CLEAN ENERGY FABRICATOR USING THERMIONIC ENERGY CONVERTER

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ABSTRACT:

Electricity is essential for any kind of machinery to work. Heat produced from the machinery can be converted to produce clean energy which can be recycled. Clean energy is non-polluting and environment friendly. Recycling of energy helps in reducing the operating cost of machineries. This project is about the reuse of the waste heat produced by a machine while its operation to electricity break through. More than 70% of heat is being produced by the coil, when it is being heated for its operation. However heat produced from the coil goes out of no use. This project proposes on to produce the electricity from the waste heat, this electricity produced from waste heat is again given as a part of the input to the machine, thus reducing its power consumption. This causes a reduction in power consumption, due to the reuse of heat energy produced by the machineries. This project is environment friendly and can be used in industries, to make use of the waste energy being produced.

Keyword- Thermionic energy converter, Heat energy, Batteries, Electricity.

I. INTRODUCTION

Clean energy is any source of energy that does not pollute the environment. Clean energy is similar to that of renewable energy, that can be replenished after its use. Electricity has become a basic need in the modern lifestyle. The demand for electricity is increasing immensely and so is its use. Many industries employ machineries that consume a large amount of electricity and emit waste energy in the form of heat. The heat produced from these machineries pollute the environment. This project introduces to make use of the this waste energy produced and reroute it to operate the machinery. Thermionic energy converter can be used to observe the waste energy produced and reroute its use. This project proposes on to produce the electricity from the heat produced as waste, this electricity produced from waste heat is again given as a part of the input to the machine, thus reducing its the power consumption. The energy produced by this method can also be used to operate external small scale devices.

Thermionic energy conversion is the direct production of electric power from heat by thermionic electron emission. A thermionic converter consists of a hot emitter electrode from which electrons are vaporized by thermionic emission and a colder collector electrode into which they are condensed after conduction through the interelectrode plasma. The resulting current, typically several amperes per square centimetre of emitter surface, delivers electrical power to a load at a typical potential difference of 0.5–1 volt and thermal efficiency of 5–20%, depending on the emitter temperature (1500–2000 K) and mode of operation. The energy thus produced is stored in a battery and rerouted as input energy to the machinery.

II. PROBLEM STATEMENT:

Every machine produces a heat which goes out without any utilization, or other process that uses energy, as a byproduct of doing work. All such processes give off some waste heat as a fundamental result of the laws of thermodynamics. Compared with the original energy source the heat which is being wasted has a very low utility. Sources of waste heat include all manner of human activities, natural systems, and all organisms, for example, a refrigerator warms the room air, an internal combustion engine generates high-temperature exhaust gases, and electronic components get warm when in operation. This wasted heat will also make the room more warmer, at a high temperature.

Instead of being "wasted" this heat can be utilized and converted into a useful source of energy, or a portion of heat that would otherwise be wasted can be reused in the same process if make-up heat is added to the system (as with heat recovery ventilation in a building).

Thermal energy storage, which includes technologies both for short- and long-term retention of heat or cold, can create or improve the utility of waste heat (or cold). One example is waste heat from air conditioning machinery stored in a buffer tank to aid in night time heating. Another is seasonal thermal energy storage (STES) at a foundry in Sweden. The heat is stored in the bedrock surrounding a cluster of heat exchanger equipped boreholes, and is used for space heating in an adjacent factory as needed. An example of using STES to utilize natural waste heat is the Drake Landing Solar Community in Alberta, Canada, which, by using a cluster of boreholes in bedrock for interpersonal heat storage, obtains 97 percent of its year-round heat from solar thermal collectors on the garage roofs. The biggest point sources of waste heat originate from machines (such as electrical generators or industrial processes, such as steel or glass production) and heat loss through building envelopes. The burning of transport fuels is a major contribution to waste heat.

III. PROPOSED SOLUTION:

The proposed solution consists of a set of machineries infrastructure, using a simple thermionic energy converter and a battery.From a physical electronic viewpoint, thermionic energy conversion is the direct production of electric power from heat by thermionic electron emission. A thermionic converter is the one which consists of a hot emitter electrode from which electrons are vaporized by thermionic emission and a colder collector electrode into which they are condensed after conduction through the interelectrode plasma. The resulting current, typically several amperes per square centimeter of emitter surface, delivers electrical power to a load at a typical potential difference of 0.5–1 volt and thermal efficiency of 5–20%, depending on the emitter temperature (1500–2000 K) and mode of operation. The total amount of heat which is being produced from the thermionic device is the square of the emitter device. This current which is being produced is given as a part of the input to the machine itself. On this idea the power consumption of the device can reduced to a certain extent.

