



# Modern Automotive Technology Chapter 31

## Starting System Fundamentals



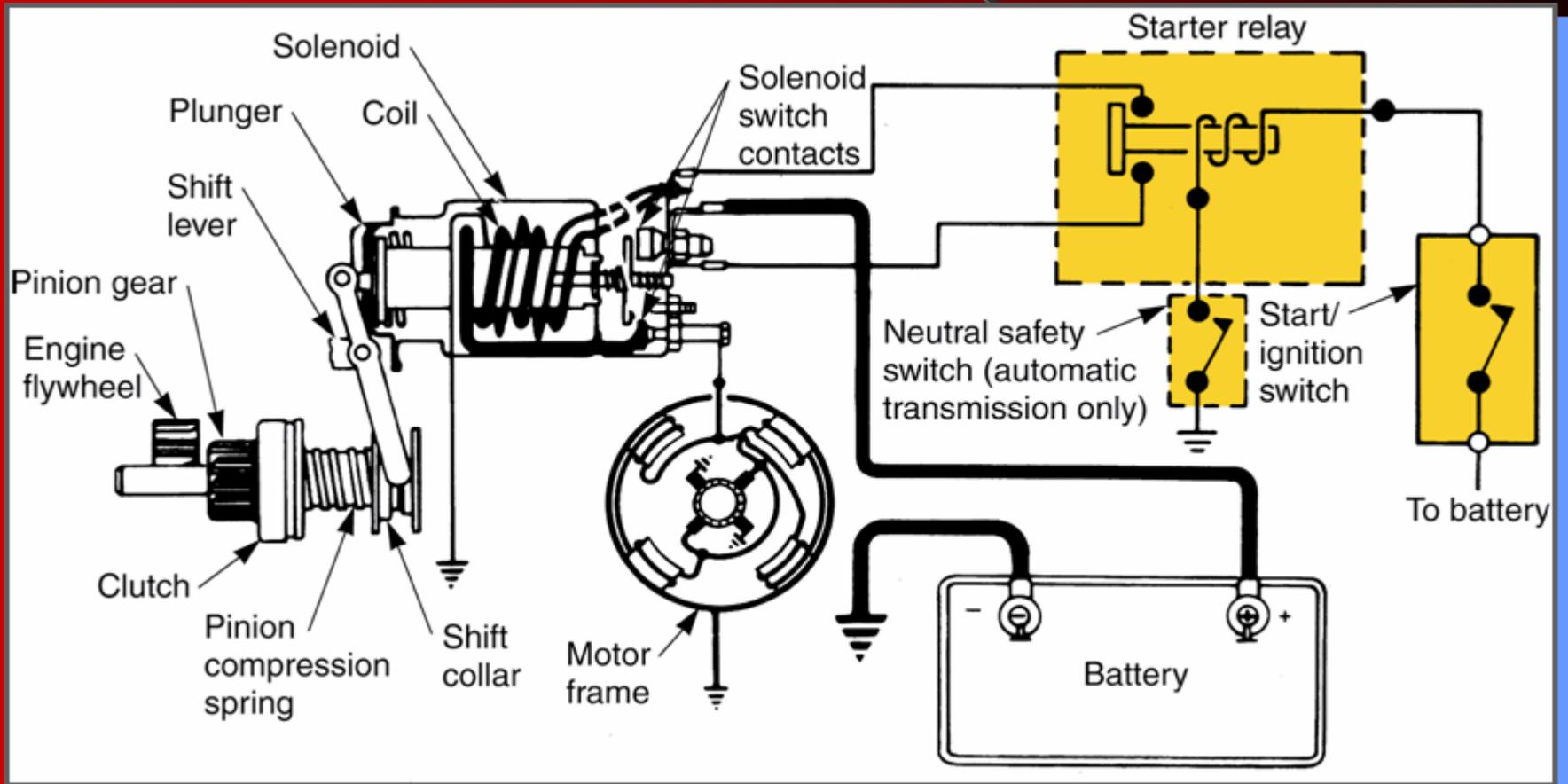
*North Montco  
Technical Career Center*

# Learning Objectives

- Explain the principles of an electric motor.
- Describe the construction and operation of a starting motor.
- Sketch a simple starting system circuit.
- Explain the operation of solenoids.
- List the functions of the main starter drive parts.
- Describe starter drive operation.
- Compare different types of starting motors.
- Describe starting system safety features.



