Jurnal Pendidikan Fisika

Volume 8 Number 2, August 2023, pp. 148~153
P-ISSN:2477-7935
E-ISSN: 2548-6225
DOI: 10.59052/edufisika.v8i2.25987

THE EFFECT OF CONSTANT AND NICROMES WIRE LENGTH ON THE LARGE OF CONVERTING RESISTANCE

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Article Info
Recieved: 13 Jun 2023
Revised: 17 Jul 2023
Accepted: 24 Jul 2023
OnlineVersion: 28 Jul 2023

Abstract :
This article discusses the importance of electricity in everyday life and its role in the development of modern technology. This research focuses on conducting resistance analysis using constant wire and nichrome wire. The research method used is a quantitative method using experimental methods. Data is measured using a wire to conduct electricity from the power supply or voltage. The results showed a relationship between the wire's length and the conductor's resistance. The longer the wire, the more excellent the opposition to its conduction. In addition, the type of wire also affects the resistance of the conductor, with nichrome wire having a more excellent resistance than constant wire. In conclusion, the value of the resistance of the conductor is proportional to the length of the wire and the type of wire used. However, it should be kept in mind that these conclusions only apply to the experimental situations conducted in this study.

Keywords: Constant; Resistance value; Wire length

INTRODUCTION

Electricity has become an integral part of our daily life and plays a very important role in the development of modern technology. From lighting, transportation, communication, to the various electronic devices we use, all depend on the existence and application of electricity. Electricity and electric power have a close relationship because electric power is a measure of the amount of electrical energy consumed or produced by a system. The development of the times has made electric power something that cannot be separated from human life and has become one of today's essential needs. This is due to the increasing number of human activities that require electrical energy (Kasli et al., 2020).

In the process of electric current, there are several terms used to describe each of the variables involved, such as amperage, voltage, and resistance. Electric current occurs due to the movement of electric charges from an area with a high potential to an area with a low potential through a conductor (Yusuf Lubis et al., 2020). A certain amount of electric charge that penetrates a cross section of a conductor in a certain time unit is referred to as electric current strength (Jiang et al., 2018; Kasli et al., 2020).

The current flowing in a conductor can be expressed by Ohm's Law, Ohm's Law, which was formulated by a German physicist named Georg Simon Ohm in 1827, has an understanding and development of important electrical concepts (Muhammad & Choiril, 2021; Yasu & Hadi, 2021) . Ohm's law involves Ohm's research and experiments related to the flow of electric current. Ohm's Law states that the electric current (I) flowing through a conductor is directly proportional to the voltage (V) applied to the conductor, and inversely proportional to the resistance (R) of the conductor. In its mathematical formula, Ohm's law can be formulated as follows (Halliday et al., 2005; Halliday & Resnick, 2005; Saefullah et al., 2018; Yasu & Hadi, 2021).

$$I = \frac{V}{R} \qquad (1)$$

Based on experiments conducted by George Simon Ohm, changes in the resistance of the wire (R) of a conductor are very dependent on three things, namely the type of resistance of the wire (ρ), the length of the wire (L), and the cross-sectional area of the wire (A). Mathematically it can be written as follows (Halliday et al., 2005; Halliday & Resnick, 2005; Juwariyah & Djaya, 2018; Kasli et al., 2020).

$$R = \rho \frac{l}{A} \qquad (2)$$

Equation 2 illustrates that the resistance of the wire (R) is proportional to the type of resistance of the wire (ρ) and the length of the wire (L), and inversely proportional to the cross-sectional area of the wire (A). In other words, the higher the resistance of the type of wire or the longer the wire, the higher the resistance of the wire. Conversely, the larger the cross-sectional area of the wire, the lower the wire resistance (Yusuf Lubis et al., 2020).

Basically, the resistance of a conductor describes the degree to which the conductor impedes the flow of electric current. Conductor resistance refers to the resistance or difficulty encountered by an electric current as it flows through a conductor. Each conductor has resistance associated with its physical characteristics and material properties (Ainslie et al., 2018; Early, 2020).

In this experiment the analysis of the resistance of the conductors was carried out by different wires, namely constant wire and nichrome wire (Fortuna et al., 2018). This experiment was conducted to analyze the length of the constant and nichrome wire against the resistance of the conductor. Therefore this article is entitled "The Effect of Constant and Nichrome Wire Length on the Resistance of Conductors".

RESEARCH METHOD

This study uses quantitative research methods, namely research that takes data in the form of numbers. Overall the quantitative research observed was literature study, background research problems, identification of research problems, formulating/explaining research problems, research objectives, compiling research instruments, laboratory trials, collecting data, analyzing data, and compiling research reports. The experimental method is described as a way of mastery by conducting experiments in its delivery with the aim that practitioners can experience gaining knowledge which involves direct enjoyment and reflection on that experience (Risalatul Lutfiyah Shoum, 2014).

