

AUTOMOBILE ENGINEERING TECHNICIAN

Second Year

Paper-I: Auto Transmission & Electrical Systems

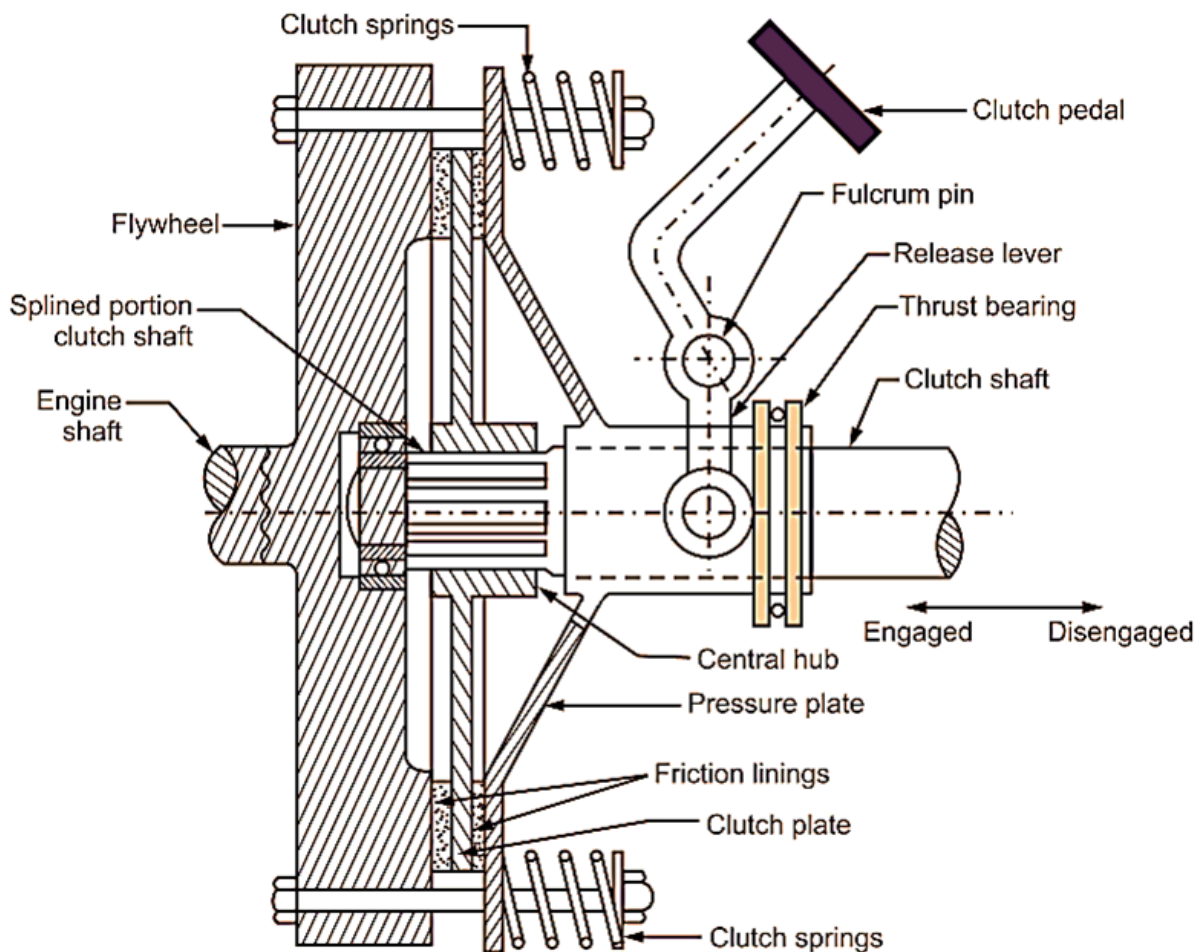
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Section - I

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1. Overhauling of single plate clutch.



Aim:

The aim of this practical exercise is to perform the overhaul of a single plate clutch to ensure its optimal functionality and longevity. This involves disassembling, inspecting, cleaning, and reassembling the clutch components.

Materials:

Single plate clutch assembly
Cleaning solvent
Emery paper
Grease
Gasket sealant
Replacement parts (if necessary)
Rags
Measuring tools (calipers, micrometer)
Assembly lubricant

Tools:

Screwdrivers
Spanners/wrenches
Clutch alignment tool
Circlip pliers
Bearing puller
Feeler gauges
Dial gauge
Torque wrench
Clutch plate separator
Vernier calipers

Procedure:

Safety Precautions:

- Ensure the vehicle is securely supported on jack stands.
- Disconnect the battery to prevent accidental engagement.

Disassembly:

- Remove the transmission to access the clutch assembly.
- Use appropriate tools to loosen and remove the pressure plate bolts.
- Carefully separate the pressure plate from the clutch cover.
- Remove the clutch plate, release bearing, and other components.

Inspection:

- Examine each component for wear, scoring, and damage.
- Measure the thickness of the clutch plate and compare it to the manufacturer's specifications.
- Check the flywheel surface for scoring and heat spots.
- Inspect the release bearing, pressure plate, and clutch cover for wear and damage.

Cleaning:

- Clean all components using a suitable cleaning solvent to remove oil, grease, and debris.
- Use emery paper to lightly sand the surface of the flywheel and pressure plate for better grip.

Replacement of Parts:

- Replace any worn or damaged components.
- Ensure the new parts match the specifications of the manufacturer.

Reassembly:

- Apply a thin layer of grease to the input shaft splines.
- Use a clutch alignment tool to correctly position the clutch plate.
- Reassemble the clutch components in the reverse order of disassembly.
- Torque the pressure plate bolts to the manufacturer's specifications.

Adjustment:

- Adjust the clutch pedal free play according to the vehicle manufacturer's recommendations.
- Use feeler gauges to check the air gap between the release bearing and pressure plate fingers.

