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Explore our latest gallery of Editors’ Picks.Browse Editors' Favorites Last updated at Dec. 16, 2024 by Teachoo An electric generator is a device which converts mechanical energy into electrical energy. It looks like Principle of Electrical generator The electrical generator works on the principle that when a straight conductor is moved in a magnetic field, then current is induced in the conductor. Types of Generators Generator is used to generate electric current. The electric current can be - AC current or DC current. Thus, Electric Generators is of two types AC Generator - Generates Alternating Current (AC current) DC Generator - Generates Direct Current (DC current) Note : Whenever Electric Generator is mentioned, we will assume it is a AC Generator Construction of an AC Electric Generator AC Electric Generator consists of Rectangular Coil of Wire ABCD A strong horseshoe magnet (or 2 different magnets) - If we take 2 magnets, North Pole of first magnet faces South Pole of Other Magnet, as shown in figure... The coil is placed perpendicular to the magnet as shown in figure The ends of coil are connected to two rings - R 1 and R 2 The external conducting edges of rings R 1 and R 2 are connected to two stationary brushes - B 1 & B 2 respectively The inner side of the rings is insulated and attached to the axle The axle is mechanically rotated to rotate the coil These brushes are attached to a galvanometer to show the flow of current in the circuit Working of an AC Electric Generator Let's look at the working of an AC Electric Generator Suppose axle is rotated clockwise, so coil is also rotated clockwise, Side AB of Coil moves up and side CD Moves down Applying Fleming's Right Hand Rule on side AB, force is upwards, magnetic field is left to right, So, current flows into the paper i.e. from A to B And applying Fleming's Right Hand Rule on side CD, force is downwards, magnetic field is left to right, So, current flows out of the paper i.e. from C to D Hence, current flows into the Brush B 2 , moves along galvanometer and finally enters B 1 Hence, we say current flows from B 2 to B 1 in the external circuit. After half a rotation, Side CD Comes on left side and AB Comes on Right Side Now, on left side CD comes down, Applying Fleming's Right Hand Rule on side CD, force is downwards, magnetic field is left to right, So, current flows out of the paper i.e. from D to C And on right side, AB comes up, Applying Fleming's Right Hand Rule on side AB, force is upwards, magnetic field is left to right, So, current flows into the paper i.e. from A to B Hence, our circuit is now DCBA, and current moves in the opposite direction Hence, we say current flows from B 1 to B 2 in the external circuit. Thus, after every half rotation, direction of current changes. Hence, Alternating Current is produced Now, lets look at DC Generator - where current is in one direction Note: To convert AC generator to DC Generator, we use a commutator with split rings (Split, not slip). Just like we do in an Electric Motor Construction of DC Generator DC Electric Generator consists of Rectangular Coil of Wire ABCD A strong horseshoe magnet (or 2 different magnets) - If we take 2 magnets, North Pole of first magnet faces South Pole of Other Magnet, as shown in figure... The coil is placed perpendicular to the magnet as shown in figure The ends of coil are connected to a split ring commutator - P and Q The external conducting edges of rings P and Q are connected to two stationary brushes - X & Y respectively The inner side of the rings is insulated and attached to the axle The axle is mechanically rotated to rotate the coil These brushes are attached to a galvanometer to show the flow of current in the circuit Working of a DC Electric Generator Let's look at the working of a DC Electric Generator Suppose axle is rotated clockwise, so coil is also rotated clockwise, Side AB of Coil moves up and side CD Moves down Applying Fleming's Right Hand Rule on side AB, force is upwards, magnetic field is left to right, So, current flows out of the paper i.e. from C to D Hence, current flows into the Brush Y , moves along galvanometer and finally enters X Hence, we say current flows from Y to X in the external circuit. After half a rotation, Side CD Comes on left side and AB Comes on Right Side And Split ring P is connected to coil CD and split ring Q is connected to coil AB. Which keeps the direction of current in the circuit same. Hence, current flows from Brush Y , moves along galvanometer and finally enters X Hence, we say current flows from Y to X in the external circuit. Thus, direction of current after every half rotation, direction of current changes. Hence, Alternating Current is produced How does Power Stations increase Current and Voltage produced? They increase current and voltage produced by Using Electromagnet in place of permanent magnet Large number of turns of conducting wire(More the turns in wire more the magnetic field) Soft iron Core on which coil is wound Rotating the coil faster Questions NCERT Question 4 - The essential difference between an AC generator and a DC generator is that AC generator has an electromagnet while a DC generator has permanent magnet. DC generator will generate a higher voltage. AC generator will generate a higher voltage. AC generator has slip rings while the DC generator has a commutator. View Answer NCERT Question 6 (b) - State whether the following statements are true or false. An electric generator works on the principle of electromagnetic induction. View Answer NCERT Question 16 - The essential difference between an AC generator and a DC generator is that View Answer Question 1 Page 237 - State the principle of an electric generator. View Answer Question 4 Page 237 - A rectangular coil of copper wire is rotated in a magnetic field. The direction of the induced current changes once in each (a) two revolutions (b) one revolution (c) half revolution (d) one-fourth revolution View Answer Generators are essential components of electricity and power generation, especially during a blackout. There are many generators available today for commercial and residential use, and it’s because of the fine-tuning of these power-generating machines over the years that so many options are available. They are widely used throughout the world, and electricity would not be possible without their invention. Michael Faraday discovered and created the first transformer in August 1831. Based on this apparatus, he made the first electric generator. Faraday’s Law is the principle used to generate almost