# Starting System Circuit



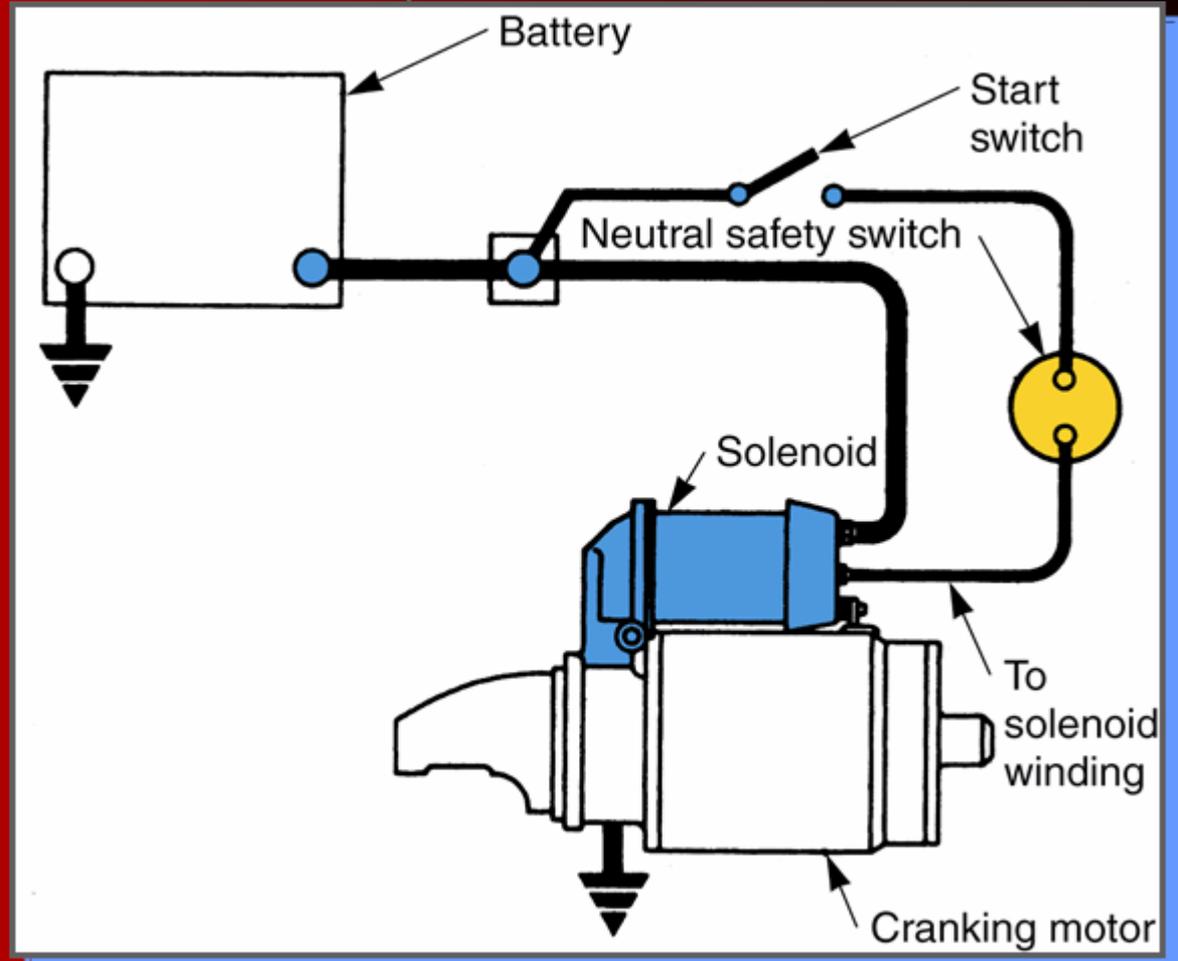
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1. Neutral Safety Switch prevents the starting system from working when the transmission is in gear.
2. The Battery is the source of energy for the starting system.
3. The Field Frame is the center housing that holds field coils and pole shoes.

