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TOPIC:

**POWER TRANSMITTERS. FUNCTIONS AND CLASSIFICATION OF
TRANSMITTERS IN ELECTRIC MACHINES.**

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I. POWER TRANSMITTERS: FUNCTION AND CLASSIFICATION OF TRANSMITTERS

Powertrains are important elements in modern vehicles and mechanical systems. They ensure the efficient transfer of energy from the power source (engine, generator, battery, etc.) to various vehicle systems and components to fulfill key functions such as propulsion, steering, and safety.

I.1 Duties of Power Transmitters

- **Energy Transfer**

Power transmitters transfer mechanical, electrical, or hydraulic energy from the power source to other devices that need it.

- **Energy Transformation**

Many transmitters serve to transform energy from one form to another. For example:

- The alternator converts mechanical energy into electrical energy.
- The hydraulic pump converts mechanical energy into hydraulic energy.

- **Power Modulation**

Transmissions adjust power to suit operating conditions, ensuring efficiency and stability. For example, a gearbox (transmission) varies torque and speed based on needs.

- **Systems Coordination**

Transmitters coordinate the operation of various systems, such as the engine and transmission system to drive the vehicle's wheels.

- **Security and Control**

Transmissions ensure controlled and safe power distribution to avoid overloading or system failure. For example, hydraulic braking distributes power evenly to the wheels.

I.2 Classification of Power Transmiflers

Transmitters are classified according to the type of energy transmitted, the transmission medium, and the area of application.

1. According to the Type of Energy Transmifled

- **Mechanical Power Transmiflers**
 - Examples: Gearboxes, transmission axles, differentials.
 - Function: Transmit rotational or linear mechanical energy.
- **Electric Power Transmiflers**
 - Examples: Alternators, electric motors, inverters.
 - Function: Distribute and transform electrical energy for vehicle systems.
- **Hydraulic Power Transmiflers**
 - Examples: Hydraulic pumps, hydraulic cylinders, power steering.
 - Function: Transmit energy through pressurized fluids, mainly in braking or steering.
- **Pneumatic Power Transmiflers**
 - Examples: Air compressors, air brake systems (e.g., in trucks).
 - Function: Transmit energy through compressed air.

2. According to the Means of Transmission

- **Live Broadcast**
 - Includes elements such as chains, belts, and pulleys for instant power transmission.
- **Fluid Transmission**
 - It uses hydraulic fluids or compressed air to transmit power.
- **Electrical Transmission**
 - Cables and electrical circuitry distribute power to electric motors and auxiliary systems.

3. According to Vehicle Application Area

- **Power Transmiflers for Motion (Propulsion)**
 - Examples: Gearboxes, axles, differentials.
 - Purpose: Distribute power from the engine or electric motor to the wheels to provide movement.
- **Auxiliary Transmiflers**
 - Examples: Alternator, air conditioning compressor, power steering pump.
 - Purpose: Adapted to power systems not related to movement.
- **Transmiflers for Security Systems**
 - Examples: Brake boosters, ABS hydraulic units.
 - Purpose: Provide power distribution and management for safety-critical systems.

4. According to the Technology Used

- **Traditional Broadcasters**
 - Examples: Manual gearboxes, chains.
 - They are used in vehicles with internal combustion engines.
- **Modern Broadcasters**
 - Examples: CVT transmissions (Continuously Variable Transmissions), electrical inverters.
 - They are used in hybrid and electric vehicles.

5. By Vehicle Type

- **Light Vehicles**
 - Example: Passenger vehicles use compact transmissions such as automated gearboxes or electrical inverters.
- **Heavy Vehicles**
 - Example: Trucks and buses have powerful transmissions such as hydraulic pumps and torque converters.

II. CLASSIFICATION OF MECHANICAL POWER TRANSMITTERS

1. By Transmission Type

- **Rotary Transmiflers**
 - Examples: Shafts, chains, belts, gears.

- Function: Transmit energy in rotational form.
- **Linear Transmiflers**
 - Examples: Lead screws, hydraulic or pneumatic drive devices.
 - Function: Transform energy from rotational to linear for specific applications.

2. According to the Means Used for Transmission

- **Direct Contact Transmifler**
 - Examples: Chains, gears, belts.
 - Function: Transfer energy through direct physical contact.
- **Friction Transmission**
 - Examples: Friction wheels, tensioned belts.
 - Function: Use the force of friction to transfer energy from one component to another.

3. By Function

- **Power Ratio Modification Transmifler**
 - Examples: Transmissions (manual or automatic), differentials.
 - Function: Modify the ratio of torque and speed.
- **Direction Change Transmifler**
 - Examples: Bevel gear systems, universal shafts.
 - Function: Change the direction of mechanical movement.
- **Transmiflers for Specialized Applications**
 - Examples: Cranes, drive systems in special vehicles.
 - Function: Serves for specific applications, such as lifting or pushing.