all electrical power. The Beginning – 1700’s The early 1700s could be considered the birth of the steam engine, which was later referred to as the generator. In 1781, James Watt developed the most efficient, powerful steam engine after noticing a huge loss of energy during operation in the Newcomen 1712 engine due to the amount of energy required to heat up the cylinders when it started. Because of his discoveries, the unit of measurement for energy is known as the watt. After many people were inspired to look for new developments in the industry, the 1700s became a remarkable era for the progression and development of generators. The Development of Electricity – 1800’s The 1800s were a momentous period for the development of generators. In the early 1800s, the skills of Michael Faraday allowed him to invent the electric generator, which also played a significant role in the invention of electricity. The generator was functioned by the phenomena of magnetic induction, known as Faraday’s Law” which states that when a conductor is placed in a varying magnetic field, an electromotive force is generated. Rotating two magnets within the poles that surrounded it caused a high current with a low voltage. Dynamo was the first electric generator built in 1832 by a French instrument maker named Hippolyte Pixii. This generator was produced based on Faraday’s principles and was the first electric generator to supply power. Many inventors sought ways to use Faraday’s induction principle to generate electricity mechanically in the 1860s and 1870s. That’s when two types of generators emerged, one of direct current electricity and one of alternating electricity. Both AC and DC generators were used from the 1870s and on, but in the late 1870s, Thomas Edison introduced the Electric Lighting System using DC generators. The amount of power generated by this system was enough to power up light for commercial and residential properties. Inventors began looking for ways to distribute central-station power over longer distances because of the success of central power distribution in the 1880s, but Edison’s direct current system was flawed for this. Edison used 12-volt bulbs and motors, but a lot of energy is lost as heat, and a higher voltage would have made transmission down long wires easier. Nikola Tesla then improved the existing AC generator, causing significant changes in the generator progression. Tesla developed a Polyphase AC system that combined several different AC flows to produce a single polyphase AC output. Tesla’s system, with a practical AC motor and generator, as well as transformers to raise and lower voltage, allowed power companies to use larger power plants, enabling them to distribute more extensive power networks. This helped reduce costs, increasing the demand for electricity, especially in residential areas. The Expansion Period – 1900 and 2000’s During the 1900s, several generators were designed, inspired, and motivated by the interventions and developments since Faraday’s first generator. By the 2000s, the need for generators to be moved increased, resulting in the invention of the portable generator. They came with all the necessary elements but in smaller sizes and included a starting mechanism and a battery so they could be turned on fast and easily. Image By: Virrage Images, Shutterstock The First Electric Generator Michael Faraday was a British physicist and chemist known for his invention of the first electric generator. Michael Faraday created two devices to produce electromagnetic rotation. In 1831, using his Homopolar motor led to the discovery of electromagnetic induction. This induction ring was the first electric transformer. His experiments went on to serve as the foundation for modern electromagnetic technology. Michael Faraday discovered the working principle of electromagnetic generators in 1831. This major development, known as a Faraday Disk, paved the way for our modern electrical era. In 1832, based on Faraday’s Law, Hippolyte Pixii built the first Dynamo generator. Dynamos were the first electrical generators that could provide power to industry, and they served as the foundation for many later electric-power conversion devices. This early design was flawed as it had a low average power output. Around 1860, an Italian physics professor named Antonio Pacinotti solved this problem by developing the first dynamo that provided continuous DC power. Werner Von Siemens and Charles Wheatstone developed a more powerful and useful dynamo a few years later by replacing the weak permanent magnet with a self-powered electromagnet. Pacinotti’s design was reinvented by Zénobe Gramme in 1871. He filled the magnetic field with an iron core, which provided a better path for the magnetic flux. In 1876, American Charles F. Brush was credited with developing the most reliable and efficient dynamo design. Brush was awarded one of his 50 career patents for the “perfect” open coil-type dynamo, a forerunner of the modern generator. In Conclusion The history of the electric generator involves many names in science and physics, but depending on how far back you want to go, the generator we know today evolved from Michael Faraday’s work. He created the first transformer, which led to the discovery of electromagnetic induction, and his principles serve as the foundation for all electrical power generated today. Many inventors followed his principles, and several variations and developments were made, leading up to the creation of the wide variety of generators available today. Related Reads: Featured Image Credit: Potashev Aleksandr, Shutterstock As its name suggests, a generator generates electricity. Michael Faraday’s discovery of electromagnetic induction demonstrated a way to construct a simple generator, but there was little need for such a device until commercial technologies that used electricity, such as lights, appeared. The earliest commercial uses of electricity, such as telegraphy, arc lighting systems, and metal electroplating used batteries as their power source. This was a very expensive way of generating electricity. Dynamos in Wilmington, DE In the 1860s and 1870s many inventors sought ways of using Faraday’s induction principle to generate electricity mechanically. Two kinds of generators emerged. The first type was a generator of direct current (DC) electricity. The second type was a generator of alternating current (AC) electricity. In truth, a DC generator could generate AC current, but it contains a simple device called a commutator to turn AC into DC. A commutator reroutes the flow of electrons inside the DC