Design and Construction (1KVA) a Quite Low-Cost Inverter with High Efficiency and Quality Output Capabilities

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Abstract- ***Power inverter is an electrical appliance that can be used with DC battery as an alternative source of energy supply in the event of power failures and energy crisis. It is cheap, clean, very conducive and silent when in operation and a very reliable source of power supply The methodology was divided into four stage firstly determination of the oscillatory frequency and determination of the transistor switching current is being determined from the oscillating frequency and also the drain current of the MOSEF was determine. The input of the inverter is 12V while the output voltage is 220V and 4.5A. In conclusion the inverter has good efficiency and durable. it is recommended that increasing is the power rating and conversion of the inverter to acts like uninterrupted power supply to generator***

Indexed Terms- ***Low-Cost, High Efficiency and Good Quality Output***

I. INTRODUCTION

Power electronic systems are used widely to convert electric energy from one form to other using electronic devices. Four basic power electronics functions are AC to DC conversion, DC to AC conversion, DC to DC conversion and AC to AC conversion. These basic functions are used to build power supplies, DC transmission systems, electric drives and others (Mushairin, 2006).Mobility and versatility have become a must for the fast-paced society today. People can no longer afford to be tied down to a fixed power source location when using their equipment. Overcoming the obstacle of fixed power has led to the invention of a DC/AC power inverter (Dustin *et al.*, 2004).Companies, Industries, Organizations, Homes among the others are posed with a major problem of power shortage especially here in Nigeria. Although in developing countries, shortage of power is a problem commercially and domestically. New offices have tremendous load on already existing power generation sources. When added to rapidly increasing private and domestic demand, the situation, especially in certain urban areas becomes devastating. Simply stated, our ability to consume power is growing faster than our ability to supply power. Under such conditions, failure will occur unpredictably and without any warning due to stresses on the inadequate sources of power. Hence, there is need for the alternative sourceof power which could fill in the gap and cover the lapses of shortage in power supply. Overcoming this obstacle led to the invention of DC/AC power inverters.At the early stage, sun was the source of energy for generating power. Due to the inadequacy of the power generated through this source, there was a need to find other ways to improve the power supply when the generating station could not meet the demand of the people. As the technology advances, the hydroelectric generation was developed, gas firing generating station, and wired tubing methods of generating power supply were developed. In spite of all these developments, there was still failure in electrical power generation as a result of obsolete equipment at the generating stations. There was still need to find alternative for solving the problem. As a result of this, some options like alternators, inverters and others were developed (Babarinde*et al.*, 2014).Power inverter is an electronic device that has the ability to convert the direct current (DC) from the battery or solar cells (panels) into an alternating current (AC) which is the conventional form that powers many electrical appliances. It maintains a continuous supply of electric power to the connected loads or equipment when the utility power is not available.Inverters are generally used in a host of applications that include variable speed drive,

uninterruptible power supplies, flexible AC transmission systems, (FACTA), high voltage DC transmission systems (HVDC), active filters among the others (Geethalakshmi and Dananjayan, 2010).An inverter used for backup power in a grid connected home will use grid power to keep the batteries charged, and when grid power fails, it will switch to drawing power from the batteries and supplying it to the building electrical system. For a business home or office, a reliable power source is invaluable for preventing lost data on computer systems. Most modern inverters also include overvoltage and under voltage protection, protecting sensitive equipment from dangerous power surges as well (Alaskan, 2006). An inverter is a device that takes a direct current input and produces a sinusoidal alternating current output. An inverter needs to be designed to handle the requirements of an energy hungry household yet remain efficient during periods of low demand. The efficiency of inverter is highly being dependent on the switching device, topology and switching frequency of the inverter (Mushairin, 2006).Alternating current (AC) power is used as a power source as well for transmission purpose because it can be generated and also converted from one voltage to another. Transmission of AC power over long distance is still used until now, however it results in relatively high transmission loses. The types of loses are transient stability problem and operational requirements such as dynamic damping of electrical system may also arise along the transmission line. Direct Current (DC) transmission is an alternative which overcomes most of this problem. Besides that, it is more economically feasible only when the transmission distance exceeds 500 to 600 km, underwater cables for the case in a small distance transmission. At the receiving end HVDC is converted back to HVAC or LVAC. The design of an inverter is referring to the requirement of point distribution and economical aspect (Muhamed, 2010).Power inverters come in all shapes and sizes, from low power functions such as powering a car radio to that of backing up a building in case of power outage. Inverters may come in different varieties, differing in price, power, efficiency and purpose. Power inverters are used today for many tasks like powering appliances in a car such as cell phones, radios and televisions. They also come in handy for consumers who own camping vehicles, boats and at the construction sites where an electric grid may not be as accessible to hook into (Hazlan, 2009).Inverters, besides coming in a wide variety of power capacities, are distinguished primarily by the shape of the alternating current wave they produce. The three major waveforms are square-wave, modified sinewave and true sine-wave. Square wave inverters are largely obsolete, as the waveform shape is not well suited for running most modern appliances, and prices have come down considerably for the superior modified sine wave and true sine wave types (Alaskan, 2006).An inverter with the use of many batteries is capable of generating power for hour's even days depending on the capacity of the battery and the load connected to it, and this power could be very crucial since in some office set-up, a failure of about one minute could cause losses that could run into millions. Many researchers have worked on design of inverters with different capacities to archives their aims. The aim of the work is to design and construct (1KVA) a quite low cost inverter with high efficiency and quality output capabilities to power some selected domestic appliances such as computers, television sets and lighting systems. the objectives include but limited to Design and construct an inverter to serve as an alternative source of power supply, reduce cost of electricity bills, reduce carbon discharges and Improve and reliable energy source.

