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Implementation of mechanical storage of electricalenergy using windup technology

Raghavendra Dakuri Venkata

Electrical Power EngineeringSchool of Engineering
University of Greenwich, Kent, UK
sunil.dakuri@gmail.com

***Abstract*:** The project utilised to implement the hand-powered energies and storage system by using the advantages of the current energy generation and storage system. This project has also improved the construction of a simple windup technology with the hand crankshaft, gearbox system and tiny dynamos. The generated energy or the outcome of the design was efficient to drive the power circuits system. This project experimentally described the different directions to improve the better windup technology applications to navigate the larger power circuits and utilise the environmental energies into the conversion of electrical and reducing of the power usage utilities and used as a primary power source of ever applications. Overall, the design dealt with several different areas, such as the design consideration and technical issues and thoroughly investigated the principle behind the mechanism and the further modifications of the current technologies.

Index Terms: Mechanical Storage, Windup Technology

I.INTRODUCTION

The mechanical title storage of electrical energy; indicated that the project deals with the concept of transformation and storage of points from one form to another form such as automatic to the electrical state of energies. Widely described in windup products such as windup radio and windup torch, which stores mechanical energy in a spring and, when it is released, will power an electrical generator [Kermit, 1989]. The battery storage system was inefficient since its storage capacity was not constant. The primary purposes of the project were improving the energy storage system for much more time, reducing

Figure 1. The Block Diagram of Mechanical Storage of Electrical Energy System

1.1 Mechanical Input System

The mechanical input devices produced the energy with the help of giving some external kinetic energies. However, the input devices could be applied kinetic energy such as hand crankshaft or windup technology instruments. The primary concept of this procedure was the generation of a hand-powered input mechanism.

1.2 Storage System

The storage systems will store and supply the electrical energies, and the central concept was to keep the powers for a long time. It can be either any storage device like batteries or supercapacitors.

1.3 Electrical Output System

The electrical output devices will utilise the energies from the energy storage system and use that for the loads like glowing LED's were applied in this project.

I. BACKGROUND OF PROJECT

The background of the storage system of electrical energy was that it worked and operated under the conditions of giving input supply to the system that will generate electric power and stores it through any storage mechanism. Previously these types of technologies were applied in the windup radios and torches. These types of equipment worked under the conditions of giving some hand-powered windups to the system through dynamos and then transmitted into the system's output. Generally, the electrical energy storage system in a windup torch operates with the help of hand-powered input energy. With a hand crankshaft, the mechanical energy would be created and transformed into electrical and then transmitted into the storage system like batteries. When required, it will supply the system's outputs and directly connect to the storms' storage system. Because of the limited characteristics of the batteries, it was unable to store the same amount of power for a more extended period [Puscas et al., 2010]. So like, these energies are can't be used and stored for a sufficient period as per the requirement of the application.

2.1 Mechanical Energy Generation

The energy generation system's basic concept was that by giving some hand-powered mechanical inputs to the system, the energies would generate and store in the storage system. It's developed with the help of wind up technologies like rotating hand crankshafts. The powers will induce with the rotation of dynamo, which will store in the storage system.

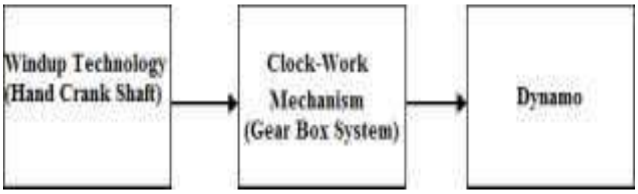

Figure 2: The Block Diagram of Mechanical Energy Generation System

The windup Technology consisted of a hand crankshaft to rotate the generators clockwise or in anticlockwise directions. The windup technology system was connected to the clockwork mechanism for the rotation of dynamo, thereby producing energy [Oman, 1991].

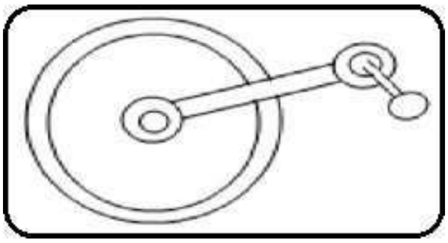
Figure 3: The Schematic Diagram of Windup Technology

The Clockwork Mechanisms mainly consist of a gearbox system for maintaining the system's rotations in either direction. It was holding the steel plate with the generator attached, with the help of a generator underneath. The gears will rotate when the power is applied, putting the dynamo in operation and producing voltage. [Lawton, G.Sept 2004]

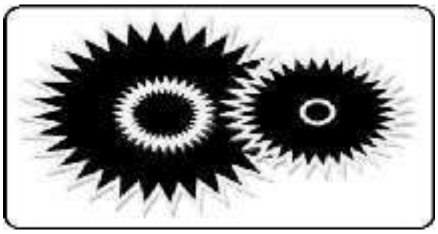
Figure 4: The Schematic Diagram of Gear Box Mechanism