generator, so that the energy that appears at the output is a pulsing direct flow. An AC generator does not need a commutator and generates AC directly. One of the most important inventors of generators was German Werner von Siemens, who designed improved DC generators and called them dynamos. An even better generator was introduced by French Zénobe-Théophile Gramme in 1867, which produced substantially higher voltages than previous attempts. In 1871 he demonstrated a working model, and with Hippolyte Fontaine began manufacturing them. Gramme’s dynamos generated AC current and were widely used in arc lighting systems. In 1872, however, von Siemens reemerged and invented what is essentially the modern type of dynamo, referred to as the drum armature type of machine, which was a more efficient design. AC and DC generators were both used from the 1870s on. For example, AC generators were used in a type of outdoor arc lighting known as the Jablochkoff Candle. However, in the late 1870s when Thomas Edison devised his highly successful electric lighting system, he used DC generators. A major reason for this choice was that Edison wanted to use electric power both for lighting (for which AC was fine) and for running electric motors. At the time, there was no good AC electric motor available, so DC was the only option. In 1882 Edison installed DC generators at the Pearl Street station facilities in New York City, one of the earliest commercial power generating plants. As electric lighting and centrally distributed power began to achieve commercial success in the 1880s, inventors began looking for ways to distribute central-station power over longer distances. Edison’s DC system was poorly adapted to this, because he had chosen to use 120-volt bulbs and motors. A much higher voltage would have been easier to transmit down long wires, because at a low voltage much energy is lost as heat. Edison stations, such as that at Pearl Street, could be no more than about a mile from the customer. AC offered an alternative: a way to generate at a low voltage, “step up” the voltage for transmission using a simple device called a transformer, and then “step down” the voltage at the customer premises. The only remaining problem, though, was the lack of a suitable AC motor design. Nikola Tesla, a Serbian immigrant to the United States, devised an improved AC generator as well as a practical AC motor. Tesla’s system used polyphase AC, in which the generator generated several different AC flows that were combined or superimposed onto one another to create a single polyphase AC output, with the component currents “out of phase” with one another. The Tesla motor, introduced in 1887, was designed so that the peaks of this polyphase current supplied power at just the right moment in the rotation of the motor, and the resulting induction motor as he called it, ran smoothly. With a practical AC motor and generator in hand, along with transformers to raise and lower voltage, Tesla’s system could be used by power companies to create ever-larger networks of power distribution using massive power plants, such as the Niagara Falls hydroelectric plant built in the 1890s. Larger power systems helped lower costs, which stimulated demand for electricity, especially in homes. Further Reading For more information on the history of the electrification of New York City, Joseph Cunningham’s book, York Power is available for purchase from Amazon.com AC generator is an important tool used in the electronics field to study different concepts therefore, it becomes necessary to study what is an AC generator. In this article, we will study the AC generator and learn how it is useful in our daily lives. We will try to study the applications of AC generators through some real-life examples. Later, we will study the advantages and disadvantages of using an AC generator. In the end, we will discuss some potential developments in AC generators and how can impact future trends. What is an AC Generator?Electricity is a very necessary phenomenon required for powering different equipment like motors, gadgets, and many more. This electricity is generated using different methods one of which is the generation of electricity using generators. An AC generator is a device that converts one form of energy mainly mechanical energy to electricity. An AC generator usually uses turbines to convert mechanical energy to generate power. Let us study the principle on which AC generator works Parts of AC GeneratorLet us study the different parts of the AC generator Parts of AC GeneratorField: The part of AC generator that is responsible for producing the output voltage is called field. It is generally coil made of conducting material that receives and input voltage resulting in creation of flux.Armature: The output voltage of generator is produced at armature since it is capable of carrying the current. It generally is a bundle of coils wrapped together.Rotor: As the name suggests, it is the rotating part of AC generator and an external source is required for driving this rotor.Stator: As the name suggests, it is the stationary part of the generator. It is generally made of magnetic iron to minimize and loss of current (mainly eddy current).Slip Rings: The slip rings act as a medium or a connection to transfer power from the rotor of the AC generator.Working Principle of AC GeneratorThe working of an AC generator is based on the principle of the law of electromagnetic induction which states that A current-carrying conductor when placed in a uniform magnetic field experiences a force due to the interaction between the conductor and the magnetic field known as the EMF (Electromotive Force). AC GeneratorWorking Principle: As we observe from the diagram of the AC generator, the generator consists of an armature coil that is placed between two poles as shown. The armature coil is made to rotate in the magnetic field of the poles. Due to the rotation of the armature in the magnetic field, the flux associated with the coil changes. Based on the principle of electromagnetic induction, "a changing flux of the conductor in a uniform magnetic field induces current in the conductor." This results in the generation of electric current which is measured by the galvanometer. On careful observation, we see that the sign of current changes from positive to negative in each rotation which shows that the current generated in the AC generator is alternating current. Let us see some applications of AC generators in real-life. AC generators are used as a power source in major power stations like wind turbines, and hydropower