Data collection uses tools and materials in the laboratory room, namely there are power checkers/voltmeters, multimeters, resistors, pawns, conducting wires (constant wires, nichrome wires), crocodile claws. In addition, the researcher uses a practicum book to record the data obtained and other writing tools such as pens and rulers. The scheme of this Conducting Obstacle research is to first prepare the tools and materials needed in the research, connect the conducting wire to the pion or voltage source, namely the power supply/voltmeter, multimeter, use crocodile claws or connecting cables, then make sure the measurements are from the power check/voltmeter, multimeter to measure resistance and also the electric current, then measure the cross-sectional area/thickness of the wire from the constant wire and nichrome wire, then measure the length of the conducting wire, then record the research results in the practicum book and analyze the data, then make a conclusion from the research on the conduction resistance obtained. This type of research uses mixed method research, where mixed method research is a research method that involves collecting quantitative and qualitative data (Hadju et al., 2022; Masrizal, 2011). This study uses the Explanatory type of approach, this type uses a quantitative approach as an initial stage to examine the relationship between certain variables broadly, and then uses qualitative data to explain the results found. (Sari et al., 2022). Qualitative data is used to gain a deeper understanding of the context and mechanisms underlying the relationships found.

RESULTS AND DISCUSSION

This study aims to determine the effect of wire length on the value of the conductor resistance. Variables in this study include wire length (L), cross-sectional area (A), resistance (R), and wire type resistance (ρ). This research was conducted using constant type wire with a thickness diameter of 0.35 mm and nichrome wire with a thickness diameter of 0.33 mm. The experiment was carried out 3 times with different wire lengths, namely 18.5 cm, 37 cm and 55.5 cm. The data obtained are as follows:

Table 1. Data from Constant Wire Observations

Cross-sectional area	Voltage (Volt)	Pawn	Wire Length (m)	Conducting Wire Type Barriers x 1 (ρ) (Ωm)
		1	1.85 ± 0.0002	0.9 ± 0.55
	0 ± 0	2	0.37 ± 0.001	2 ± 0.25
		3	5.55 ± 9.0	3 ± 0.16
		1	1.85 ± 0.0002	1 ± 0.5
0.035 ± 0.01	3 ± 0.5	2	0.37 ± 0.001	2 ± 0.25
		3	5.55 ± 9.0	3 ± 0.16
		1	1.85 ± 0.0002	0.9 ± 0.55
	6 ± 0.25	2	0.37 ± 0.001	1.9 ± 0.26
		3	5.55 ± 9.0	2.9 ± 0.17

Table 2. Data on Nichrome Wire Observations

Cross-sectional area	Voltage (Volt)	Pawn	Wire Length (m)	Conducting Wire Type Barriers x 1 (ρ) (Ωm)
		1	1.85 ± 0.0002	3.1 ± 0.16
	0 ± 0	2	0.37 ± 0.001	5.9 ± 0.08
		3	5.55 ± 9.0	8.5 ± 0.05
		1	1.85 ± 0.0002	3.4 ± 0.14
0.035 ± 0.01	3 ± 0.5	2	0.37 ± 0.001	5.9 ± 0.08
		3	5.55 ± 9.0	8.6 ± 0.05
		1	1.85 ± 0.0002	4 ± 0.01
	6 ± 0.25	2	0.37 ± 0.001	5.9 ± 0.08
		3	5.55 ± 9.0	8.4 ± 0.05

The relationship between the length of the wire and the resistance of the conductor can be explained by Ohm's law. Ohm's law states that the electrical resistance (R) of a conductor is directly proportional to its length (L) and inversely proportional to its cross-sectional area (A). In other words, the longer the conducting wire, the greater the resistance it creates. The formula that describes this relationship is poured in equation 2 that has been presented. Therefore, the results of the data analysis regarding the resistance of the conductors are presented in Table 3 below.

Table 3. Constant Wire Conductor Resistance Value

Voltage (volt)	Pawn	Delivery Barriers (Ω)
	1	$2{,}58 \pm 0{,}09$
0	2	$5{,}01 \pm 0{,}06$
	3	$7{,}29 \pm 0.06$
	1	$2{,}65 \pm 0.18$
3	2	$5{,}01 \pm 0.09$
	3	$7{,}29 \pm 0.06$
	1	$2{,}58 \pm 0{,}19$
6	2	$5{,}02 \pm 0.09$
	3	$7{,}31 \pm 0.06$

When using a constant type wire in the first experiment with a voltage of 0 volts and a wire length of 18.5 cm, a resistance of 2.58 ± 0.09 Ω was obtained. When the length of the wire was extended to 37 cm (second experiment), the resistance increased to 5.01 ± 0.06 Ω. Likewise in the third experiment with a wire length of 55.5 cm, the resistance increased 7.29 ± 0.06 Ω. Meanwhile, when the voltage was increased by 3 volts, in the first experiment with a wire length of 18.5, the conductor resistance was 2.65 ± 0.18, while when the wire was 37 cm the resistance was 5.01 ± 0.09 and when the wire length was 55.5 cm the value of the conductor resistance was 7.29 ± 0.06. meaning that this resistance is increasing. When the voltage is increased again by 3 volts, with a wire of 18.5 cm you get a resistance value of 2.58 ± 0.19, and when the wire is 37 cm long it is 5.02 ± 0.09, and when the wire is 55.5 cm long the resistance is 7.31 ± 0.06.

