COMPARATIVE ANALYSIS OF TESLA COIL LIGHTS ON SHIPS ON GENERATOR FUEL EFFICIENCY

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ABSTRACT

At the moment This development technology transportation Keep going develop rapidly , specially technology shipping . This thing encourage developers _ technology make tool For transfer energy electricity without use cable . Currently _ cable conductor Still become most effective way in transfer energy electricity . In research This writer make analysis comparison of tesla coil lights on board to efficient material burn the generator using method data collection on board and from a number of reference journal . Especially on accommodation boat For minimize power that will be charged to the machine auxiliary (generator). Comparison This use literacy from a number of tesla coil journal with method utilise voltage tall For create Medan electricity around electrode delivery provided _ distance with electrode recipient so that as if second electrode the works as capacitor . The purpose of doing it analysis This For determine how much efficient material burn the generator if light on board Tesla coil based . The results obtained own mark quantitative that the tesla coil is used on ships can give efficiency and minimizing usage material burn on the generator.

Keywords: *Wireless , tesla coil , generator power*

1. INTRODUCTION

Tesla coil is a medium that can transmit energy electricity through intermediary air . This Tesla coil produce voltage high , frequency tall However the current is very weak . Basically the tesla coil produces wave induction electro magnetic that can turn on neon lights with move the internal atoms light that . [1]

In the current era This distribution energy electricity Still use wire sender . Can be seen position wire the conductor is convoluted and not nice seen matter That can make technician difficulty in the process of maintenance and repair . Specifically For on board consumption material the generator also burns more many, from more coasts high and to its efficiency is low . In research This discuss about distribution energy electricity in a way wireless with burden light or can turn on light without wire conductor (*wireless).*

Wireless energy was first proven by someone originating scientist _ from Smiljan , Yugoslavia in 1893 named Nikola Yesla , in his research about wireless energy transfer. Nikola Tesla builds A named tower _ Wardenclyffer , in his research Nikola Tesla experienced A failure consequence happen diffusion power , in 2007 _ surprising , Marin Soljacic researchers at the Massachusetts Institute of Technology (MIT), succeeded turn on light bulb 60 watts of electricity at a distance of 2 meters, they find that For get efficiency transmission energy high electricity , between _ sending and receiving must own frequency the same resonance (Muchtar., 2013).

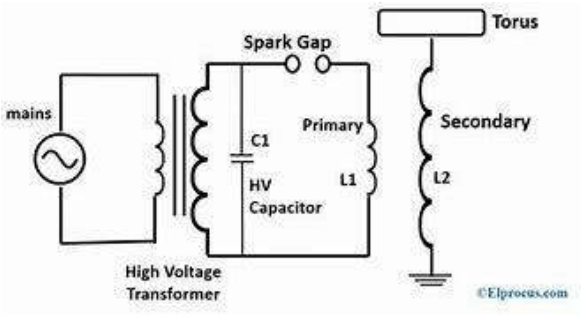
Writer will make A Suite design system tesla coil technology for burden lamp consisting _ from Suite transmitter that uses Tesla coil and circuit technology recipient who uses it burden A lights . Suite transmitter works For converts DC energy into AC energy for send magnetic field through frequency and then induce to burden recipient (Mung et al., 2015). Writer will analyze with use big different windings in the circuit the transmitter as well as test distance and intensity light the light produced with use method the same testing that has been done previously (Muchtar, 2013).

2. METHOD

2.1 Research analysis for a national seminar This writer use methodology writing as following

A. Literature Study
   The literature study method is a series of activities relating to methods of collecting library data, reading and taking notes, and managing research materials (Zed, 2008:3)
B. Data Collection
   methods used to collect and analyze data. By collecting data, researchers can answer certain questions, test hypotheses, and assess results. Both qualitative and quantitative research each have different data collection methods (Revou , 200 2)
C. Quantitative data
   Data from results nature research _ structured or patterned so that variety of data obtained from source research more easy read .

2.2 Research This use Tesla coil design with high voltage generator and spark gap . Like picture under this :



Component Analysis Suite Tesla coil prototype :

