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Indicator With Emergency Lighting Function Camping Lights

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ABSTRACT

The motivation of this paper, when camping outdoors, we are afraid of running out of electricity, so we can generate electricity by hand-cranking. We use a small AC generator, high-capacity lithium-ion batteries, and high-brightness LED lights to make the control circuit, LED driver circuit, voltage regulator circuit, and USB charging and discharging circuit, and the brightness is adjustable in three steps. It can also be used as cell phone mobile power.

Keywords: Emergency Lighting, LED, Camping light

1.INTRODUCTION

Traditional camping lights, using incandescent bulbs, electricity consumption and can not be charged. The new hand-crank rechargeable camping light uses energy-saving high-brightness LED bulbs, which can be recharged by hand-crank. Hand-cranked power generation to 60 revolutions per minute to produce 5.2V external power charging, lighting brightness three adjustable, can be used as cell phone mobile power.

2. SYSTEM STRUCTURE

The system structure block diagram is shown in Figure 1. Screening small AC generators, high-capacity lithium batteries, high-brightness LEDs and other components to create charging circuits, control circuits and LED driver circuits.

Traditional camping lights use incandescent bulbs, which consume power and cannot be recharged. For this reason, we developed a new hand-crank rechargeable camping lights, using energy-saving high-brightness LED bulbs, small AC generator, can use hand-crank power to recharge. It can also be charged with an external 5 volt USB power supply, the battery selection of lithium can be used when going out camping, first charge their own, ready to use [1-6].

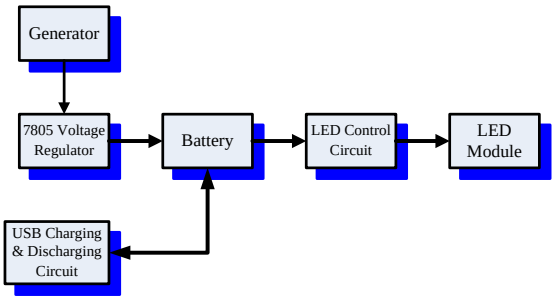

Figure 1: System structure block diagram

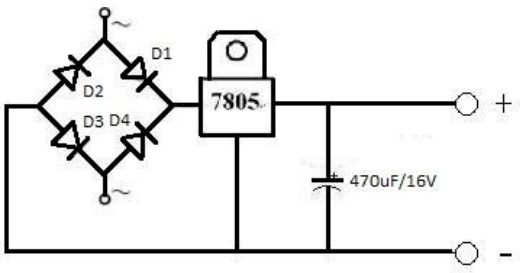

Figure 2: Rectifier and regulator circuit diagram

Figure 2 shows the diagram of the rectifier-regulator circuit, Figure 3 shows the photo

of the rectifier-regulator circuit, Figure 4 shows the photo of the combination of the LED driver circuit and the mechanical switch circuit, Figure 5 shows the LED driver circuit, the first section of the LED setting, lighting up the inner 4pcs. The second LED setting is to light up the outer 8 LEDs. The third LED setting lights up all 12 LEDs. Figure 6 shows the USB charging and discharging circuit - LTC3428, and Figure 7 shows the LTC3428 boost circuit.

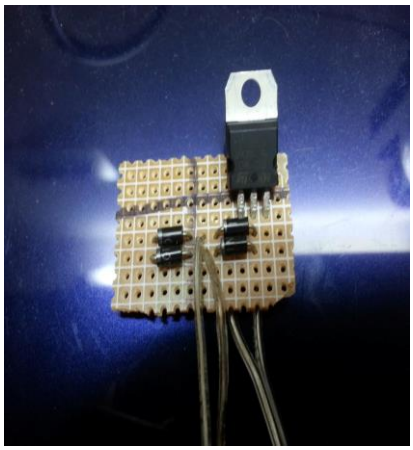

Figure 3: The Photo of Rectifier Regulator Circuit

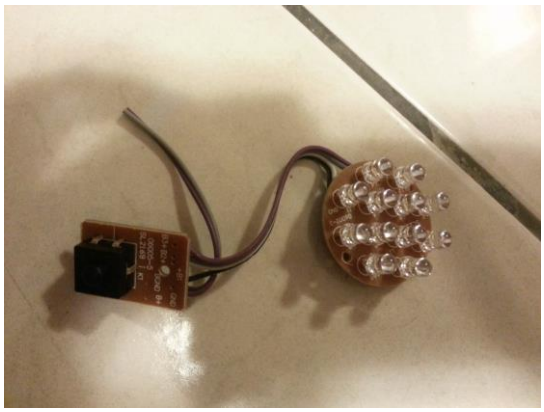

Figure 4: Photograph of the combination of LED driver circuit and mechanical switch circuit

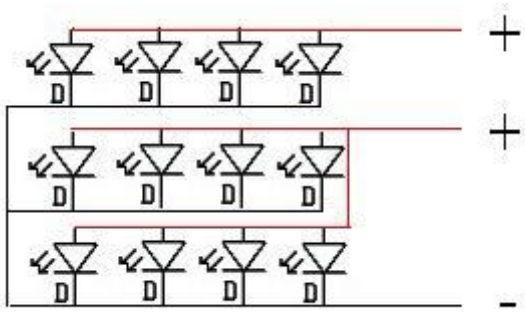

Figure 5: LED driver circuit

In Figure 7, the output voltage

$$V_{OUT} = 1.243V_{in} \cdot (1 + \frac{R_1}{R_2}) =$$

$$= 1.243 \cdot 3.3 \cdot (1 + \frac{121k}{383k}) = 5.3978(V) \approx 5(V)$$

, DC 5V and 2A power can be output to the load.