Table 4. Nichrome Wire Resistance Values

Voltage (volt)	Pawn	Delivery Barriers (Ω)
	1	$2{,}45 \pm 0.2$
0	2	$4{,}47 \pm 0.11$
	3	$6{,}12 \pm 0{,}08$
	1	$2{,}43 \pm 0{,}2$
3	2	$4{,}47 \pm 0.11$
	3	$6{,}10 \pm 0.081$
	1	$2{,}39 \pm 0.20$
6	2	$4{,}47 \pm 0.1$
	3	$6{,}14 \pm 0.08$

When using nichrome type wire in the first experiment with a voltage of 0 volts and a wire length of 18.5 cm, a resistance of 2.45 ± 0.2 Ω was obtained. When the length of the wire was extended to 37 cm (second experiment), the resistance increased to 4.47 ± 0.11 Ω. Likewise in the third experiment with a wire length of 55.5 cm, the resistance increased 6.12 ± 0.08 Ω. When the voltage is increased by 3 volts, the pion 1 produces a conductor resistance of 2.43 ± 0.2, the pion 2 with a wire length of 37 cm is 4.47 ± 0.011 and when the wire length is 55.5 cm, the wire resistance is 6.10 ±0.08. When the voltage is also different by 6 volts, on pawn 1 d with a wire length of 18.5 cm, you get a conductor resistance of 2.39 ± 0.20, and on pawn 2 with a wire length of 37 cm you get 4.47 ± 0.1 and when the wire length is 55.5 cm you get a conductor resistance of 6.14 ±0.08.

From these results, both contact type wire and nichrome wire, when the wire is longer, the value of the resistance of the conductor is farther away, this is because the longer the wire, the longer the resistance automatically, because the distance that the current must travel to the obstacle is getting farther. Also, a longer wire has a greater resistance because the electric current has to pass through more material and has the same cross-sectional area. This causes the resistance of the conductor to increase as the length of the wire increases. From the results of the analysis of the calculation of the resistance of the conductor, graph 1 is presented concerning the effect of the length of the wire on the resistance of the conductor. In the graph, it can be seen that the longer the wire used, the greater the value of the conductor resistance, which is presented as follows.

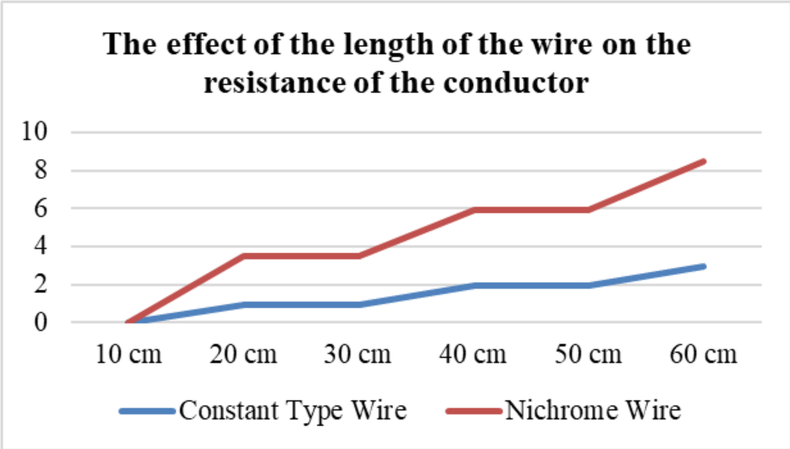

Figure 1. The Relationship Between Wire Length and Conductor Resistance

From graph 1 it can be seen that the relationship between the length of the wire (L) is proportional to the resistance of the wire (R) because when the length of the wire is added, the resistance of the wire is enlarged and vice versa the shorter the wire the smaller the resistance of the wire. And it can also be seen in graph 1 that the type of wire affects the resistance of the wire, the smaller the type of wire (p), the greater the resistance of the wire (R). Then the type of wire is inversely proportional to the resistance of the wire. In this case, the nichrome wire has a greater conducting resistance than the constant wire.

According to (Kasli, 2020) in his research on the type resistance on different wires, it states that each material must have certain resistance. The difference in the resistance of a particular material is referred to as the specific resistance. According to (Ariyanto et al., 2018) in his research, it states that the resistance value of the conducting wire for each variation in the length of the wire will change and increase.

CONCLUSION

We would like to express our gratitude to the lecturers in the Physics Laboratory for Advanced School I course and the Laboratory Assistant for the Advanced School Physics 1 course who have helped and guided the practical activities.

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