II. METHODOLOGY

Materials used for this research to be complete, there is a need to know the components used in the design. In electronics, the power system is designed in such a way that the equipment always has power so that it can function effectively. These components include: Integrated Circuit(IC) SG 3524 PWM, IC NE 555 Timer, IC LM 393 (LM 324) Comparator, Transistor, Metal Oxide Semiconductor Field Effect Transistor (MOSFET), Transformer, Relay Switch, Rectifier, Capacitor, Diode, Light-Emitting Diode (LED), Resistor, Breakers, OptoIsolator, Operational Amplifier

Design

In one simple inverter circuit, DC power is connected to a transformer through the center tap of the primary winding. A switch is rapidly switched back and forth

to allow current to flow back to the DC source following two alternate paths through one end of the primary winding and then the other. The alternation of the direction of current in the primary winding of the transformer produces alternating current (AC) in the secondary circuit. The electromechanical version of the switching device includes two stationary contacts and a spring supported moving contact. The spring holds the movable contact against one of the stationary contacts and an electromagnet pulls the movable contact to the opposite stationary contact. The current in the electromagnet is interrupted by the action of the switch so that the switch continually switches rapidly back and forth. This type of electromechanical inverter switch, called a vibrator or buzzer, was once used in vacuum tube automobile radios. A similar mechanism has been used in door bells, buzzers and tattoo machines.As they became available with adequate power ratings, transistors and various other types of semiconductor switches have been incorporated into invertercircuit designs. Certain ratings, especially for largesystems (many kilowatts) use thyristors (SCR). SCRs provide large power handling capability in a semiconductor device, and can readily be controlled over a variable firing range. when not coupledto an output transformer, produces a square voltage waveform due to its simple off and on nature as opposed to the sinusoidal waveform that is the usual waveform of an AC power supply. Using Fourier analysis, periodic waveforms are represented as the sum of an infinite series of sine waves.

Based on the basic H-bridge topology, there are two different fundamental control strategies called basic frequency-variable bridge converter and PWM control (Kassakian, 1991). Here, in the left image of H-bridge circuit, the top left switch and others are in counterclockwise order. For the basic frequency-variable bridge converter, the switches can be operated at the same frequency as the AC in the electric grid (60 Hz in the U.S.). However, it is the rate at which the switches open and close that determines the AC frequency. We could control the on-off states of the switches to adjust the AC magnitude and phase. We could also control the switches to eliminate certain harmonics. This includes controlling the switches to create notches, or 0-state regions, in the output waveform or adding the outputs of two or more converters in parallel that are phase shifted in respect to one another.

CONCLUSION

In conclusion, the inverter was able to convert an input voltage of 12V DC source into an output voltage of 220V AC power supply and a frequency of 50Hz and it can now be use to power electrical appliances rated 700W depending on the capacity of the battery and can also reduce family spending on energy utilization because of its non-fuel consumption, low price and maintenance cost as compared to the other sources of power supply in the market but it cannot be used on three-phase machines, domestic appliances with voltages above 240V and below 220V, and devices with 60Hz frequency. The total cost of all components used in the construction of the circuit was around GHC200 as compared to the GHC400 modifier sine wave inverters on the market now.

RECOMMENDATIONS

More research should be made into power inverter systems design as a more cost-effective means of electric power generation in our part of the world due to adverse climatic change which poses threat to the already available power supplies and care should also be taken in the installation, maintenance and usage of power inverter systems, extreme caution should be taken when handling batteries and electrolyte and final, for the constant unavailability of electronic components in the market, the School of Engineering should study research proposals of students and made available the basic components for each academic year, the Electrical and Electronic Engineering Department should also put up a state of the art electrical and electronic laboratories to enable students to undertake their final projects and also have first-hand information and usage of modern tools or gadgets.

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