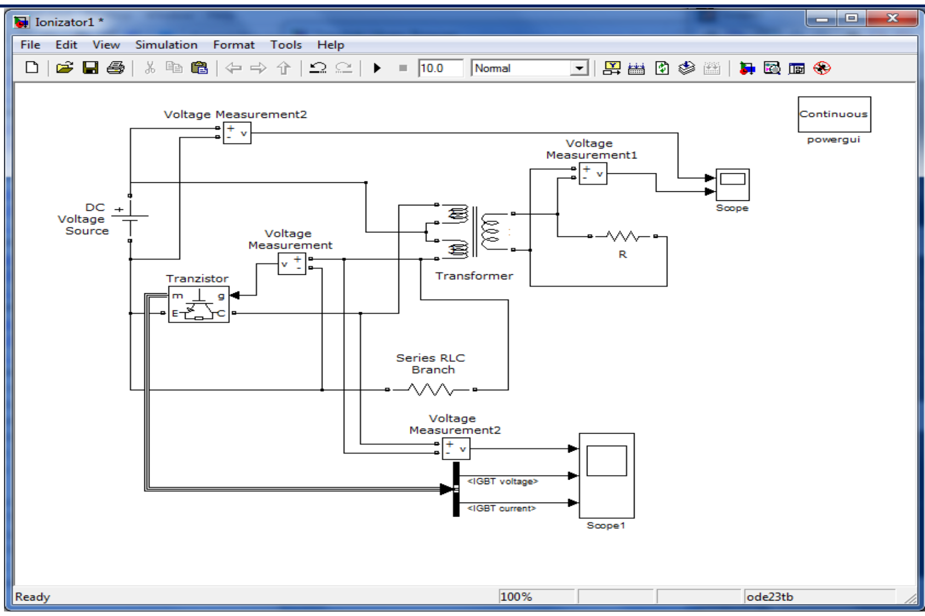

Figure 9. Mathematical model of the scheme of obtaining the frequencies generated at the input and output of the ionizer in the program MATLAB (SPS)

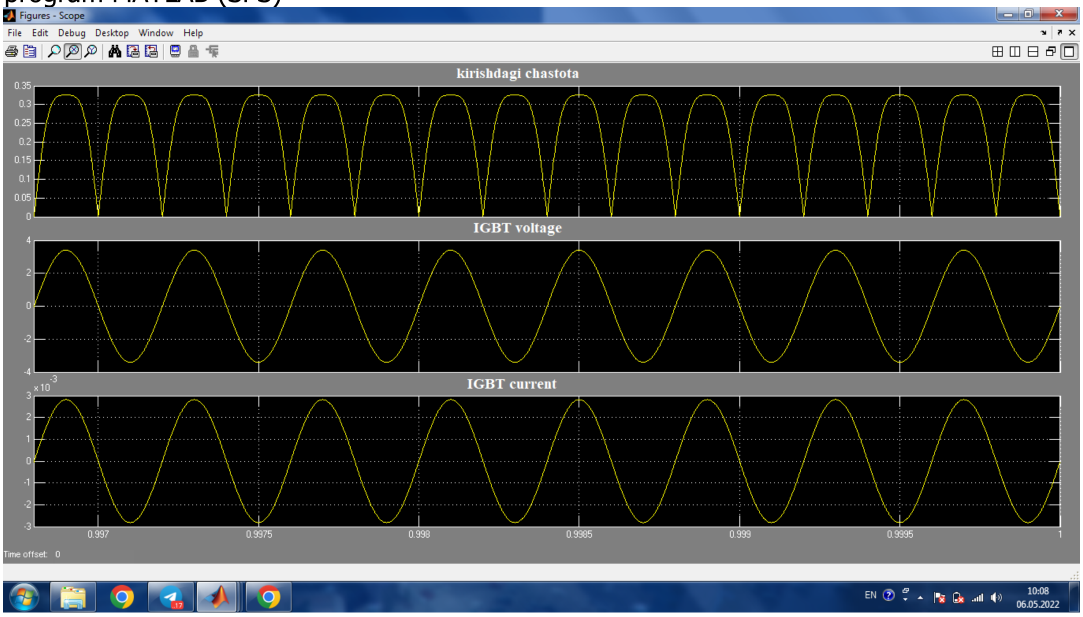

Figure 10. Oscillograms of the frequencies generated at the input and output of the ionizer in the program MATLAB (SPS)

Figure 11-12 is the oscillogram at the input and output of a KTD718 transistor used in an electrical circuit to generate a high voltage.