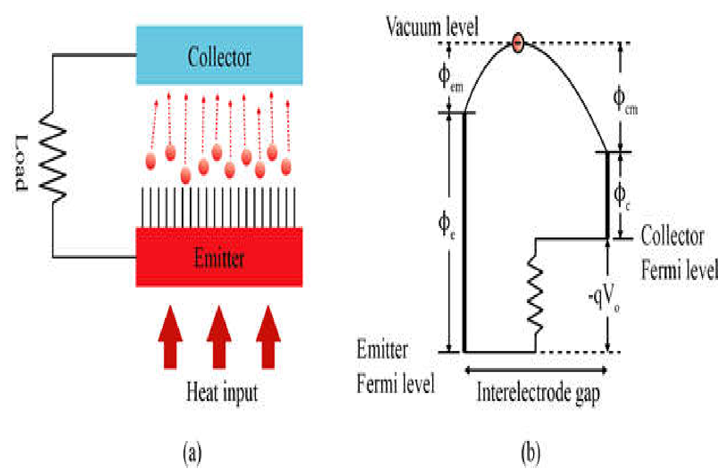
IV. CURRENT PRODUCTION:

Harvesting renewable and clean energy is often associated with solar cells or photovoltaic cells, which are novel technology devices for collecting solar energy to produce useful electricity. These technologies have been evolving over the past several decades, to achieve the ultimate goal, i.e., higher conversion efficiency. In order to meet growing energy demands and to reduce our dependency on the conventional energy resources, alternative yet efficient methods of energy conversion from another easy-obtained source of energy (heat) are being considered and evaluated. Efficient, direct thermal energy to electricity conversions could be a suitable alternative to the conventional approaches, as they eliminate losses due to mechanical work during the conversion process, which reduces the overall efficiency. Although the technology has been discovered and promised good results, the progress in the development of thermionic energy converters (TECs) has been limited due to the lack of advanced technology and fabrication techniques. At very high temperature this thermionic energy converter is used to produce electricity. The thermal emission is the basic principle behind this energy converter—the evaporation of electrons from conductors at high temperatures. In its simplest form, the converter consists of two electrodes in the parallel plate capacitor geometry, and it uses the thermionically emitted current to drive an electrical load. This technology has existed for over half a century, with applications mostly limited to space use. However, with recent advancement in Nano/micro fabrication, together with engineered high-temperature materials, two dimensional materials, and powerful computing methods, e.g. density functional theory (DFT), we are committed to revolutionizing this technology to be more robust with higher efficiency. To be specific, our work is focused on fabricating thermally robust emitters, ultra-low work function collectors, and micron-meter scale inter-electrode gap.

Modern micro fabrication techniques promise to overcome many of the challenges for TEC devices: large electrode spacing's, thermal shorting, and thermal expansion mismatches. In the last few years, we have demonstrated thermionic energy converters based on suspended cathodes. Silicon carbide (Sic) is an attractive material for electronic devices operating at high temperatures and high power. The three most common Sic polymorphs (3C, 4H, and 6H) have relatively large band gaps and are chemically and thermally stable, with thermal decomposition temperatures of over 2500°C. Recent developments in Sic surface micromachining have made possible the fabrication and testing of poly-Sic MEMS devices that operate at temperatures of 1000°C or higher. These superior properties allowed us to design a thermionic emitter.

The work function is the surface property that determines how easily electrons can escape into a vacuum or gas environment, with lower work functions generally facilitating electron emission. Discovery of thermally stable materials with low work functions has promising applications in thermionic energy converters (TECs) and photon-enhanced thermionic energy converters (PETECs). Traditional methods of work function lowering rely on alkali coatings, which were first developed in the first half of the 20th century. However, these coatings typically enable work functions only as low as 1.5 to 1.0 eV. For applications such as the (PE)TEC, whose output efficiency is highly dependent on its anode's work function, a work function of over 1eV is not low enough for efficient operation. Previous calculations have shown that with a work function of 0.5eV a TEC device can theoretically reach an efficiency of over 50% under 1000x concentrated solar radiation, which almost doubles the efficiency of the theoretical limit of single junction solar cell. By using DFT, combining with various of experimental approaches, we are looking for ultra-low work function materials.