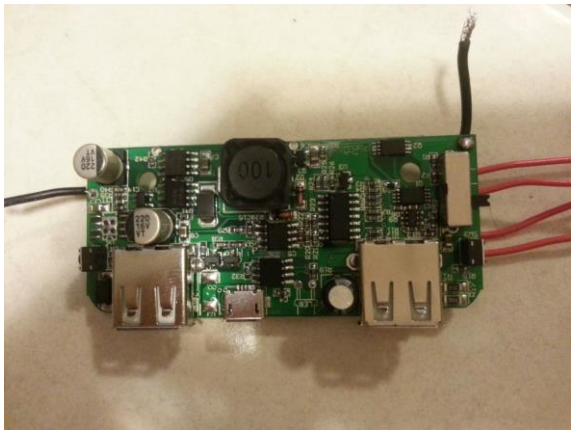

Figure 6: USB Charge and Discharge Circuit - LTC3428

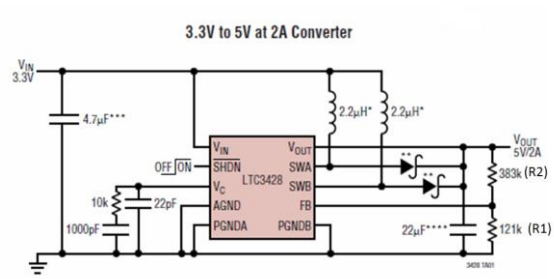

Figure 7: LTC3428 Boost Circuit Diagram

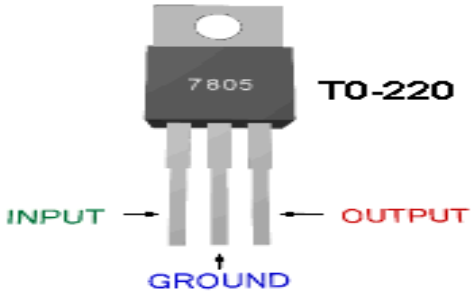

Figure 8: 7805 pin diagrams

2.1 Related Components

2.2.1. LED driver circuit

Also known as light emitting diode Currently, light emitting diode driver chips can be classified by type: constant voltage driver chips, constant current driver chips and pulsed driver chips. Among them, the

constant voltage driver chip is generally the one we commonly see.

2.2. 2. Switching circuit

It means that a circuit can control the action of other circuits by external control signals or its own spontaneous periodic ON or OFF alternation.

2.2.3. IC7805

The input voltage of IC78xx series is between DC5~18V, the output voltage of 7805 is ideally 5V, the actual output voltage is between 4.8~5.2V. First find the transformer, the use of 110V to 6V transformer can be, the transformer out of the AC power by the bridge rectifier to DC and then capacitor filtering, capacitors with 470μF, 35V and then is connected to the 7805, connected to a 100μF and 0.033μF capacitors. As shown in Figure 8, 7805 for the 3 pins are 1: INPUT 2: GND 3: OUTPUT,

2.2. 4. Micro three-phase alternators

3-24v brushless small power wind power hand crank silent power motor.

(1) Appearance size: length 46mm * width 38.5mm * height 28.5mm * outer diameter 29mm.

(2) Motor parameters: 3v-24v, rated rotation: 300-6000rpm, rated power: 0.5-12W

(3) The product adopts brushless technology, large power generation, no noise, no wear and tear, long life.

(4) Suitable for hand cranking radio, flashlight, cell phone 3V, 6V, 9V, 12V battery hand cranking charging or other electronic products hand cranking charging.

Figure 9: Micro three-phase alternator

3. PARTS & Specifications

Table 1: Parts & Specifications

Parts	Quantity
Micro three-phase alternator	x 1
7805 voltage regulator IC	x 1
Ｉ R4001 Diode	x 4
470 μF Capacitor	x 1
18650 Battery (3.6V 3000mah)	x 2
High brightness LED	x 12
Four-stage switch	x 1
USB charge & discharge module	x 1