plants where they convert mechanical energy of rotation into electrical energy. Therefore, AC generators forms an integral part in energy conversion and are used widely in power plants.After the generation of electricity, AC generators are also used in transmission lines for transmitting power over long distances. This power is supplied from power plants to various cities, industries, and other institutes. the ability of transformers to step up or step down is used for transferring the electricity over large distances with minimum loss.AC generators are used as a backup source in different industries that work on electricity. In case of power outrage, AC generators can be used temporarily for generating electricity. This is important for factories that are largely dependent on electricity for all the basic operations like manufacturing, designing etc.Since AC generators allow direct control over the generation of electricity, they are often used in research and development purposes where scientists require stable and controlled power for testing. Here, AC generator generates just the right amount of power which is necessary to drive the components and perform the analysis.In certain areas where the main source of power is unavailable, AC generators are used to provide power to operate the lighting, sound systems, stages, and other equipment in any event. This can be any entertainment event like parties, functions or inaugurations.To more understand the Applications of AC Generators let's go through some of the examples Examples of AC GeneratorsLet us now understand the applications of AC generators through examples. Power Source: Power Plants like hydropower plants need power on a large scale and this power is generated using AC generators. Power plants like the one with wind turbines have large turbines that rotate when high-speed winds strike the blades. The wind turbine then is connected to the shaft of the generator. As the rotor is moved in the magnetic field, it induces an alternating current in the coil which is then transported to various industries for power usage. Other examples include plants based on steam, water, wind, and gas.Long Distance Transmission: The power generated needs to be transmitted from one point to another , AC generator thus becomes an ideal choice for long distance transmission. During the transmission of this power, certain power is wasted due to the resistance of the transmission line. To reduce this wastage of power , we need high voltage signals and this can be achieved only using AC generator which allows us to step-up or step-down the voltage. Using this, the voltage is stepped up while traveling through transmission line and is stepped down to bring it to domestic limit.Power backup source: You might have seen that the majority of residential houses are equipped with backup generators. These power generators are very useful in cases when the main power source is unavailable. For example in situations like floods, or lightning the main power source is unavailable and the backup source turns on automatically to supply power for essential devices like lights, refrigerators and the other source can be used when power returns.Transportation: AC generators are also used in transportation since they can be used to generate the power required to run electric vehicles. For example, electric trains require power to control the train's motor. This power is generated through the overhead cables present above the train. This is a common usage of AC generators especially in urban areas to avoid traffic.Industrial and Residential Application: Different industrial and residential complexes require AC generators to power certain devices. In case of power outrage, all the nearby power stations are notified and AC power is transmitted over long distances through transmission lines. This ensures that even in case of power outrage, industries can continue their operations without any loss or interruption.Research and development: AC generators are used in the field of research and development (R&D) to control the power needed. AC generators are used to supply electrical power which is then used for testing purposes. Power is needed to supply electrical power for signal generators, spectrum analyzers, and oscilloscopes. The power requirement for these instruments is quite specific in terms of voltage and frequency and AC generators allow researchers to control this power.Advantages of AC GeneratorLet us see some advantages of AC generator AC generators are useful since they can be used for stepping up or stepping down voltage by controlling the number of rotations.The loss associated with an AC generator as compared to the loss associated with the generation of power in a DC generator.AC generators are generally smaller in size as compared to DC generators which makes them easier to carry and set in any location.AC generator provides a choice of generating electricity at different frequencies. This feature is useful in certain devices and can be controlled by changing the design of the generator.The majority of power systems in the real-life world are based on AC power input which makes the AC generator more compatible and a standard choice.Disadvantages of AC GeneratorLet us see some disadvantages of AC generator Since an AC generator provides more features like voltage and frequency control, it is a bit more complex to control as compared to a DC generator which has a simple operating system.The maintenance requirements of AC generators are higher since they can suffer from machine breakdown and fluctuations more often as compared to DC motors.AC generator is only useful for high loads. In the case of low loads, it can experience decreased efficiency due to increased fuel consumption.AC generators can experience voltage drops when transmitting power over large distances due to the resistance involved in transmission lines.AC generators that operate at high frequency can be a source of potential hazard due to the high voltage of operation. This can cause electric shocks if handled carelessly.AC Generator over DC GeneratorWe have studied AC generators deeply, and now let us see why AC generators are preferred over DC generators. Property AC Generator DC Generator Design Simple and easy design due to absence of commutator. Complex design due to presence of commutator. Stepping up or down AC generators can be easily stepped up or stepped down using transformer. DC generators are very difficult to step up or step down. Operating Range Better operating range than DC motor. Can't operate at high volltage due to fear of