II.1 Main Components of Mechanical Power Transmiflers

1. Transmissions (Gearboxes)

- Power and torque ratios vary to meet the needs of the movement.
- Types: Manual, automatic, CVT (Continuously Variable Transmission).

2. Chains and Belts

- They transmit mechanical power between two shafts.
- Common types: Valve chains and V-belts.

3. Transmission Shafts

- They transfer mechanical energy from the engine to the wheels or auxiliary equipment.

4. Gears

- Devices that use gears to transmit power between shafts.
- Types: Cylindrical, conical, helical.

5. differential

- It ensures that the wheels receive torque independently, making cornering easier.

6. clutch

- They ensure the connection and disconnection of mechanical power in motion systems.

7. Rotary Couple Converter

- It is used in automatic transmissions to modify the torque between the engine and the transmission system.

II.2 Main Duties of Electric Power Transmiflers

1. Electricity Transfer

- The electrical energy produced by sources, such as a battery or alternator, is transferred to consumers (electric motors, lighting, auxiliary systems, etc.).

2. Electricity Transformation

- It is often required to transform electrical energy from one form to another (e.g., from DC to AC or vice versa).
- For example, inverters in electric vehicles convert DC power from the battery into AC power for the electric motors.

3. Voltage and Current Regulation

- It is ensured that the voltage and current are suitable for the operation of various systems. This is achieved through voltage stabilizers and transformers.

4. Efficient Energy Storage and Distribution

- Managing electrical energy to avoid losses and ensure efficient vehicle operation.

5. Energy Monitoring and Control

- Modern systems use integrated electronics to monitor and manage the power supply, improving efficiency and safety.

III. CLASSIFICATION OF ELECTRIC POWER TRANSMITTERS

1. By Main Function

- **Electricity Generators**
 - Examples: Alternator, generator, energy regeneration system (e.g., regenerative braking).
 - Function: Production of electricity to power the vehicle.
- **Transformers and Regulators**

- Examples: Inverters, voltage stabilizers.
- Function: Transform and stabilize electrical energy for safe use.
- **Energy Savers**
 - Examples: Lithium-ion batteries, capacitors.
 - Function: Store electrical energy for use when needed.
- **Energy Distributors**
 - Examples: Fuse boxes, cables and electrical connectors.
 - Function: Ensure the distribution and connection of electrical power to all vehicle systems.

2. By Type of Electricity

- **DC Power Transmifler (Direct Current)**
 - They are used for hybrid and electric vehicles, as well as for auxiliary equipment.
- **AC Power Transmifler (Alternating Current)**
 - They are used for electric motors that require alternating current for their operation.

3. According to the Vehicle Application Area

- **Transmifler for the Main Engine**
 - Examples: Electric motors, inverters, power controllers.
 - Function: Used for vehicle propulsion, especially in electric and hybrid vehicles.
- **Auxiliary Transmifler**
 - Examples: Alternator, electric air conditioning compressor, electric heaters.
 - Function: Serves non-movement related equipment and systems, such as heating, cooling, and lighting.
- **Transmiflers for Security Systems**

- Examples: ABS braking systems, ESP (Electronic Stability Control).
- Function: Use electrical energy to increase the safety and stability of the vehicle.

4. According to the Technology Used

- **Traditional Systems**

- They use generators and alternators for vehicles with internal combustion engines.

- **Modern and Intelligent Systems**

- They use inverters, battery managers (BMS), and intelligent power distribution systems for electric and hybrid vehicles.

IV. MAIN COMPONENTS OF ELECTRIC POWER TRANSMITTERS

1. Alternator

- Generates AC electricity to power the vehicle's battery and auxiliary systems.

2. The inverter

- Converts DC power from the battery into AC power for electric motors in hybrid and electric vehicles.

3. Battery

- The main energy storage device, usually lithium-ion for modern vehicles.

4. Battery Manager (BMS)

- Monitors and manages battery performance, including its voltage, temperature, and capacity.

5. Electrical Cables and Connectors

- They distribute energy safely between the source and its consumers.

6. Regenerative Braking

- System that recovers electrical energy during braking and stores it in the battery.

7. Electronic Control Systems (ECU)

- They are used for monitoring and regulating all electrical transmissions.

8. Voltage Transformers

- They reduce or increase voltage to meet the demands of various devices.

1. Examples of the Use of Electrical Power Transmitters

1. Electric and Hybrid Vehicles

- Electric motors and inverters transfer energy from the battery to power the vehicle.

2. Auxiliary Systems

- The alternator supplies power for lighting, heating, air conditioning, and other auxiliary systems in traditional vehicles.