Testing:

- Engage and disengage the clutch several times to ensure smooth operation.
- Check for any unusual noises or vibrations.

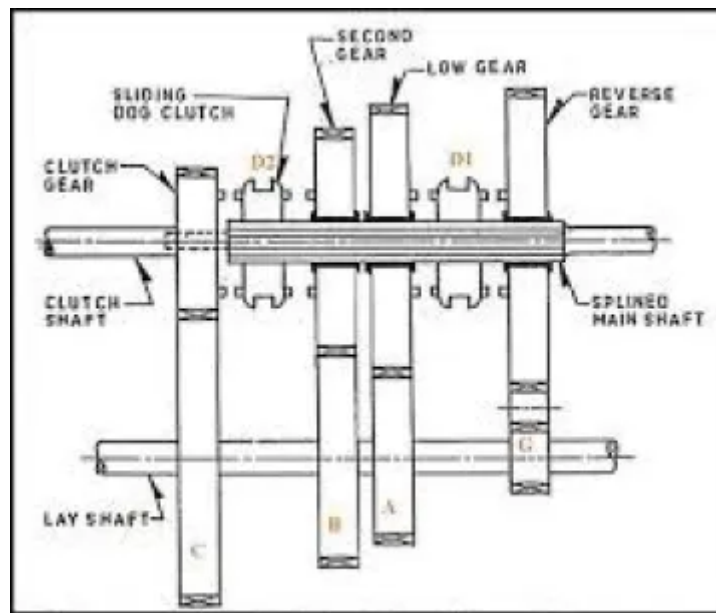
Precautions:

- Follow the manufacturer's specifications and guidelines throughout the process.
- Handle all components with care to avoid damage.
- Use appropriate safety gear, such as gloves and safety glasses.

Results:

Upon completion of the overhaul, the single plate clutch should function smoothly, engaging and disengaging without slippage or noise. Any worn or damaged components should be replaced, ensuring the clutch system's reliability and performance. The vehicle should be road-tested to confirm the successful overhaul of the single plate clutch.

2. Overhauling of constant mesh gearbox.



Aim:

The aim of this practical exercise is to perform the overhaul of a constant mesh gearbox, ensuring its proper functioning, and extending its lifespan. This involves disassembling, inspecting, cleaning, and reassembling the gearbox components.

Materials:

- Constant mesh gearbox assembly
- Cleaning solvent
- Gear oil
- Gasket sealant
- Replacement parts (if necessary)
- Rags
- Paint/markers for labeling
- Emery paper
- Bearings and seals kit
- Measuring tools (calipers, micrometer)

Tools:

- Screwdrivers
- Spanners/wrenches
- Gear pullers
- Bearing pullers
- Dial indicators
- Torque wrench
- Bearing press

Feeler gauges
Gear puller
Seal drivers

Procedure:

Safety Precautions:

- Ensure the vehicle is securely supported on jack stands.
- Disconnect the battery to prevent accidental engagement.
- Work in a well-ventilated area.

Disassembly:

- Drain the gearbox oil.
- Remove the gearbox from the vehicle.
- Carefully disassemble the gearbox components, labeling each part for proper reassembly.
- Use appropriate tools to remove gears, shafts, and bearings.

Inspection:

- Examine each component for wear, scoring, and damage.
- Measure gear and shaft clearances using dial indicators.
- Check for worn synchromesh rings and engagement dogs.
- Inspect bearings and seals for wear and damage.

Cleaning:

- Clean all components using a suitable cleaning solvent to remove oil, grease, and debris.
- Use emery paper to remove any rust or corrosion on gear surfaces.

Replacement of Parts:

- Replace any worn or damaged components.
- Ensure the new parts match the specifications of the manufacturer.
- Install new bearings and seals from the kit.

Reassembly:

- Reassemble the gearbox components in the reverse order of disassembly.
- Use a torque wrench to tighten bolts and nuts to the manufacturer's specifications.
- Lubricate all moving parts with gear oil.

Adjustment:

- Adjust gear clearances and backlash according to manufacturer specifications.
- Check synchromesh operation and adjust as necessary.
- Ensure all gears engage smoothly without any grinding.

Testing:

- Fill the gearbox with the recommended type and amount of gear oil.

- Run the gearbox through its gears while the vehicle is stationary.
- Road test the vehicle to ensure smooth shifting and proper operation.

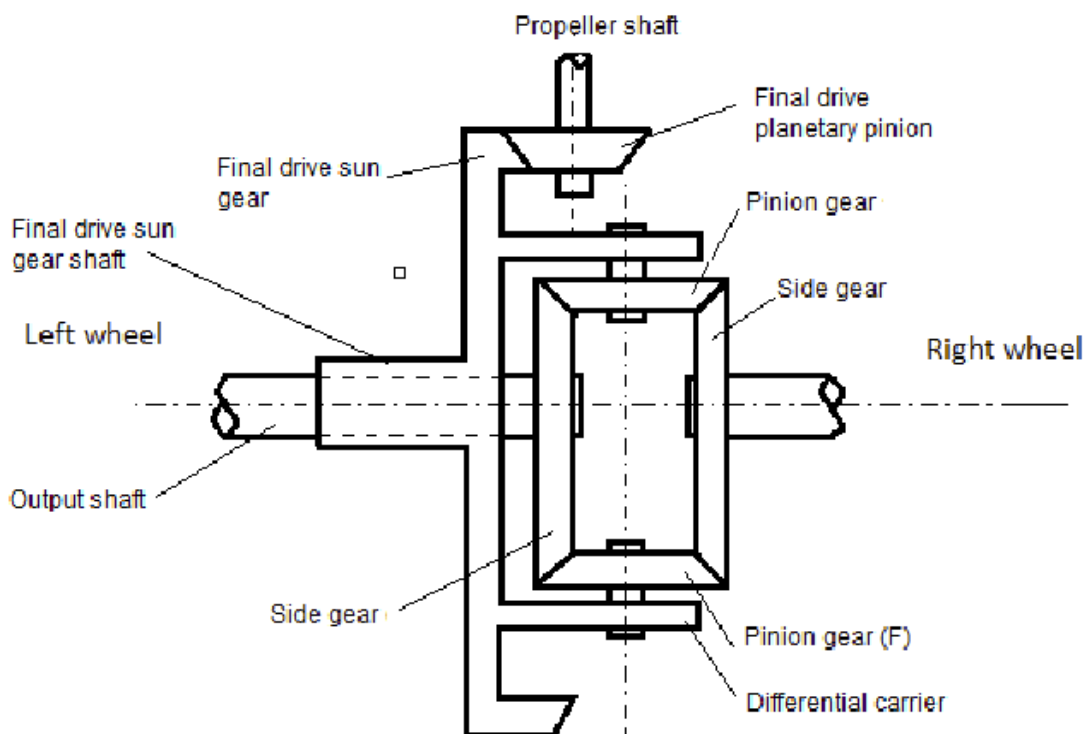
Precautions:

- Follow the manufacturer's specifications and guidelines throughout the process.
- Handle all components with care to avoid damage.
- Use appropriate safety gear, such as gloves and safety glasses.

Results:

Upon completion of the overhaul, the constant mesh gearbox should operate smoothly, with improved shifting and reduced noise. Any worn or damaged components should be replaced, ensuring the gearbox's reliability and performance. The vehicle should be road-tested to confirm the successful overhaul of the constant mesh gearbox.

3. Overhauling of Differential unit.



Aim: The aim of this practical exercise is to perform the overhaul of a differential unit, ensuring proper functionality, and addressing any wear or damage. This involves disassembling, inspecting, cleaning, and reassembling the differential components.

Materials:

Differential unit assembly
Gear oil
Cleaning solvent
Replacement parts (if necessary)
Gasket sealant
Bearings and seals kit
Rags
Marking paint or markers
Emery paper
Measuring tools (calipers, micrometer)

Tools:

Socket set and wrenches
Screwdrivers
Pry bars
Differential spreader tool
Dial indicator
Torque wrench
Bearing pullers
Gear pullers
Feeler gauges
Seal drivers

Procedure:

Safety Precautions:

- Ensure the vehicle is securely supported on jack stands.
- Disconnect the battery to prevent accidental movement.
- Use proper personal protective equipment, including gloves and safety glasses.

Disassembly:

- Drain the differential oil.
- Remove the differential unit from the vehicle.
- Mark the positions of various components for correct reassembly.

- Use appropriate tools to remove the differential cover, axles, and other components.
- Remove the differential carrier and ring gear.

Inspection:

- Inspect the ring and pinion gears for wear, scoring, and damage.
- Measure gear backlash and tooth contact patterns.
- Check bearings and seals for wear and damage.
- Inspect the differential carrier and side gears for wear.

Cleaning:

- Clean all components using a suitable cleaning solvent to remove oil, grease, and debris.
- Use emery paper to remove any rust or corrosion on gear surfaces.
- Thoroughly clean the differential housing.

Replacement of Parts:

- Replace any worn or damaged components, including bearings and seals.
- Ensure the new parts match the specifications of the manufacturer.
- Install new bearings and seals from the kit.

Reassembly:

- Reassemble the differential components in the reverse order of disassembly.
- Use a torque wrench to tighten bolts and nuts to the manufacturer's specifications.
- Lubricate all moving parts with gear oil.

Adjustment:

- Adjust gear backlash and tooth contact patterns as needed.
- Check and adjust bearing preload.
- Verify that the differential carrier and side gears are properly aligned.

Testing:

- Fill the differential with the recommended type and amount of gear oil.
- Rotate the differential manually to ensure smooth operation.
- Road test the vehicle to confirm proper differential function.

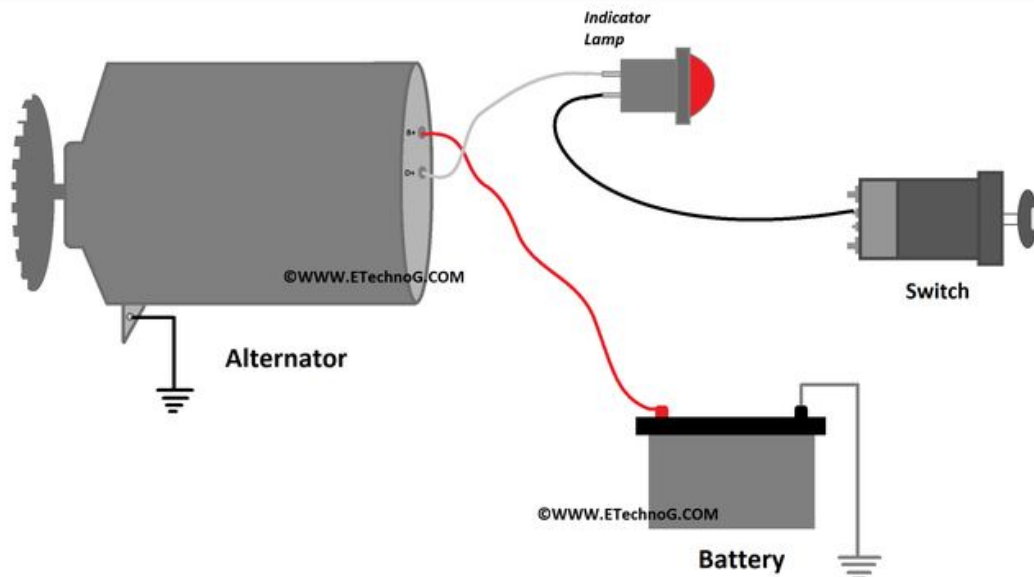
Precautions:

- Follow the manufacturer's specifications and guidelines throughout the process.
- Handle all components with care to avoid damage.
- Use appropriate safety gear, such as gloves and safety glasses.