sparks. Cost AC generators are cheap. DC generators are expensive. Features AC generator provides more features like long distance transmission, high voltage DC generator doesn't offer these features. Future TrendsThere is a large scope for improvement in AC generators. These improvements can be seen in terms of sustainability and efficiency. Researchers are trying to incorporate modern technology into generator design to ensure modern design that is compatible with the changing needs of the future. These modern designs aim to make the generators more simple, compact, and lighter. Other improvements that can be made are installing smart grids in AC generators that will allow better control over power generation and will also allow us to monitor the generators using smart technology. Another expected future improvement is an increase in the efficiency of the AC generator which can be achieved by optimizing the performance and the quality of material used. This will eventually minimize the power wasted thereby increasing the overall efficiency. ConclusionWe have seen that AC generator plays a significant role in our day-to-day life. The AC generator's ability to transform one form of energy into another form has been channelized to make certain tasks easier. We also saw how AC generators are used in almost every field from electricity generation in hydropower plants to generating power in alternators. Despite the uses, we also studied some limitations of AC generators. Further development and upgradation in AC generators can help to increase their demand in the future. Readers are advised to go through the article again in case of any doubts. A generator or dynamo is a machine used for generating electric current by converting mechanical energy into electrical energy. Generators are of two types depending upon the type of current they produce. It is of two types : AC Generator or Dynamo : When a coil (conductor) is rotated in a magnetic field, the magnetic flux linked with it changes and therefore an alternating e.m.f. is induced in the coil. Construction: The main parts of a dynamo are: Field magnet: It is a strong horse shoe permanent magnet. An electromagnet run by a DC source can also be used for high power generators. Armature: It is a soft iron core on which a coil ABCD having a large number of turns of insulated copper wire is wound. This armature (or coil) is rotated rapidly in the magnetic field between the poles of the magnet. Slip rings: The ends of the armature (or the coil) are connected to two coaxial metallic slip rings S1 and S2 which rotate along with the coil. Brushes: Two brushes B1 and B2 made of carbon, press against the slip rings S1 and S2 respectively The external circuit (i.e. load) is connected between the other ends of brushes. The brushes B1 and B2 do not rotate along with the coil. Working of an AC generator: Suppose that the generator coil ABCD is initially in the horizontal position. Again suppose that the coil ABCD is being rotated in the anticlockwise direction between the poles N and S of a horse-shoe type magnet. (i) As the coil rotates in the anticlockwise direction, the side AB of the coil moves down cutting the magnetic lines of force near the N - pole of the magnet and side CD moves up, cutting the lines of force near the S-pole of the magnet. Due to this, induced current is produced in the sides AB and DC of the coil. On applying Fleming's right-hand rule to the sides AB and DC of the coil, we find that the currents are in the directions B to A and D to C. Thus, the induced currents in the two sides of the coil are in the same direction and we get an effective induced current in the direction BADC. (ii) After half revolution, the sides AB and DC of the coil will interchange their positions. The side AB will come on the right hand side and side DC will come on the left hand side. So, after half a revolution, side AB starts moving up and side DC starts moving down. As a result of this, the direction of induced current in each side of the coil is reversed after half a revolution. Since the direction of induced current in the coil is reversed after half revolution so that polarity (positive and negative) of the two ends of the coil also changes after half revolution. The end of coil which was positive in the first half of rotation becomes negative in the second half. And the end which was negative in the first-half revolution becomes positive in the second half of revolution. Thus, in 1 revolution of the coil, the current changes its direction 2 times. The alternating current (AC) produced in India has a frequency of 50 Hz. That is, the coil is rotated at the rate of 50 revolutions per second. Since in 1 revolution of coil, the current changes its direction 2 times, so in 50 revolutions of coil, the current changes its direction 2 x 50 = 100 times. Thus, the AC supply in India changes its direction 100 times in 1 second. Another way of saying this is that the alternating current produced in India changes its direction every 11100 second. That is, each terminal of the coil is positive(+) for 1/100 of a second and negative (-) for the next 1/100 of a second. DC Generator (or DC Dynamo): "DC generator" means "Direct Current generator". That is, a DC generator produces direct current. Construction of a DC Generator: A simple DC generator consists of a rectangular coil ABCD which can be rotated rapidly between the poles north and south of a strong horse-shoe type magnet M. The generator coil is made of a large number of turns of insulated copper wire. The two ends of the coil are connected to the two copper half rings (or split rings) R1 and R2 of a commutator. There are two carbon brushes B1 and B2 which press lightly against the two half rings. When the coil is rotated, the two half rings R1 and R2 touch the two carbon brushes B1 and B2 one by one. So, the current produced in the rotating coil can be tapped out through the commutator half rings into the carbon brushes. From the carbon brushes B1 and B2, we can take the current into the various electrical appliances like radio, TV, electric iron, bulbs, etc. Working of a DC generator: Suppose that the generator coil ABCD is initially in the horizontal position. Again suppose that the coil ABCD is being rotated in the anticlockwise direction between the poles N and S of a horse-shoe type magnet. (i) As the coil rotates in the anticlockwise direction, the side AB of the coil moves down cutting the magnetic lines of force near the N-pole of the magnet and side DC moves up, cutting the lines of force near the S-pole of the magnet in figure. Due to