3. Heavy Vehicles

- Electric trucks and buses use powerful electric drive systems to ensure performance and efficiency.

4. Autonomous Vehicles

- These vehicles use electrical transmitters to power sensors, cameras, and control systems.

IV.2 Advantages and Disadvantages of Electric Power Transmiflers

strengths

- **High Efficiency:** Electrical transmission has fewer losses compared to mechanical systems.
- **Accurate Control:** Power electronics allow precise power regulation for various devices.
- **Renewable Energy Opportunities:** Easily adapt to renewable energy sources.
- **Environmental Cleaners:** Use in electric vehicles reduces emissions.

Disadvantages

- **High Initial Cost:** Equipment like batteries and inverters are relatively expensive.
- **Technical Complexity:** They require complex monitoring and management systems.

- **Capacity Limitations

V. HYDRAULIC POWER TRANSMITTERS

Hydraulic power transmissions are an essential component in many industries, including automotive, construction, and industrial manufacturing. They provide a reliable and efficient way to transfer power in systems that require precise control and high performance.

Hydraulic power transmissions are systems that use pressurized fluids to transfer energy from a source (such as hydraulic pumps) to actuators or mechanisms that convert this energy into mechanical work. These transmitters are widely used in vehicles and machinery due to their high efficiency and ability to transmit large amounts of power with a small amount of fluid.

1. Main Functions of Hydraulic Power Transmitters

1. Transfer of Power

- Transmission of energy from the source (hydraulic pump) to systems that perform mechanical work (hydraulic cylinders or motors).

2. Power Growth and Control

- Enables power to be increased with a small input force through fluid pressure.

3. Movement Control

- They ensure precise and controlled movement in connected devices and mechanisms.

4. Energy Conversion

- They convert the mechanical energy of the pump into hydraulic energy and then into mechanical energy to perform work.

5. Great Power Supply

- They are ideal for applications that require high power in limited spaces.

V.2 Classification of Hydraulic Power Transmiflers

1. According to Main Components

• Hydraulic Pumps

- The main source of energy in hydraulic systems. Generates fluid pressure.
- Types: Piston pumps, gear pumps, vane pumps.

• Hydraulic Actuators

- They convert hydraulic energy into mechanical energy.
- Types: Hydraulic cylinders (for linear motion) and hydraulic motors (for rotary motion).

• Control Valves

- They are used to control the flow, pressure and direction of fluid.
- Types: Pressure valve, flow valve, and directional valve.

- **Transmission Lines**
 - Pipes and tubes that transport pressurized fluid from pumps to actuators.
- **Liquid Deposits**
 - Tanks that store hydraulic fluid for continuous use.

2. According to the Application

- **Vehicle Transmiflers**
 - Examples: Hydraulic brake systems, hydraulic steering, hydraulic lifters.
- **Transmiflers for Heavy Machinery**
 - They are used in excavators, cranes, and bulldozers for moving and lifting heavy loads.
- **Transmiflers for Industrial Equipment**
 - They are used in material processing machinery, assembly systems, and printing machinery.

3. According to the Type of Movement They Provide

- **Linear Motion Systems**
 - Hydraulic cylinders are used to create linear motion.
- **Rotary Motion Systems**
 - Hydraulic motors are used to create rotary motion.

4. According to Operating Pressure

- **Low Pressure**(up to 200 bar)
 - They are used for less demanding systems such as hydraulic steering.
- **High Pressure**(over 200 bar)
 - They are used for industrial applications and heavy vehicles.

V.3 Main Components of Hydraulic Power Systems

1. Hydraulic Pumps

- The main source of pressure in a hydraulic system.
- Examples: Axial pumps, gear pumps.

2. Hydraulic Fluid

- It conducts energy and lubricates system components.

3. Hydraulic Cylinders

- They are used for lifting, pressing, or linear movement.

4. Hydraulic Motors

- They provide rotational movement for various applications.

5. Control Valves

- They control the pressure, direction, and flow of fluid.

6. Pipes and Connectors

- They ensure the transmission of pressurized fluid throughout the system.

7. Filtrate

- Remove impurities from the fluid to avoid damage to components.

V.4 Examples of the Use of Hydraulic Power Transmiflers

1. In Vehicles

- Hydraulic braking system, which uses the force of fluid to activate the brakes.
- Hydraulic steering, which helps in easy steering maneuvering.

2. In Heavy Machinery

- Excavators use hydraulic cylinders to raise the arms and open the buckets.
- Trucks use hydraulic lifts to lift loads.

3. In Industrial Equipment

- Printing machinery and metalworking machinery.
- Equipment for testing mechanical forces.