1. Input Source Input voltage This Tesla coil prototype sourced from 5 V battery . This input source is used For turn on the HV Generator so produce voltage 400 Kv .
2. Mini High Voltage Generator HV Generator is A module For increase voltage electricity . For turn on module This required DC electrical input source with a voltage of 3 V to 6 V current 1 A to 4 A so produces an AC output voltage high 400 kV with current 0.005 A.
3. Switch is an electronic media as breakers and connectors current electricity . Switch paired between input source with HV generator.
4. Spark Gap Spark gap this tesla coil use two _ conductor form screw 0.5 cm in diameter with length 3.5 cm which is not each other touch with distance 1 cm so produce jump electricity . Buffer made from 3/2 dim PVC paralon pipe with height 5 cm with objective can A little dampen the sound produced from jump electricity . Leap electricity happen because voltage from very high prototype with rated 400 kV so capable pass with intermediary air . Without the existence of a spark gap in the process of transfer electricity No will Can done and only will damage Tesla coil prototype .
5. For primary winding is created in helix shape ie spiral upwards _ surround coil secondary with distance 2.5 cm between primary and secondary windings . Use copper enamel wire with a wire diameter of 0.3 mm and quantity 10 coils . _ For know long wire in the primary winding is used with equation 1 as following :

   l = (2.π.r) x 10 Turns
   l = (2 x 3.14 x 4) x 10
   l = 25.12 x 10 l = 251.2 cm l = 2.5 m

6. Coil secondary show coil copper wrapped around a 3/2 dim or 3.81 cm AW PVC pipe with installed height 50 cm very neat winding so that can maximize electricity transfer intermediary air from This Tesla coil prototype . On the winding secondary use wire copper 0.3 mm or 0.03 cm in diameter . However wire tied only 40 cm on the paralon pipe with the remaining 10 cm is used as a torus. Calculation long twisted cable _ with equation 2 as following :

   N = l/D
   N = (40 cm) /(0.03 cm)
   N = 1333 Coils

   Where N is amount coil copper enamel wire on PVC paralon pipe with calculation on so can fulfilled to 1400 turns to simplify the work process and calculations . Before installation wire copper required moreover formerly know Paralon pipe radius and quantity _ _ winding . Where the radius of the pipe is 1.9 cm and the amount 1400 turns . _ So it's long copper enamel wire can is known with equality as following :

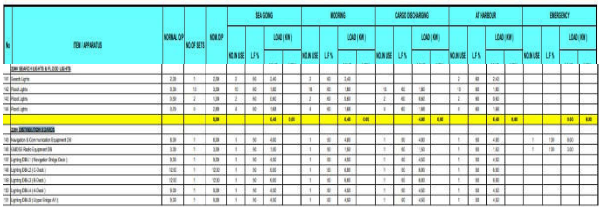
   l = (2.π.r) x 1400 Turns
   l = (2 x 3.14 x 1.9) x 1400 l = 11.932 x 1400
   l = 16704.8 cm
   l = 167 m

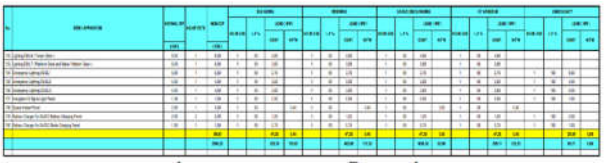
7. Ground / Grounding is system in field technique electricity , term earthing electricity refers to the connection something equipment or installation electricity on the ground so that can secure man from sting electricity , and security components installation from danger voltage abnormal current . End of copper enamel wire coated aluminum foil with 20 cm2 wide for distribution electricity to the ground can spread in a way evenly .
8. Torus In the figure , a Torus is made from tube 8 cm in diameter with 4 cm high coated aluminum foil. This torus placed on top end coil related secondary _ with coil secondary .
9. Load Light Load uses 5 W, 8 W TL lamps , 5 W LED and 5 W Incandescent 10.
10. Measuring tools use a multimeter that can measure voltage , current and frequency . Measuring tools This used For know results from the tesla coil output which can be accepted load . Then For measure flux light use application Android based lux meter with distance tool measure and load light is 1 cm

2.3 Usage Power lights on the ship

Got it from the ship database moment do practice sea normal consumption a Power lights are classified as following :

1. Search Lights & Flood Lights
2. Distribution Boards





conditions boat sail or normal on board of 107 kW and generator power of 700 kW

2.4 References journal as comparison

Study This take a number of journal as decider How many big power used _ on board If using Tesla coils.

2.4.1 Quoted from journal entitled ' Design _ Build a Tesla Coil as a Wireless High Voltage Electric Power Transmitter With a lamp load , it uses 1400 turns coil , with input source voltage 5 V DC and current in the direction of 1 A from the smartphone charger adapter. Experiments carried out use burden TL lamps 5 W, 8W, LED 5W and incandescent 5 W. The more Far distance transmitter with burden so the more A little voltage can accepted load . The current received at the load No orderly . The power received increases Far Darak burden with transmitter so power received _ burden the more reduce