this, induced current is produced in the sides AB and DC of the coil. On applying Fleming's right-hand rule to the sides AB and DC of the coil we find that the currents in them are in the directions B to A and D to C respectively. Thus, we get an effective induced current in the direction BADC. Due to this the brush B1 becomes a positive (+) pole and brush B2 becomes negative (-) pole of the generator. (ii) After half revolution the sides AB and DC of the coil will interchange their positions. The side AB will come on the right hand side and start moving up whereas side DC will come on the left-hand side and start moving down. But when sides of the coil interchange their positions, then the two commutator half rings R1 and R2 automatically change their contacts from one carbon brush to the other. Due to this change, the current keeps flowing in the same direction in the circuit. The brush B1 will always remain positive terminal and brush B2 will always remain negative terminal of the generator. Thus, a DC generator supplies a current in one direction by the use of a commutator consisting of two half-rings of copper. Difference between a DC generator and an AC generator: In a DC generator we connect the two ends of the coil to a commutator consisting of two, half rings of copper. On the other hand, in an AC generator, we connect the two ends of the coil to two full rings of copper called slip rings. Specializing in the installation, repair, and maintenance of whole-house Generac standby generators, we ensure your home stays powered and protected no matter what. Schedule A Free Consultation Fourier's Law of Heat Conduction explains the heat transfer process through a material. It asserts thatThe space charge region on either side of the junction, where an accumulation of immobile ions forms a layer near the junction, is called the depletion regionThe photoelectric effect is a phenomenon where metals emit electrically charged particles upon absorbing electromagnetic radiation. Specifically, it...A combination of capacitors refers to how multiple capacitors are connected within an electric circuit.The adiabatic process is a thermodynamic process in which the pressure, volume, and temperature of the system change, but there is no exchange of heat between the system and the surroundings.In an isothermal process, the system's pressure and volume can vary while the temperature remains constant.In thermodynamics, a process refers to the sequence of changes a system undergoes as it moves from one state to another. Sign Up Now &Daily Live Classes3000+ TestsStudy Material & PDFQuizzes With Detailed Analytics+ More BenefitsGet Free Access Now Share — copy and redistribute the material in any medium or format for any purpose, even commercially. Adapt — remix, transform, and build upon the material for any purpose, even commercially. The licensor cannot revoke these freedoms as long as you follow the license terms. Attribution — You must give appropriate credit , provide a link to the license, and indicate if changes were made . You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use. ShareAlike — If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original. No additional restrictions — You may not apply legal terms or technological measures that legally restrict others from doing anything the license permits. You do not have to comply with the license for elements of the material in the public domain or where your use is permitted by an applicable exception or limitation . No warranties are given. The license may not give you all of the permissions necessary for your intended use. For example, other rights such as publicity, privacy, or moral rights may limit how you use the material. Home | Physics | Uses of AC Generator May 16, 2023 The major uses of AC generator are to produce alternating current (AC) and electrical power. This electrical generator operates on the principle of electromagnetic induction. It converts mechanical energy into electrical energy by using a magnetic field and a rotating conductor. AC generators have a wide range of applications in various industries, including power generation, renewable energy, and transportation. In this article, we will discuss the different uses of AC generators. Before we delve into the different uses of AC generators, it is essential to understand how they work. AC generators consist of a stationary magnetic field and a rotating conductor. The conductor is usually in the form of a coil that rotates within the magnetic field, generating a voltage that alternates in polarity. This alternating voltage induces an alternating current that can be used to power electrical devices. The primary use of AC generators is for power generation. AC generators are used in power plants to generate electrical power for industrial, commercial, and residential use. These generators can produce electricity at various voltages and frequencies, making them suitable for a wide range of applications. AC generators are also used in renewable energy systems such as wind turbines and hydroelectric power plants. Wind turbines use AC generators to convert the mechanical energy of wind into electrical energy, which can be used to power homes and businesses. Hydroelectric power plants use AC generators to produce electricity from falling water. AC generators are used in various transportation systems such as trains, ships, and airplanes. They are used to power electric motors that drive the propulsion systems of these vehicles. AC generators are preferred over DC generators in transportation systems due to their high efficiency and ability to produce high power output. AC generators have various industrial applications such as welding, arc lighting, and induction heating. They are used in welding machines to generate high currents and voltages required for welding. AC generators are also used in arc lighting systems to produce intense light. In induction heating, AC generators are used to produce high-frequency AC current, which is used to heat metallic objects. AC generators are also used in medical applications such as magnetic resonance imaging (MRI) machines. MRI machines use powerful magnets that require a high voltage and high-frequency AC current to operate. AC generators are used to provide the required power to the MRI machines. AC generators are also used in home appliances such as refrigerators, air conditioners, and washing machines. These appliances use electric motors that require AC power to operate. AC generators provide the required power to these appliances. Chapter-Electromagnetic Induction An AC generator