Results:

Upon completion of the overhaul, the differential unit should function smoothly, with proper gear engagement and minimal noise. Any worn or damaged components should be replaced, ensuring the differential's reliability and performance. The vehicle should be road-tested to confirm the successful overhaul of the differential unit.

4. Overhauling of alternator.



Aim:

The aim of this practical exercise is to perform the overhaul of an alternator, ensuring optimal charging system performance and addressing any wear or damage. This involves disassembling, inspecting, cleaning, and reassembling the alternator components.

Materials:

- Alternator assembly
- Replacement parts (if necessary)
- Cleaning solvent
- Grease
- Brushes and brush holder assembly
- Voltage regulator (if applicable)
- Bearings kit
- Diode trio (if applicable)
- Gasket sealant
- Rags

Tools:

Screwdrivers
Wrenches
Socket set
Bearing pullers
Multimeter
Brush holder puller
Soldering iron (if needed for soldering)
Circlip pliers
Bench vise
Clean, lint-free cloth

Procedure:

Safety Precautions:

- Disconnect the battery to prevent electrical shock.
- Ensure the alternator is cool before starting the overhaul.
- Use appropriate personal protective equipment, including gloves and safety glasses.

Disassembly:

- Remove the alternator from the vehicle.
- Disconnect the electrical connections, including the output terminal and field winding.
- Disassemble the alternator by removing the pulley, front and rear covers, and any other applicable components.

Inspection:

- Inspect the rotor and stator windings for signs of burning or damage.
- Check the brushes for wear and proper spring tension.
- Measure the resistance of the diode trio (if applicable).
- Examine the bearings for smooth rotation and any signs of wear.

Cleaning:

- Clean all components using a suitable cleaning solvent to remove dirt, oil, and debris.
- Use a clean, lint-free cloth to wipe down components.

Replacement of Parts:

- Replace worn brushes, the diode trio (if applicable), and bearings.
- Ensure replacement parts are of the correct specifications.

Reassembly:

- Reassemble the alternator in the reverse order of disassembly.
- Use a torque wrench to tighten bolts to the manufacturer's specifications.
- Apply a thin layer of grease to the bearings.

Voltage Regulator Check (if applicable):

- Test the voltage regulator using a multimeter to ensure proper voltage regulation.

Testing:

- Bench test the alternator to confirm proper charging output.
- Reinstall the alternator in the vehicle and check the charging system voltage.

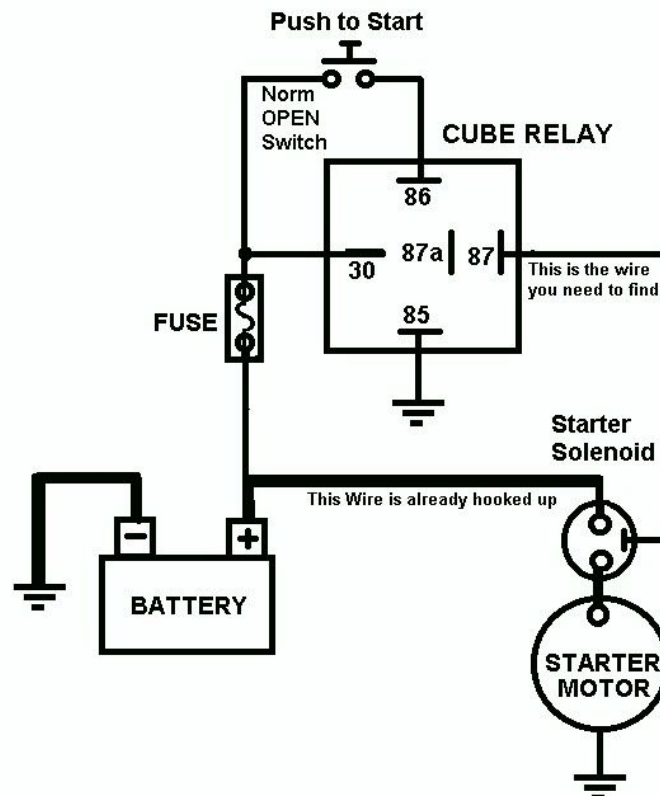
Precautions:

- Be cautious of electrical connections; ensure the alternator is properly grounded.
- Handle electrical components with care.
- Follow proper soldering techniques if soldering is required.

Results:

Upon completion of the alternator overhaul, the charging system should function optimally, providing the correct voltage output. Any worn or damaged components should be replaced, ensuring the alternator's reliability and performance. The vehicle's electrical system should be tested to confirm the successful alternator overhaul.

5. Check horn circuit and repair.



Aim:

The aim of this practical exercise is to check and repair the horn circuit in a vehicle, ensuring proper functionality and addressing any issues that may be causing the horn to malfunction.

Materials:

Multimeter
Replacement horn (if necessary)
Electrical tape
Wire connectors
Fuse (if necessary)
Wiring diagram for the vehicle

Tools:

Screwdrivers
Wire strippers/crimpers
Test light
Socket set
Wrenches
Jumper wires
Electrical contact cleaner
Sandpaper or emery cloth

Procedure:**Safety Precautions:**

- Disconnect the vehicle's battery to ensure safety while working on the electrical system.
- Park the vehicle on a level surface and engage the parking brake.

Visual Inspection:

- Inspect the horn for physical damage and loose connections.
- Check the fuse related to the horn circuit for any signs of damage.

Check Power Supply:

- Use a multimeter to check if there is power reaching the horn when the horn button is pressed.
- If there is no power, check the fuse, relay, and wiring for any issues.

Check Ground Connection:

- Ensure that the horn has a good ground connection. Clean the ground connection point if necessary.