2.4.2 Cited from journal entitled 'TESLA COIL TECHNOLOGY SYSTEM DESIGN FOR LAMP LOADS' The voltage used by the power supply is 9V, 10 V, 11 V, and 12 V with magnitude current 3 A. Using amount the same winding , ie use light finger with dop brand 8W. Test results show The more bright intensity light the light produced . At a distance nearest namely a radius of 5 cm with voltage parameters of 9 Volts, 10 Volts, 11 Volts and 12 Volts, then intensity the light produced namely 311 Lux, 317 Lux, 339 Lux, and 391 Lux. Light distance with coil transmitter so magnetic field produced by the coil transmitter will the more big , and getting bigger big supplied voltage _ so magnetic field generated by the transmitter will the more big too

3. RESULTS AND DISCUSSION

Determine big power used _ For light on board of 107 kW when boat currently sailing .
On the power generator of 700 kW with usage material burnt 1,747 MT. price material burn on the ship at the bunker in Singapore at $ 610.00/MT or equivalent with Rp. 9,554,430.00. So deep One day usage found :

Tot. price material burn per day = price /MT X usage /MT

=9 ,554,430.00 X 1.747
=15 ,985,050

Within the period time One day normal use of materials burn amounting to Rp. 15,985,050

If you know the day used light on board of 107 kW then can done minimalize usage Power light with use Tesla coil method . Far more efficient Because No use cable . Can be counted use comparison from mark quantitative obtained _ from results testing reference journal .
In the journal ' Design Build a Tesla Coil as a Wireless High Voltage Electric Power Transmitter With Lamp Load ' known input voltage of 5V and 1 A is increased by the main HV generator of 400 kV Maximum value power received _ load at a distance of 3 cm on all burden light with 8 W TL lamp , 5 W LED , 5 W incandescent . 8 W TL lamp accepted Power of 0.00286 W and 5 W LED lamps of 0.000897 5 W lamps receive Power of 0.0044 W.

Application on board use TL lamp 18 W. then For know power that can be received light use formula comparison .

- Incoming power at voltage

  P = VXI
  P = 5V X 1 A
  P = 5 W

  Power input 5 W can be turn on 8 W TL lamp that can accept Power of 0.00286 W using a Tesla coil for an 8 W TL lamp on .

- Voltage input to the ship For all over light of 107 KW or 107,000 W. Lamps using TL 18 W then input power of .

  $Pin_1 / Pout_1 = Pin_2 / Pout_2$
  5 W / 0.00286 W= 107,000 W / $Pout_2$
  5W X $Pout_2$ = 306.02 W
  $Pout_2$ = 61,204 KW

  So the TL lamp is 18 W on the ship can using a tesla coil so power that can be received amounting to 61,204 kW

  Usage power on board of 107 kW, when using a power Tesla coil of 61,204 kW far more economical and efficient rather than lamp that uses cable .

4. CLOSING

Conclusion case

Based on results testing Good in a way measurement nor in a way calculation from wireless electric tesla coil using method capacitive transmission so can taken conclusion as following :

1. From the results The wireless electric Tesla coil prototype design was obtained that the more big Tesla coils and more Lots amount coil will depends on the size distance receiver reception and more the amount of voltage transferred is also large so that the more distant energy transfer electricity can done . Then reason voltage rises as well down is mark capacitance between electrode transmitter and electrodes the recipient who caused it side oscillations _ recipient

different , increasingly in accordance oscillation between coil transmitter and receiver primary coils that is transistor oscillations against coil feed back .
2. Based on results from planning wireles electric tesla coil then obtained that difference load and distance will produce varying efficiency , where _ the more near distance transmitter with recipient so will the more the resulting efficiency is also good , and vice versa
3. Use of Tesla coils on ships can minimize power and consumption material burn the generator

Suggestion

1. With multiply amount coil coil and also enlarge the tesla coil is expected capable enlarge distance reception on the rectifier circuit .
2. With increase oscillator driver circuit expected can increase Power stand input voltage and current so can transfer energy electricity more big again .

5. LITERATURE

[1] Fahlevi , M. 2018. " Designing a Wireless Electric Tesla Coil Using the Capacitive Method Transmission ." (thesis). Medan: Muhammadiyah University of North Sumatra

[2] Widiatmiko , E. 2017. Tesla Coil Voltage High.http ://majalah1000guru.net/2017/12/ koiltesla /. Accessed December 1, 2020.

[3] Muchtar, M., Studi, P., Elektro , T., Teknik, A., & Makassar, I. (2013). New Transmission Breakthrough Electrical Energy Without , (November), 14–15. Sulistyo , B, A. (2016). Design Build and Analyze a Prototype Circuit for Wireless Electric Power Transfer

[4] SW Pratomo , " Design Wireless Power Transfer System For Unmanned Aerial Vehicle (Uav) Micro Quadcopter Type," no. 3, 2016.

[5] I Putu Nanda Nugraha Utama , I Wayan Arta Wijaya . Design Build a Tesla Coil as a Wireless High Voltage Electric Power Transmitter with a Light Load . SPECTRUM Journal Vol. 8