also called the Alternating Current Generator is a type of device that converts the mechanical energy that is present into alternating energy for daily use in various appliances. AC generators contain slip rings to produce alternating currents whereas DC generators tend to use direct current as the result of the DC generator. Bicycles, electric scooters, microwaves, and sailboats all use the AC generator to produce AC current. Mechanical energy is provided by steam and gas turbines as well as internal combustion engines to the AC generators. These are also highly useful in wind turbines and small hydropower plants in order to convert the high-pressure gas streams to lower pressure zones. Students can hence now know more regarding the AC Generator - Principle, Parts, Uses and Working through Vedantu.AC Generator - Principle, Parts, Uses and WorkingThe machine that transforms mechanical energy into electrical energy is known as an Electrical generator. The generator is usually classified into type based on the supply of power, namely AC and DC. For the DC generator, the supply to the machine is single directional, and the vice versa is applicable for the AC generator. With this difference in input supply, the internal operation differs for the generators.AC Generator, its construction, how EMF is induced, its parts and applications, and more will be discussed here in this article. Slip rings are used in AC for the generation of the alternating current in the machine. The generated voltage or current is initially alternating one in both the kinds of the generator. AC Generator DefinitionThe machine which converts the mechanical energy into electrical energy in the output of alternating current or voltage is known as AC Generator. The machine works on Faraday's law of Electromagnetic induction. Here, the Direct Current voltage is made to rotate inside the fixed coil, like a huge power generator that produces the AC current.By using Fleming's right-hand rule, the direction of the alternating current in the generator is determined. The below diagram shows the four-pole single-phase generator:Circuit Diagram AC Generator(Image will be uploaded soon)(Image will be uploaded soon)What are the Parts of an AC Generator?Here is the list of the parts of the AC generator, which mainly consists of the yoke, permanent magnets, coils or loop wound with wires, pole core, armature core, pole shoe, slip rings, and brushes. The frame acting as the protecting cover of the generator is known as a yoke. All the components mentioned above are within the yoke. The magnets generate the magnetic field between the air gaps. The coil made up of four-wire AB, BC, CD, and DC is placed inside the magnetic field. The schematic diagram of the AC generator is shown below with all the labels for your understanding.(Image will be uploaded soon)(Image will be uploaded soon)The pole shoe is within the pole core to house the windings—the armature windings placed in the armature core. The armature flux results in the production of the armature core. The operation is conducted smoothly, with the use of slip rings. The rings are attached to the brush through which the current passes. As the slip rings pass smoothly through the brushes, it avoids the twisting of the wires.(Image will be uploaded soon)(Image will be uploaded soon)Working of AC Generator The principle of Faraday's law of electromagnetic induction is followed for the working of the AC generator.An EMF is induced whenever a conductor cuts the lines of magnetic flux, which causes the current to pass through the conductors. For a better insight into the mechanism of an AC Generator, let's consider a simple loop generator which is placed under the influence of a magnetic field. Name the loop placed in the magnetic field named ABCD; as mentioned earlier, the loop of wire is named as AB, BC, CD, and DC. With the help of an external shaft which acts as the primary mover, the loop is rotated. In the below diagram, it shows the working of the AC generator.(Image will be uploaded soon)(Image will be uploaded soon)The magnetic flux lines will move from left to right and from north pole to south pole. With the help of the shaft, the loop is rotated as it cuts the magnetic flux. This develops the EMF, which causes the current to flow through the conductors. With the help of Fleming's right-hand rule in generators, the direction of the current is determined. As per Fleming's right-hand rule, the middle finger, forefinger and thumb are positioned perpendicular to each other, which is shown in the figure below. (Image will be uploaded soon)(Image will be uploaded soon)As per the diagram below, the loop rotates; the rule determines the direction of the current inside the wire AB. For a half cycle, the current flows inside the wire AB. With the rotation of the loop, the current inside the wire AB reverses for the other cycle. The same procedure is performed for the other wires, i.e., in BC, CD, and DC, as the loop rotates the direction of the current changes for every half cycle. The figure shown below considers the above two cases for the working of the AC generator.The slip rings are attached to the loop end and are responsible for the movement of the wires when the loop is rotated. The current passes through the slip ring to the brushes and then to load as it passes smoothly the slip rings through the brushes.For every half-cycle of the loop, the direction of the current gets changed. By using a galvanometer, we can observe the alternating current at the load end. This is how the Alternating Current Generator generates an alternating voltage or current.The Bottom Line!From the above article, we had an overview of the Alternating Current Generator. The device converts the mechanical energy into electrical energy and gives an output of alternating current or voltage. Apart from that, the above article gives you insight into the working parts, uses, and their application in daily life. Specializing in the installation, repair, and maintenance of whole-house Generac standby generators, we ensure your home stays powered and protected no matter what. Schedule A Free Consultation Last updated at Dec. 16, 2024 by Teachoo An electric generator is a device which converts mechanical energy into electrical energy. It looks like Principle of Electrical generator The electrical generator works on the principle that when a straight conductor is moved in a magnetic field, then current is induced in the conductor. Types of Generators Generator is used to generate electric current. The electric current can be - AC current or DC