The dynamos are also known as electrical generators. The generator requires spinning rotors to generate energy with the help of hand-powered rotations. The rotor consists of copper turnings which produce magnetic fields to the system. The fixed magnetic field created electricity by faraday's law of induction and transmitted the energies from the winding mechanism to the storage system. [Bredthauer et al., 1987]

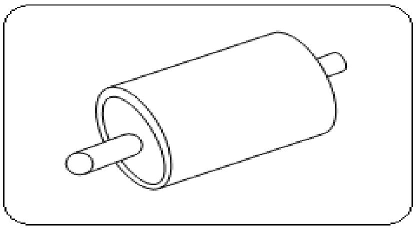

Figure 5: The Schematic Diagram of Dynamo

2.2 The Capacitor Storage System

It stores relatively tiny amounts of electrical energy. The higher-powered capacitors have raised the possibility of the applications. The double-layer capacitor looks to have the capability to support such functions as power stabilisation systems. The capacitors consist of two conducting plates separated by a dielectric insulator. The capacitance of capacitor Cin farads, when subjected to a potential difference of V volts,

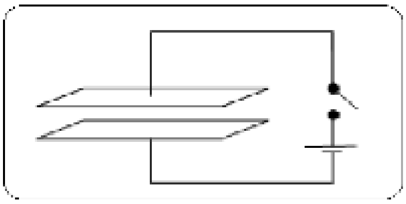

Figure 6: The block diagram of Capacitors

$W = \frac{1}{2} CV^2$, Where the capacitance can states
$C = A\varepsilon/d = AK/d$
A = Plate Area ε = Permittivity of Dielectric D = Plate Separation K = Dielectric Constant
U.E. = ½ KE2 gives the energy density

2.3 The Series Regulator Circuit

The Series Regulator Circuit was a very efficient and straightforward to implement the mechanical storage of electrical energy systems. It consisted of a rectifier, storage system, regulator section and a LED. The bridge rectifier transmits the induced energies clockwise or in an anticlockwise direction into a storage system. A series regulator circuit will regulate the voltage to the required level. [S.S, F.C, 1984]

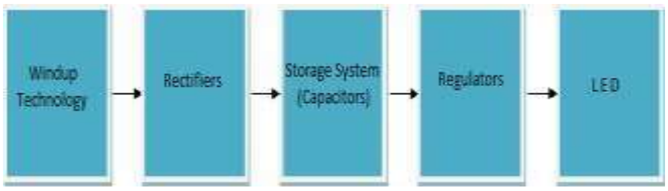

Figure 7: The Block Diagram of Series Regulator Circuit

2.4 The Schematic Design of Mechanical Storage of Electrical Energy using with the Series Regulator System:

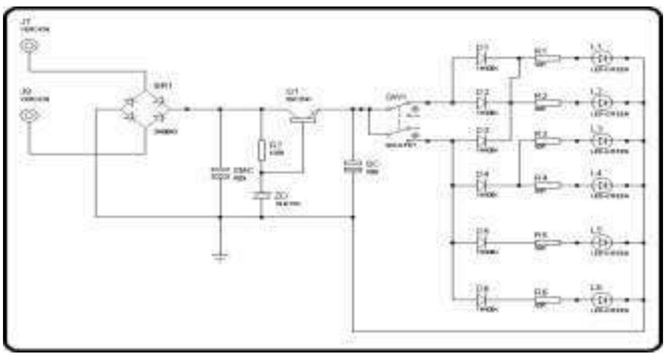

Figure 8: The Circuit Diagram of Series Regulator System

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2.4.1 The Electronic System:

This electrical energy storage system design includes a bridge rectifier, a series pass Zener regulator, a supercapacitor for storing the energies and a switch (while in power generation, the system energies must be in not utilise and stored in the storage system itself). The D.C. generator produced about 6 volts D.C. by turned of the hand crankshaft.

2.4.2 The Bridge Rectifier:

The bridge rectifier usually converts A.C. voltages to D.C voltage. That allows the generator to the PCB in either direction of conduction to connect to the series regulator.

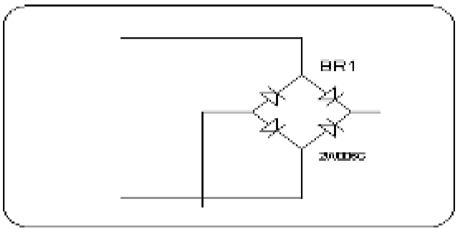

Figure 9: The Block Diagram of Bridge Rectifier Section

2.4.3 The Series Regulator

The series regulator circuit consists of a Transistor Q1, Resistor R7 and Zener Diode Z.D. The transistor functioned as a voltage follower, and the Zener diode fixed the base of the transistor to 4.3 volts, which caused the emitter to be about 0.7volts less than the Zener diode's voltage.