Test Horn:

- Use a jumper wire to directly connect the positive terminal of the horn to the positive battery terminal.
- If the horn sounds, it indicates the horn itself is functional.

Check Horn Button and Relay:

- Inspect the horn button on the steering wheel for any damage or disconnection.
- Test the horn relay by swapping it with a similar relay from another part of the vehicle.

Inspect Wiring:

- Inspect the wiring from the horn button to the horn for any breaks or damage.
- Use a test light or multimeter to check for continuity in the wiring.

Clean Contacts:

- Clean the horn contacts, relay contacts, and any other electrical connections with electrical contact cleaner.
- If contacts are corroded, use sandpaper or emery cloth to clean them.

Replace Faulty Components:

- Replace any faulty components, such as a damaged fuse, relay, or wiring.
- If the horn itself is faulty, replace it with a new one.

Reassembly:

- Reconnect the battery after completing the repairs.
- Test the horn to ensure it is functioning properly.

Precautions:

- Work in a well-ventilated area.
- Handle electrical components with care.
- Follow safety guidelines for working with vehicle electrical systems.

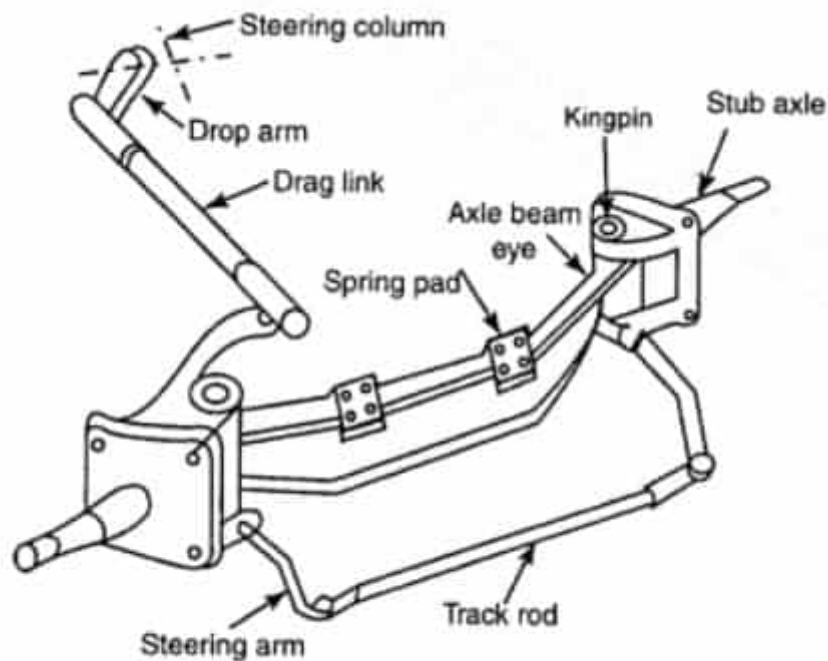
Results:

Upon completion of the horn circuit check and repair, the horn should function properly when the horn button is pressed. Any issues with the power supply, ground connection, wiring, or components should be addressed, and the horn should be restored to proper working condition. Test the horn in different scenarios, such as when the vehicle is stationary and when it's in motion, to confirm its reliability.

Section - II

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6. Inspect and report given front axle.



Aim:

The aim of this practical inspection is to assess the condition of the given front axle, identifying any signs of wear, damage, or other issues that may affect its performance and safety.

Materials:

Visual inspection checklist
Pen and notepad for recording observations

Tools:

Flashlight
Jack and jack stands
Pry bar
Measuring tape
Dial indicator (optional)
Clean rags

Procedure:

Visual Inspection:

- Check for any visible signs of damage, such as bends or cracks in the axle beam.
- Inspect the axle for rust or corrosion, paying attention to critical areas that may compromise structural integrity.
- Examine the welds for any signs of cracking or separation.

Suspension Components:

- Inspect the condition of the bushings, control arms, and other suspension components connected to the front axle.
- Check for any leaks from shock absorbers or other hydraulic components.

Steering Components:

- Inspect the tie rod ends for wear or excessive play.
- Check the condition of the steering linkage, ensuring it is secure and free from damage.

Wheel Bearings and Hubs:

- Assess the condition of the wheel bearings by checking for play or unusual noises when the wheel is moved.
- Inspect the hubs for any signs of leaks or damage.

Brake Components:

- Check the condition of the brake calipers, rotors, and pads.
- Inspect brake lines for leaks or damage.

Axle Joints:

- Examine the CV joints or U-joints for signs of wear, such as torn boots or unusual movement.

Measurement (if applicable):

- Measure the ride height to ensure it is within specifications.
- Use a dial indicator to check for runout in the axle shafts.

Precautions:

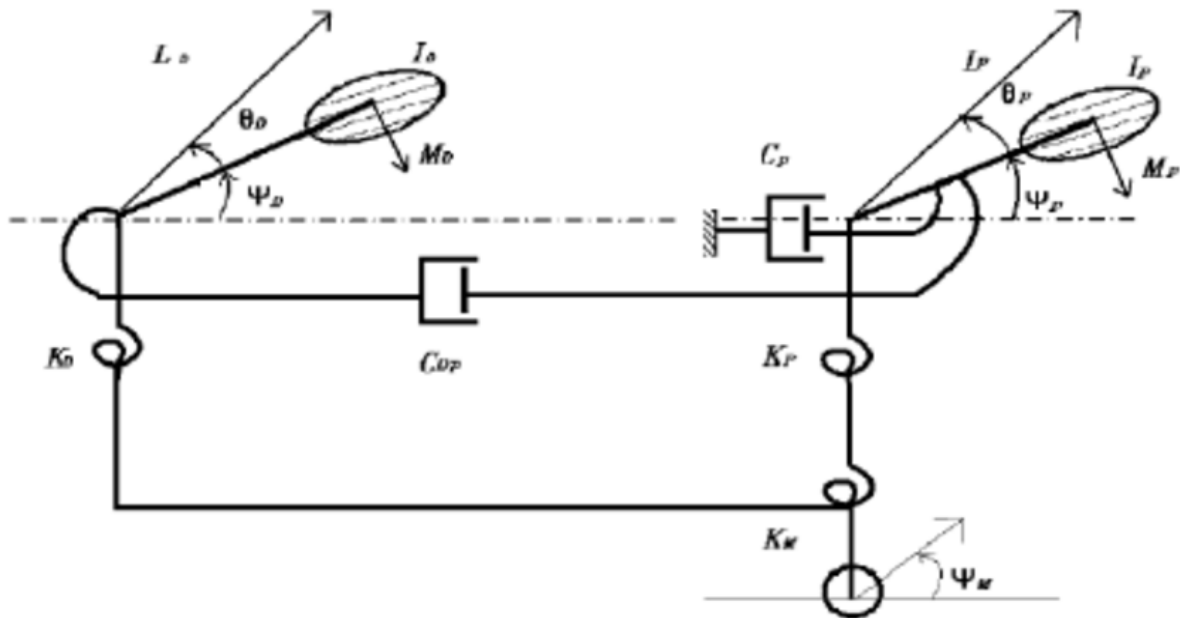
- Ensure the vehicle is safely supported on jack stands before inspecting the front axle.
- Wear appropriate personal protective equipment, including safety glasses and gloves.
- Exercise caution when working around suspension and steering components.

Result:

Upon completion of the inspection, the front axle should be reported based on the findings. The report should include details on any observed damage, wear, or issues with suspension, steering, wheel bearings, brakes, and other relevant components. Recommendations for repairs or replacements should be included if necessary. The

overall goal is to provide a comprehensive assessment of the front axle's condition for maintenance or safety considerations.

7. Inspect the working and adjustment of the wiper.



Aim:

The aim of this practical inspection is to assess the working condition and proper adjustment of the windshield wiper system, ensuring efficient and effective operation.

Materials:

Windshield wiper blades (if replacement is needed)
Washer fluid

Tools:

Screwdriver
Wrench
Clean cloth
Windshield wiper adjustment tool (if applicable)

Procedure:

Working Condition:

- Turn on the vehicle's ignition and activate the windshield wiper system.

- Observe the movement of the wiper blades and check for smooth and continuous operation.
- Ensure that both wiper blades cover the entire windshield area without leaving streaks.

Washer Functionality:

- Test the windshield washer system to ensure it sprays an adequate amount of fluid onto the windshield.
- Check for any clogs in the washer nozzles and clear them if necessary.

Blade Inspection:

- Inspect the wiper blades for signs of wear, such as cracking or torn rubber.
- Check for proper blade contact with the windshield; blades should not lift off or skip during operation.

Adjustment:

- If the wiper blades do not cover the windshield properly, use a screwdriver or a specific wiper adjustment tool to adjust the wiper arm tension.
- Lift the wiper arm away from the windshield and adjust its position to ensure proper contact and pressure.

Tightening:

- Check and tighten any loose nuts or bolts on the wiper linkage or arm.
- Ensure that the wiper arms are securely attached to the wiper motor shaft.

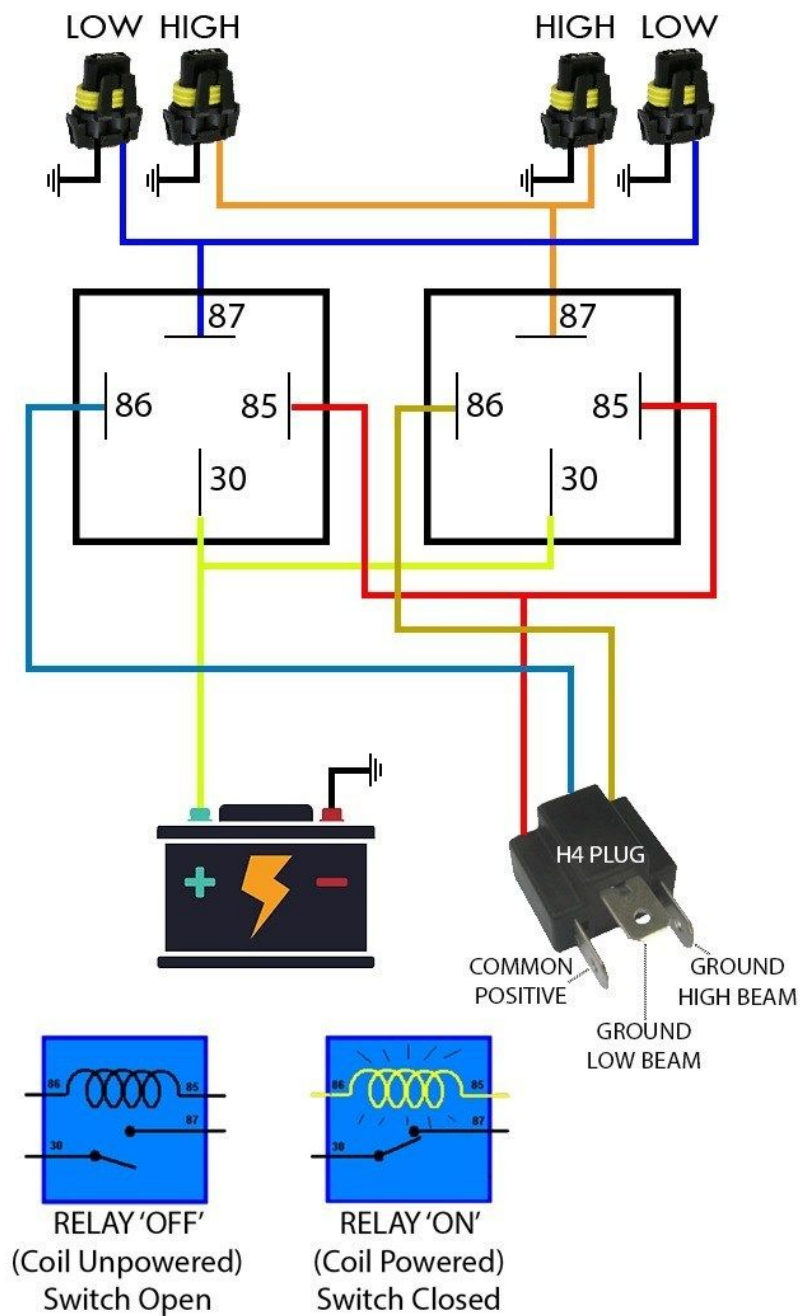
Precautions:

- Exercise caution when working with moving wiper blades to avoid injury.
- Use appropriate safety measures, such as wearing safety glasses and gloves.
- Do not operate the windshield wipers on a dry windshield, as this can damage the wiper blades.

Result:

Upon completion of the inspection and adjustment, the windshield wiper system should operate smoothly, covering the entire windshield without leaving streaks or missing spots. If any issues are identified during the inspection, such as worn blades or loose components, appropriate adjustments or replacements should be made to ensure the efficient and reliable operation of the windshield wiper system.

8. To check out the adjustment and wiring circuit of the head light.



Aim:

The aim of this practical exercise is to check and adjust the headlight aiming and inspect the wiring circuit, ensuring proper illumination and compliance with safety standards.

Materials:

- Headlight adjustment chart (if available)
- Replacement bulbs (if necessary)

Tools:

Screwdrivers
Wrenches
Measuring tape
Masking tape
Multimeter
Headlight adjustment tool (if needed)

Procedure:**Aiming the Headlights:**

- Park the vehicle on a flat surface facing a wall or garage door.
- Measure the height from the ground to the center of each headlight and mark these points on the wall with masking tape.
- Turn on the headlights and adjust them so that the beams align with the marked tape lines. Refer to the headlight adjustment chart for specific measurements.

Inspecting Wiring Circuit:

- Turn off the vehicle and disconnect the battery for safety.
- Inspect the headlight wiring harness for any visible damage or wear.
- Use a multimeter to check for continuity in the wiring, ensuring a secure electrical connection.
- Check the headlight sockets for corrosion or loose connections.

Bulb Inspection and Replacement:

- Inspect the condition of the headlight bulbs for any signs of discoloration or burnt filaments.
- Replace any bulbs that show signs of wear or are not functioning properly.

Adjustment Verification:

- Verify the headlight adjustment by visually inspecting the beam patterns on the wall. The top of the beam pattern should be below the marked tape lines.

Tighten and Secure:

- Ensure that all fasteners and adjustment screws are tightened securely after the adjustment process.
- Confirm that the headlight housing is properly seated and aligned.

Precautions:

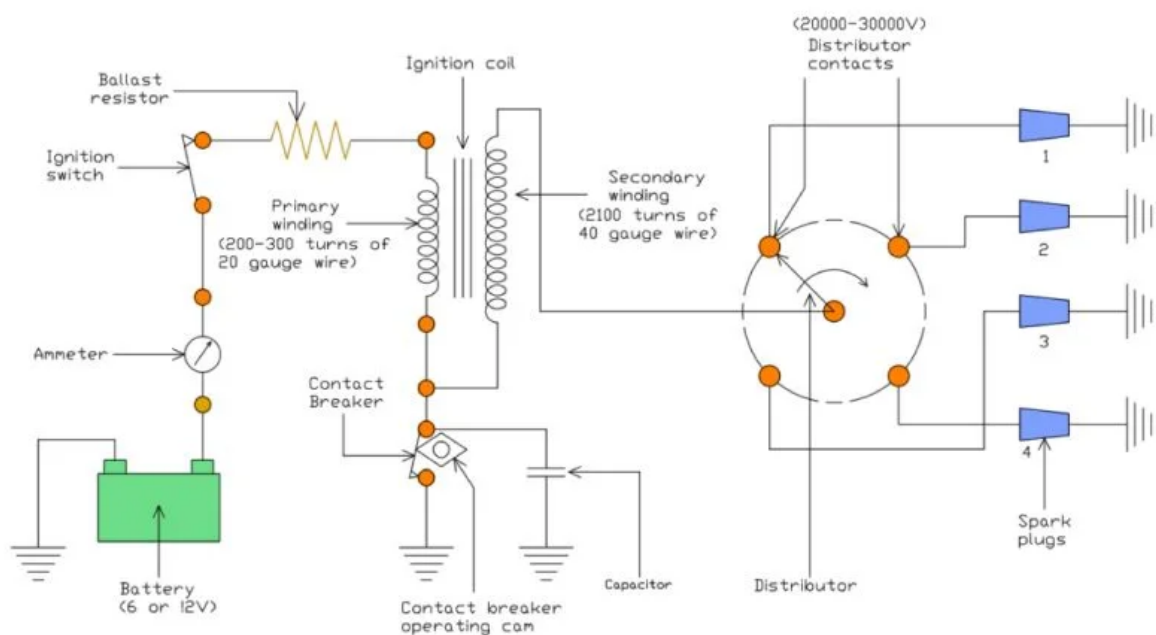
- Handle bulbs with care; use gloves or a clean cloth to avoid skin contact.

- Be cautious of hot surfaces when working around recently operated headlights.
- Follow safety guidelines for working with vehicle electrical systems, including disconnecting the battery.

Result:

Upon completion of the adjustment and wiring circuit inspection, the headlights should be properly aimed, providing effective illumination without causing glare for oncoming drivers. The wiring circuit should be free from visible damage, ensuring a secure electrical connection. If any issues are identified, such as misalignment or damaged wiring, appropriate adjustments or replacements should be made to ensure the optimal functioning of the headlight system.