Figure 10: The first section of the LED settings, light up inside 4 LEDs

Figure 11: The second section of the LED settings, light up the outer 8 LEDs

Figure 12: The third section of section LED setting, lighting all 12 LEDs

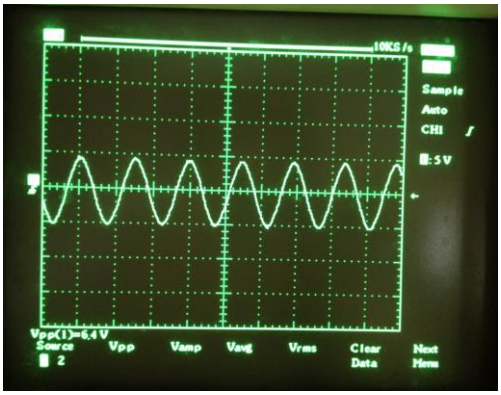

Figure 13: AC motor output waveform (60 revolutions per minute up to 6.4V)

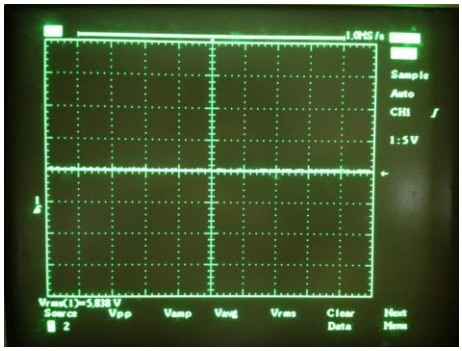

Figure 14: Waveform after bridge rectification (up to 5.8V at 60 revolutions in one minute)

4. USAGE & IMPLEMENTATION

Table 1 shows parts & specifications. Figure 10 shows the first section of the LED settings in the usage method. Figure 11 shows the second section of the LED settings. the setting of the second LED segment and Figure 12 shows the third section of the LED settings.

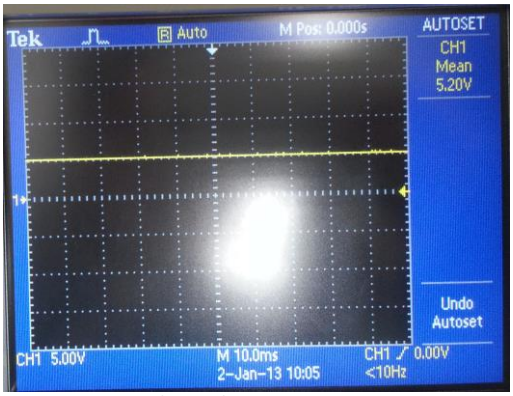

Figure 15: The waveform after 7805 voltage regulators (up to 5.2V at 60 revolutions in one minute)

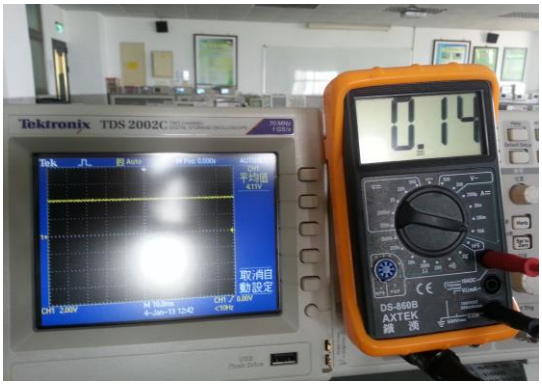

Figure 16: The waveform after the battery is installed (up to 4.11V, 0.14A at 60 revolutions in one minute)

In the implementation, Figure 13 shows the AC motor output waveform (up to 6.4V at 60 revolutions in one minute). Figure 14 shows the waveform after bridge rectification (up to 5.8V at 60 revolutions per minute). Figure 15 shows the waveform after 7805 voltage regulator (up to 5.2V at 60 revolutions in one minute). Figure 16 shows the waveform after the battery is installed (up to 4.11V, 0.14A at 60 revolutions in one minute). Figure 17 shows the finished product of the system using USB to charge the camping light. Table 2 shows the battery life under different loads.

Figure 17: The finished product of the system using USB to charge the cell phone

Table 2: The battery life under different loads

Use time (based on two 3.7v 3000mah batteries)
Output
LED light four up, consumption current 0.11A, about 54.5 hours of use
LED light eight up, consumption current 0.3A, can use about 20 hours
LED light all up, consumption current 0.34A, can use about 17.6 hours
Cell phone charging, consumption current 0.57A, about 10.5 hours of use
Input
USB charging (5V,1A), input current 0.6A, take 10 hours to fill up
Hand crank charging (1 minute 60 revolutions), input current 0.14A, full charge takes 42.8 hours

5. CONCLUSION

This project is the study of a new hand-crank rechargeable camping light, using power-saving high-brightness white LED bulbs, the use of hand-crank AC generator to generate electricity, but also with an external power supply 5 volt USB charging function. This paper can achieve the purpose of LED camping light with emergency lighting function.

Screening small AC generator, high capacity lithium battery, high brightness LED light production, control circuit and LED driver circuit production. Hand-cranked power generation to 60 revolutions per minute to produce 5.2V external power charging LED lighting brightness two adjustable also can be used as 5V 6000mA cell phone mobile power.

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Conflict Of Interest: None

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