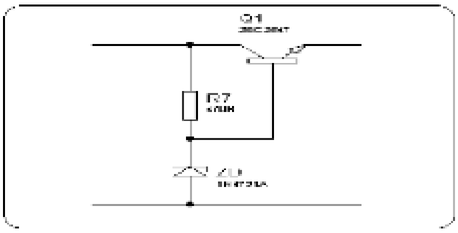

Figure 10: The Block Diagram of Series Regulator Section

2.4.4 The Super Capacitor for Energy Storage

The transistor voltage was 3.6 volts connected to the storage system. When the handle has turned, the supercapacitor will be charged up and store the induced energies into the storage system. The more windups will generate more power, and it kept in a storage system of supercapacitor for a more extended period.

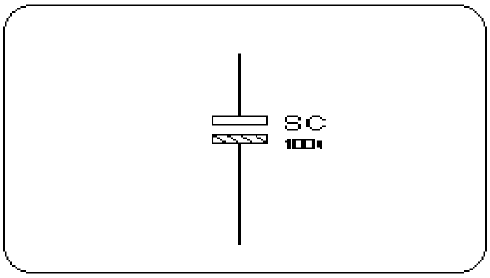

Figure 11: The Block Diagram of Super Capacitor Section

II. RESULTS

3.1 Super Capacitor Charging Characteristics

Connect the series regulator circuit into the windup technology and apply the windup rotations to the system. The supercapacitor increases the charging characteristics concerning cycles of the windup technology.

Figure 12: Schematic Diagram of Super Capacitor Charging System

01	1 min	110 rotations	4.43 volts
02	2 min	105 rotations	5.07 volts
03	3 min	116 rotations	5.53 volts
04	4 min	125 rotations	5.65 volts
05	5 min	119 rotations	5.87 volts
06	6 min	104 rotations	6.17 volts

Table 1: Tabular Readings of the Super Capacitor Charging Characteristics

3.2 Super Capacitor Discharging Characteristics

The supercapacitors are connected parallel to improve the system currents. During the discharge, characteristics of the supercapacitor were associated with a 100k resistor to reduce the discharging time; the discharging time will take place in 2 hours to reach the minimum voltages.

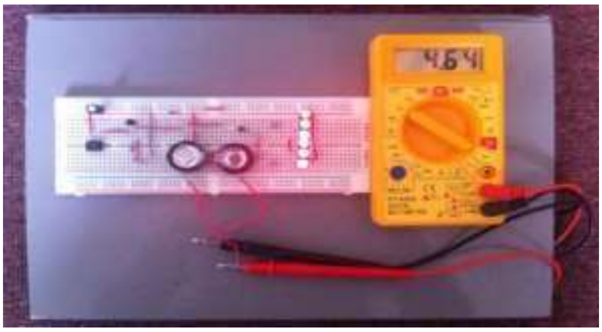

Figure 13: Schematic Diagram of Super Capacitor Discharging System

S.NO	TIME	VOLTS
01	0 min	6.00 volts
02	1 min	4.23 volts
03	2 min	3.61 volts
04	3 min	3.18 volts
05	4 min	2.87 volts
06	5 min	2.67 volts
07	6 min	2.52 volts
08	7 min	2.42 volts
09	8 min	2.35 volts
10	9 min	2.29 volts
11	10 min	2.25 volts
12	11 min	2.18 volts
13	12 min	2.16 volts
14	13 min	2.14 volts
15	14 min	2.12 volts
16	15 min	2.11 volts
17	16 min	2.10 volts
18	17 min	2.09 volts
19	18 min	2.07 volts
20	19 min	2.67 volts
21	20 min	2.52 volts
22	21 min	2.67 volts
23	22 min	2.52 volts
24	23 min	2.67 volts
25	24 min	2.52 volts

Table 2: Tabular Readings of the Super Capacitor Discharging Characteristics

III. DISCUSSION OF RESULTS

The mechanical storage of the electrical system was conducted successfully with the help of a simple regulation system. Both conditions were implemented and achieved successfully by showing the automated energy generation using a hand crankshaft and storage system. It also worked efficiently by storing the energies up to 6 to 9 volts for 2 hours. It also proves the mechanical process of the electrical storage system practical results of charging and discharging characteristics. The connection of the printed circuit board performs adequately. Still, the pulse width modulation system could not achieve the exact system outputs in practical implementation because of the mechanical noises.

IV. CONCLUSION

In conclusion, the mechanical storage of electrical energy was implemented with the help of windup technology and determined the charging and discharging characteristics successfully. The super capacitor's working was much more efficient than the batteries, and it delivered enormous amounts of power, but it stored less energy. In terms of the design and construction of supercapacitors, those were more efficient than the other sources. The methods utilise the advantages of both windup and storage technologies to reduce the system's drawbacks. This compact, cost-effective design met the system's significant aims and objectives with minimum duration. It effectively demonstrated the mechanical to electrical storage design with the help of a hand shaft mechanism. The switch used within the system was an attractive feature of this design, and with this design, the user can control the system's operation at any time. Furthermore, the design experimentally demonstrated the current storage mechanisms and utilised the best method with minimum cost.

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