Density functional theory (DFT) is a first-principles-based quantum mechanically motivated method that can offer new insights into the atomistic processes that control the work functions of various surfaces. DFT enables a systematic approach in the discovery of new nanostructured multilayer materials with low work functions. Therefore, many promising film coating combinations can be efficiently investigated for the first time.



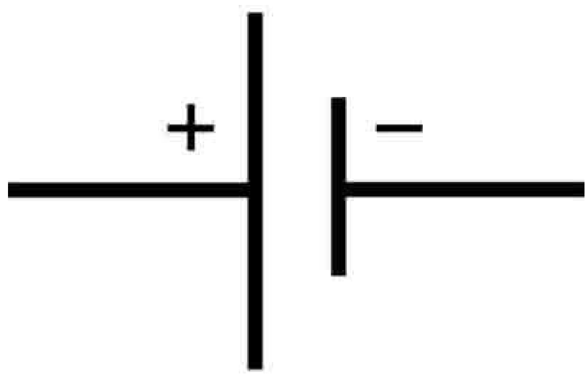
V. BATTERY SOURCE:

An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that when connected to an external circuit will flow and deliver energy to an external device. When a battery is connected to an external circuit, electrolytes are able to move as ions within, allowing the chemical reactions to be completed at the separate terminals and so deliver energy to the external circuit. It is the movement of those ions within the battery which allows current to flow out of the battery to perform work. The usage has evolved additionally to include devices composed of a single cell.

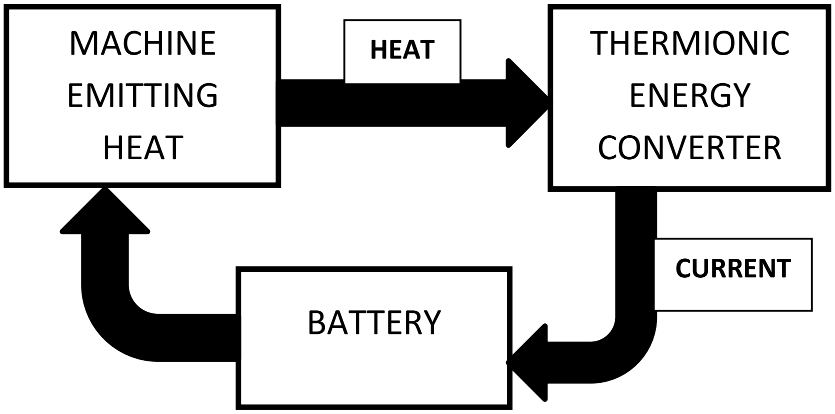
Primary (single-use or "disposable") batteries are used once and discarded; the electrode materials are irreversibly changed during discharge. Common examples are the alkaline battery used for flashlights and a multitude of portable electronic devices. Secondary (rechargeable) batteries can be discharged and recharged multiple times using an applied electric current; the original composition of the electrodes can be restored by reverse current. Examples include the lead-acid batteries used in vehicles and lithium-ion batteries used for portable electronics such as laptops and smartphones.

Batteries come in many shapes and sizes, from miniature cells used to power hearing aids and wristwatches to small, thin cells used in smartphones, to large lead acid batteries used in cars and trucks, and at the largest extreme, huge battery banks the size of rooms that provide standby or emergency power for telephone exchanges and computer data centers.

ELECTRONIC SYMBOL OF BATTERY:



BLOCK DIAGRAM:



VI. ARCHITECTURE:

Every machines which is being used in every industry is the source that which generates a heat while its operation, this generated heat goes out waste of no use. Our design proposes a structure to produce current from this waste heat.

From the machine which emits heat, is connected with the thermionic energy converter. This energy converter is the one which converts the heat energy produced from the machine into the current source.

The current source produced from the energy converter will be the square of the area of emitter source. This current which is produced from the thermionic energy fabricator is again given as the part of the input to the machine. This machine is the one from which we took the waste heat and converted this waste heat as current.

VII. CONCLUSION:

Clean energy is environment friendly. This method can be used to reduce the electricity consumption of the device which in turn reduces its expense. This method can be employed in industries as well as in home appliances. The energy produced can be stored and can be used later. The energy produced by this method can also be used to operate external small scale devices.

VIII. REFERENCES:

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https://en.wikipedia.org/wiki/Thermionic_converter