9. To check out the wiring diagram of the battery coil ignition system.



Aim:

The aim of this practical exercise is to check and understand the wiring diagram of the battery coil ignition system in a vehicle, allowing for proper troubleshooting and maintenance of the ignition system.

Materials:

Vehicle service manual or wiring diagram specific to the make and model
Multimeter

Tools:

Screwdrivers
Wrenches
Test light
Wiring diagram reading guide (if necessary)

Procedure:

Aim Identification:

- Obtain the wiring diagram from the vehicle service manual or a reliable source.
- Understand the components and connections involved in the battery coil ignition system.

Visual Inspection:

- Visually inspect the wiring harness for any visible damage, loose connections, or signs of wear.
- Verify that all components, such as the ignition switch, coil, distributor, and spark plugs, are correctly connected.

Check for Continuity:

- Using a multimeter, check for continuity in the wiring circuits associated with the ignition system.
- Verify that there is continuity between the ignition switch, coil, distributor, and spark plugs as per the wiring diagram.

Test Light Verification:

- Use a test light to check for power at key points in the ignition system, such as the ignition switch, coil, and distributor.
- Identify any areas where the test light does not illuminate, indicating potential issues with power supply.

Compare with Wiring Diagram:

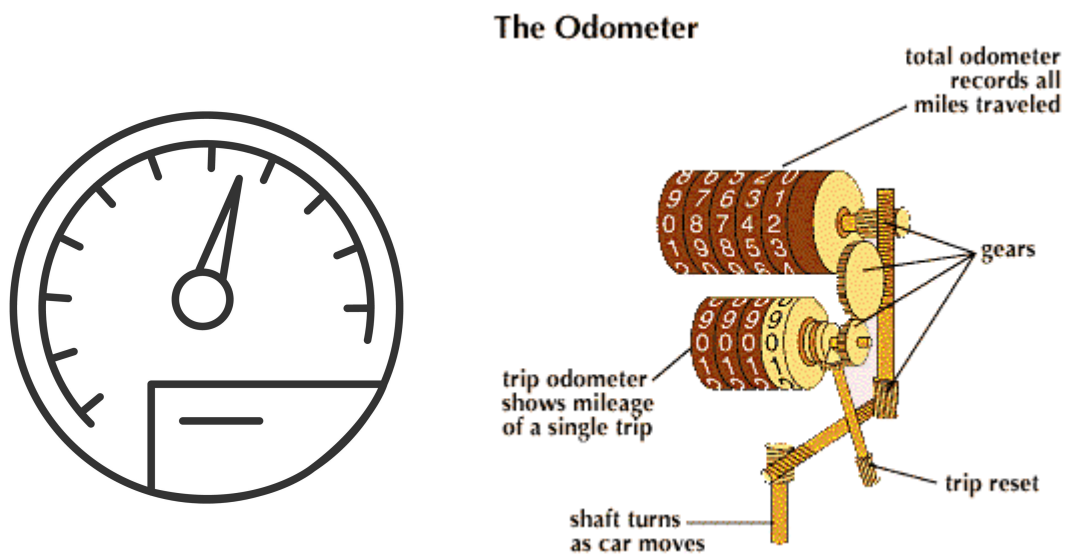
- Compare the observed wiring with the wiring diagram to identify any discrepancies or deviations.
- Cross-reference wire colors, connectors, and terminal numbers to ensure accuracy.

Precautions:

- Disconnect the battery before conducting any tests to ensure safety.
- Handle electrical components with care and avoid short circuits.
- Follow safety guidelines for working with vehicle electrical systems.

Result:

Upon completion of the practical exercise, the technician should have a clear understanding of the battery coil ignition system's wiring diagram and be able to identify any discrepancies or issues in the wiring. The wiring diagram serves as a reference for troubleshooting and addressing any electrical problems within the ignition system. If any discrepancies are found, appropriate repairs or replacements should be made to ensure the proper functioning of the ignition system.

10. To check out the speedometer and odometer.**Aim:**

The aim of this practical exercise is to check and verify the accuracy and functionality of the speedometer and odometer in a vehicle.

Materials:

Vehicle owner's manual
Replacement speedometer cable (if necessary)

Tools:

Screwdrivers
Wrenches
Test drive route map or GPS

Multimeter

Jack and jack stands

Procedure:

Visual Inspection:

- Inspect the speedometer and odometer for any visible damage or anomalies.
- Verify that the speedometer needle rests at zero when the vehicle is stationary.

Check Odometer Reading:

- Note the current odometer reading and compare it with previous records or the expected mileage based on the vehicle's age.
- Ensure that the odometer numbers are not blurry or faded.

Test Drive:

- Take the vehicle for a test drive on a known route with distance markers.
- Compare the distance covered according to the odometer with the known distance to check for accuracy.

Speedometer Accuracy:

- While driving at a steady speed, compare the speed indicated on the speedometer with the actual speed recorded by a GPS device or using speed limit signs.
- Note any discrepancies and the speedometer's accuracy at different speeds.

Check Speedometer Cable (if applicable):

- If the vehicle has a mechanical speedometer cable, inspect it for any signs of wear or damage.
- Lubricate or replace the speedometer cable if necessary.

Electrical Speed Sensor (if applicable):

- For vehicles with electronic speed sensors, use a multimeter to check the sensor's output signal.
- Compare the signal with the vehicle speed to ensure accuracy.

Precautions:

- Ensure the vehicle is securely supported on jack stands if any work is done underneath.
- Follow traffic rules and drive safely during the test drive.
- Use appropriate safety measures when working on or under the vehicle.

Result:

Upon completion of the practical exercise, the speedometer and odometer should be accurately reading the vehicle's speed and distance. Any discrepancies or inaccuracies should be noted, and if necessary, adjustments or repairs should be made to ensure the proper functioning of these components. The vehicle's speedometer and odometer readings should align with real-world distances and speeds for reliable and accurate information.