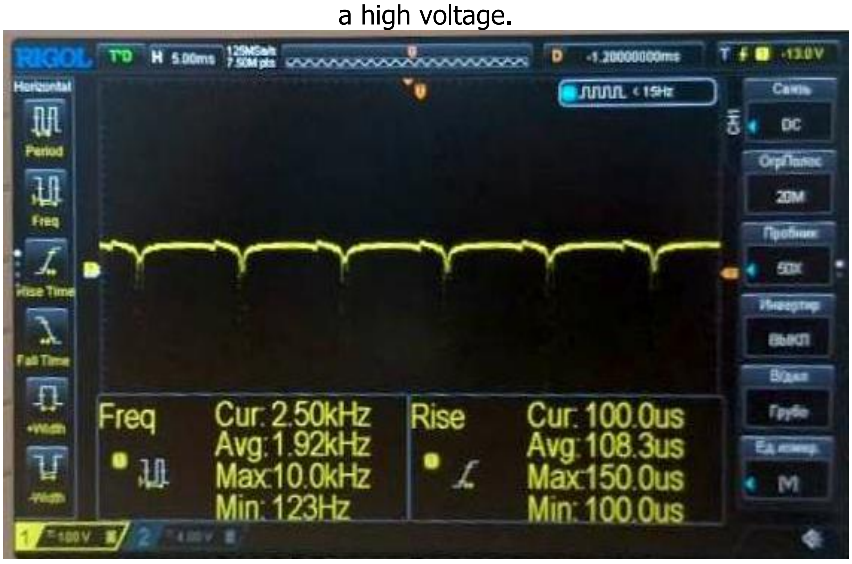

Figure 11. An oscillogram of the input frequency of a KTD718 transistor

Figure 12. Frequency oscillograms at the output of the transistor KTD718

The voltage at the input of the transistor is 0.42 V and at the output is 2.42 V. In this circuit, the transistor acts as a signal amplifier as well as a switch.

The input voltage supplied by the AC power supply is 12 V and the amperage is 4 A. The value of the current flowing through the transistor is 2.4 A at the source-emitter, 1.9 A at the collector-coil, 0.55 A at the base-coil, and 2.56 A at the source-coil. The operating voltage of the transistor in the collector-emitter range is 0.5 V, the alternating voltage is 2.2 V, the constant voltage between the base-emitter is 0.79 V, and the alternating voltage is 0.42 V.

CONCLUSION

The results of the study show that when the circuit is connected to the source, a high voltage of 4000 volts is generated when the current in the secondary circuit of the transformer is very small and the transistor heats up after a certain time. A cooling radiator is used to prevent the transistor from overheating. It should be noted that the working period of agricultural equipment is from late evening to dawn, depending on the season from 6 to 8 hours. Thus, the partial heating process of the transistor does not affect the performance of the proposed agricultural equipment at all.

REFERENCES

1. А.И.Вольдек, В.В.Попов Электрические машины. Введение в электромеханику. Машины постоянного тока и трансформаторы. Питер, 2007. 242-302 б
2. JIADUO frquency trembler pests-killing lamp. JIADUO Science, Industry and Trade CO. Ltd.
3. Л.О.Олимов, А.Юсупов, Ф.Омонбоев, Э.Юсупов Зараркунанда ҳашоратларга қарши кураш қурилмаси // Патент UZ FAP 01356., 31.01.2019.
4. Патент UZ FAP № 00332. Зарарли учар ҳашоратларни қириш қурилмаси. Р.Алиев, Л.Олимов, М.Алибоев.
5. М. П. Тиличенко, А. В. Козлов, Электротехника и электроника. Гомель 2016. С. 175-187.
6. Г.Ф.Быстрицкий, Б.И.Кудрин. Электроснабжение. Силовые трансформаторы. Москва «Юрат» 2018. 13 б, 18 б.
7. И.П.Копылов. Электрические машины. Москва «Юрат» 2012. 206 б.
8. L.O. Olimov, A.Kh. Yusupov, D.D. Alijanov. Problems of Introduction of Innovative Technologies and Modern Equipment in the Fishing Industry // International Journal of Research Studies in Electrical and Electronics Engineering (IJRSEEE) 2019. Vol. 5, Issue 4, pp. 23-25.
9. А.Х.Юсупов. Замонавий инновацион энергия ресурс тежамкор биофизик тутқич // Илмий техник журнал – Нам. МТИ. 2019. Том 4, махсус сон №3, С. 233-237.
10. Л.О. Олимов, А.Х.Юсупов, Д.Д.Алижанов. Балиқчилик учун инновацион қурилма // Илм-фан ва инновацион ривожланиш. 2019. №6 С.103-108.
11. L.O. Olimov, A.Kh. Yusupov. Problems of implementation of semiconductored leds for fishery lighting devices // The American Journal of Engineering and Technology. 2020. November, (ISSN-2689-0984) for Volume 02 Issue 11. https://usajournalshub.com/index.php/tajet/article/view/1595/1519.
12. Olimov L. O., Yusupov A. Kh.. The Influence Of Semiconductor Leds On The Aquatic Environment And The Problems Of Developing Lighting Devices For Fish Industry Based On Them // The American Journal of Applied sciences, 2021. Pages: 119-125. https://doi.org/10.37547/tajas/Volume03Issue02-14.
13. Yusupov Abdurashid Khamidillaevich, Creating A Biophysical Trapping Device Based On An Optical Radiation Source With A Light-Emitting Diode // ACADEMICIA: An International Multidisciplinary Research Journal. 2021. April, https://saarj.com Vol. 11, Issue 4, pp. 1537-1543., doi:10.5958/2249-7137.2021.01273.8.

14. Olimov, L. O., & Yusupov, A. K.. Temperature dependence of transistor characteristics of electric signal amplification in optoelectronic devices // ISJ Theoretical & Applied Science, 2021. №08(100), pp.169-171. https://dx.doi.org/10.15863/TAS.2021.08.100.32.
15. Юсупов А.Х., Олимов Л.О., Анарбоев И. Энергосберегающая биофизическая ловушка // «Роль науки и образования в модернизаци предприятий нефтегазовой отрасли», Материалы республиканской научно-технической конференции, 2021, ноябр. –Ташкент. С. 279-283.