current. Thus, Electric Generators is of two types AC Generator - Generates Alternating Current (AC current) DC Generator - Generates Direct Current (DC current) Note : Whenever Electric Generator is mentioned, we will assume it is a AC Generator Construction of an AC Electric Generator AC Electric Generator consists of Rectangular Coil of Wire ABCD A strong horseshoe magnet (or 2 different magnets) - If we take 2 magnets, North Pole of first magnet faces South Pole of Other Magnet, as shown in figure... The coil is placed perpendicular to the magnet as shown in figure The ends of coil are connected to two rings - R 1 and R 2 The external conducting edges of rings R 1 and R 2 are connected to two stationary brushes - B 1 & B 2 respectively The inner side of the rings is insulated and attached to the axle The axle is mechanically rotated to rotate the coil These brushes are attached to a galvanometer to show the flow of current in the circuit Working of an AC Electric Generator Let's look at the working of an AC Electric Generator Suppose axle is rotated clockwise, so coil is also rotated clockwise, Side AB of Coil moves up and side CD Moves down Applying Fleming's Right Hand Rule on side AB, force is upwards, magnetic field is left to right, So, current flows into the paper i.e. from A to B And applying Fleming's Right Hand Rule on side CD, force is downwards, magnetic field is left to right, So, current flows out of the paper i.e. from C to D Hence, current flows into the Brush B 2 , moves along galvanometer and finally enters B 1 Hence, we say current flows from B 2 to B 1 in the external circuit. After half a rotation, Side CD Comes on left side and AB Comes on Right Side Now, on left side CD comes down, Applying Fleming's Right Hand Rule on side CD, force is downwards, magnetic field is left to right, So, current flows out of the paper i.e. from D to C And on right side, AB comes up, Applying Fleming's Right Hand Rule on side AB, force is upwards, magnetic field is left to right, So, current flows into the paper i.e. from A to B Hence, our circuit is now DCBA, and current moves in the opposite direction Hence, we say current flows from B 1 to B 2 in the external circuit. Thus, after every half rotation, direction of current changes. Hence, Alternating Current is produced Now, lets look at DC Generator - where current is in one direction Note: To convert AC generator to DC Generator, we use a commutator with split rings (Split, not slip). Just like we do in an Electric Motor Construction of DC Generator DC Electric Generator consists of Rectangular Coil of Wire ABCD A strong horseshoe magnet (or 2 different magnets) - If we take 2 magnets, North Pole of first magnet faces South Pole of Other Magnet, as shown in figure... The coil is placed perpendicular to the magnet as shown in figure The ends of coil are connected to a split ring commutator - P and Q The external conducting edges of rings P and Q are connected to two stationary brushes - X & Y respectively The inner side of the rings is insulated and attached to the axle The axle is mechanically rotated to rotate the coil These brushes are attached to a galvanometer to show the flow of current in the circuit Working of a DC Electric Generator Let's look at the working of a DC Electric Generator Suppose axle is rotated clockwise, so coil is also rotated clockwise, Side AB of Coil moves up and side CD Moves down Applying Fleming's Right Hand Rule on side AB, force is upwards, magnetic field is left to right, So, current flows out of the paper i.e. from C to D Hence, current flows into the Brush Y , moves along galvanometer and finally enters X Hence, we say current flows from Y to X in the external circuit. After half a rotation, Side CD Comes on left side and AB Comes on Right Side And Split ring P is connected to coil CD and split ring Q is connected to coil AB. Which keeps the direction of current in the circuit same. Hence, current flows from Brush Y , moves along galvanometer and finally enters X Hence, we say current flows from Y to X in the external circuit. Thus, direction of current after every half rotation, direction of current changes. Hence,

attached to a galvanometer to show the flow of current in the circuit Working of a DC Electric Generator Let's look at the working of a DC Electric Generator Suppose axle is rotated clockwise, so coil is also rotated clockwise, Side AB of Coil moves up and side CD Moves down Applying Fleming's Right Hand Rule on side AB, force is upwards, magnetic field is left to right, So, current flows into the paper i.e. from A to B And applying Fleming's Right Hand Rule on side CD, force is downwards, magnetic field is left to right, So, current flows out of the paper i.e. from C to D Hence, current flows into the Brush Y , moves along galvanometer and finally enters X Hence, we say current flows from Y to X in the external circuit. After half a rotation, Side CD Comes on left side and AB Comes on Right Side And Split ring P is connected to coil CD and split ring Q is connected to coil AB. Which keeps the direction of current in the circuit same. Hence, current flows from Brush Y , moves along galvanometer and finally enters X Hence, we say current flows from Y to X in the external circuit. Thus, direction of current after every half rotation, direction of current changes. Hence, Alternating Current is produced How does Power Stations increase Current and Voltage produced? They increase current and voltage produced by Using Electromagnet in place of permanent magnet Large number of turns of conducting wire(More the turns in wire more the magnetic field) Soft iron Core on which coil is wound Rotating the coil faster Questions NCERT Question 4 - The essential difference between an AC generator and a DC generator is that AC generator has an electromagnet while a DC generator has permanent magnet. DC generator will generate a higher voltage. AC generator will generate a higher voltage. AC generator has slip rings while the DC generator has a commutator. View Answer NCERT Question 6 (b) - State whether the following statements are true or false. An electric generator works on the principle of electromagnetic induction. View Answer NCERT Question 16 - The essential difference between an AC generator and a DC generator is that View Answer Question 1 Page 237 - State the principle of an electric generator. View Answer Question 4 Page 237 - A rectangular coil of copper wire is rotated in a magnetic field. The direction of the induced current changes once in each (a) two revolutions (b) one revolution (c) half revolution (d) one-fourth revolution View Answer