V.5 Advantages and Disadvantages of Hydraulic Power Transmiflers

strengths

- **High Load Capacity:** They can transmit large amounts of power in small spaces.
- **Accurate Control:** Ensure precise and stable movement.
- **Variety of Applications:** Can be used for linear and rotary motion.
- **High Efficiency:** They perform well under heavy loads and difficult conditions.

Disadvantages

- **High Initial Cost:** Hydraulic components can be expensive.
- **Maintenance Request:** They require regular maintenance to avoid fluid leaks and contamination.
- **Leakage Risk:** Hydraulic fluid may leak, polluting the environment and reducing efficiency.
- **Temperature Sensitivity:** System performance may be affected by temperature changes.

VI. PNEUMATIC POWER TRANSMITTERS

Pneumatic power transmitters are systems that use compressed air or gas to transfer and control energy to perform mechanical movements. They operate by using the energy of air pressure, usually produced by a compressor, to perform work such as linear or rotary motion.

Pneumatic power transmitters are important in various industries due to their simplicity, flexibility, and safety. They are suitable for applications that require speed and cleanliness, but are not suitable for very heavy loads. Their advantages make them ideal for the food, pharmaceutical, and industrial automation industries.

1. Main Functions of Pneumatic Power Transmitters

1. Transfer of Power

- They convert the energy of compressed air into mechanical work.

2. Movement Automation

- They provide automatic and repetitive motion in various industrial and mechanical systems.

3. High Speed and Accuracy

- Providing fast movements and precise control of mechanisms.

4. Clean Energy Supply

- Air is a clean and safe source for applications that require clean conditions, such as in the food and pharmaceutical industries.

VI.2 Classification of Pneumatic Power Transmiflers

1. According to Main Components

- **Air Compressors**
 - The main source of energy in a pneumatic system; they create compressed air.
 - Types: Piston compressors, centrifugal compressors, screw compressors.
- **Pneumatic Cylinders**
 - Actuators that use compressed air to create linear or rotary motion.
 - Types: Single-acting (with movement in one direction) and double-acting (with movement in both directions) cylinders.
- **Pneumatic Valves**
 - They control the flow, pressure and direction of air in the system.
 - Type: Directional valve, pressure valve, flow valve.
- **Air Deposits**
 - Store compressed air for continuous use and ensure pressure stability.
- **Pipes and Fiflings**
 - They serve to transmit compressed air from the compressor to the actuators.

2. According to the Type of Movement They Provide

- **Linear Motion Systems**
 - Linear pneumatic cylinders are used to produce straight-line motion.

- **Rotary Motion Systems**

- Pneumatic rotary motors or actuators are used to create rotary motion.

3. According to Operating Pressure

- **Low Pressure Systems**

- They work with air pressure up to 10 bar and are used in common industrial applications.

- **High Pressure Systems**

- They are used for heavier applications, where greater power is needed.

4. According to the Application

- **In Vehicles**

- Pneumatic braking systems in trucks and trains.

- **In Industrial Machinery**

- For manufacturing and automation processes, such as conveyors and assembly lines.

- **In Construction Equipment**

- Equipment such as pneumatic hammers and drilling equipment.

VI.3 Main Components of Pneumatic Power Systems

1. Air Compressor

- Generates compressed air and determines its pressure.

2. Pneumatic Cylinders

- Devices that convert compressed air energy into mechanical movement.

3. Control Valves

- For directing and controlling air flow.

4. Air Deposits

- To store compressed air and maintain constant pressure.

5. Filters and Lubricants

- Filters remove impurities from the air, while lubricators provide lubrication to moving parts.

6. Pipes and Fittings

- They transmit compressed air throughout the pneumatic system.

VI.4 Examples of the Use of Pneumatic Power Transmitters

1. In Vehicles

- Braking systems on buses, trucks and trains that use pneumatic braking for high safety.

2. In Industrial Machinery

- Automatic systems in production lines and for product assembly.

3. On Portable Devices

- Equipment such as pneumatic hammers, sprayers and welding machines.

4. In Construction Equipment

- Drilling and excavation machinery such as pneumatic hammers and cranes.

VI.4 Advantages and Disadvantages of Pneumatic Power Transmitters

strengths

- **Air as an Infinite Resource:** Air is available everywhere and is inexpensive.
- **Clean Environment:** Suitable for industries where cleanliness is important, such as food and pharmaceuticals.
- **Speed and Quick Response:** Ensure quick and efficient actions.
- **High Security:** Does not pose a major hazard in case of leakage or damage.

Disadvantages

- **Low Energy Efficiency:** Compressors consume a lot of energy to generate compressed air.
- **Limited Cargo Capacity:** They are not suitable for applications that require very high power.
- **Sensitivity to Condensation:** Water from compressed air can cause corrosion in the system.
- **High Maintenance Cost:** Requires constant filtration and lubrication of components.