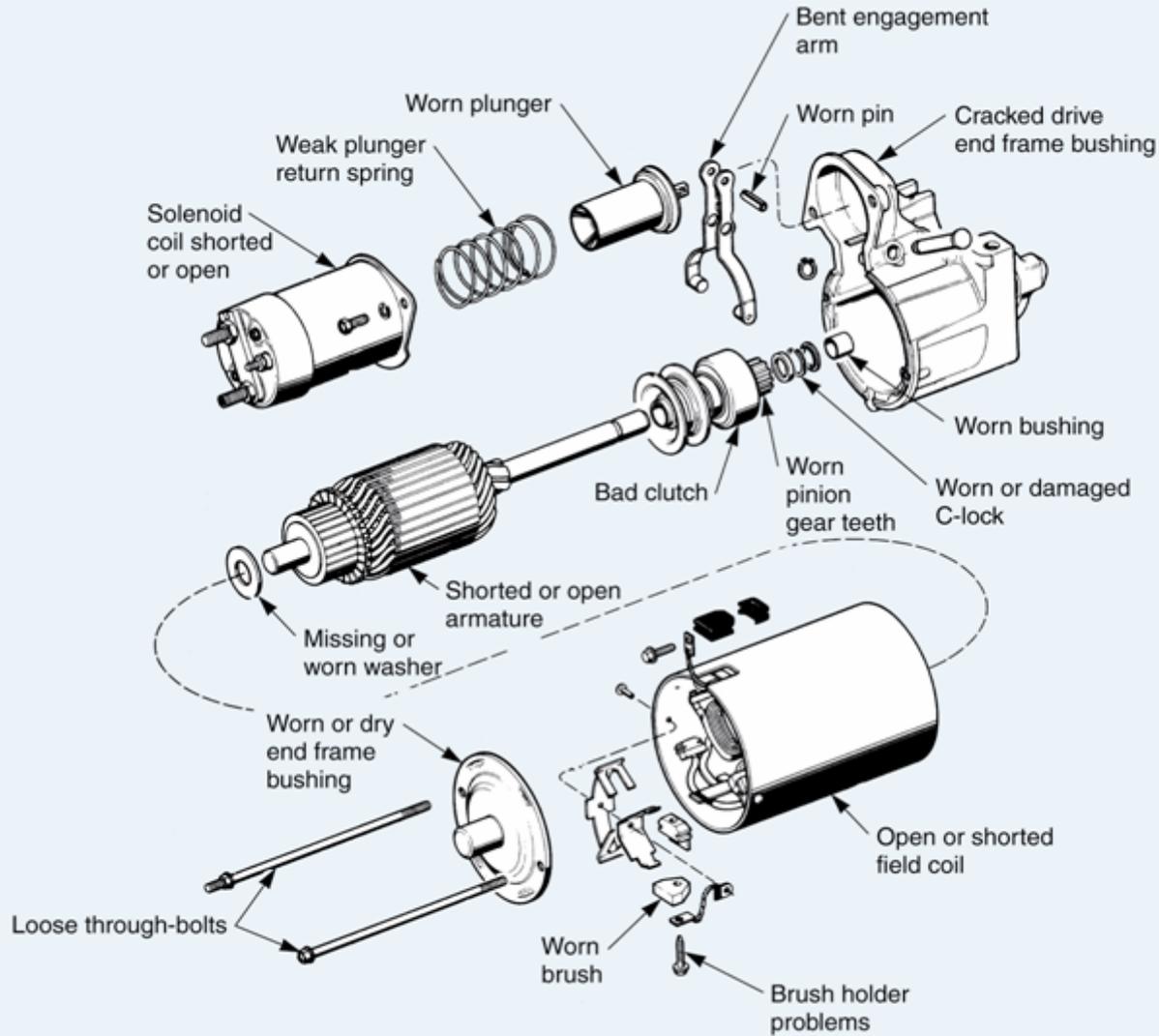


# Neutral Safety Switch

Wired in series  
with the starter  
solenoid



# Starting Motor



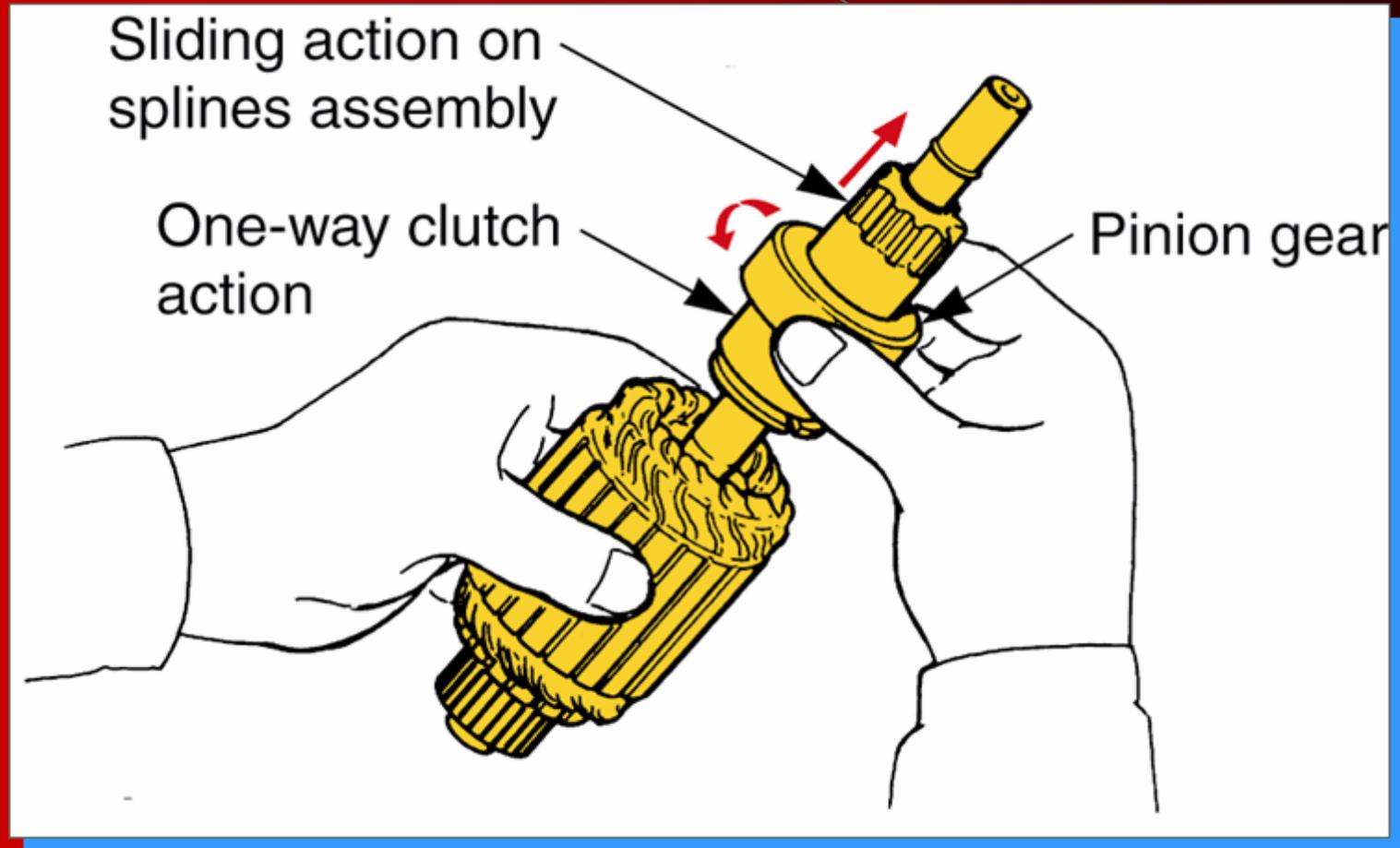


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4. The Starter Overrunning Clutch locks the pinion gear in one direction and releases it in the other, allowing the pinion gear to turn the flywheel ring gear for starting.
5. The Brushes slide on the commutator to carry battery current to spinning windings.

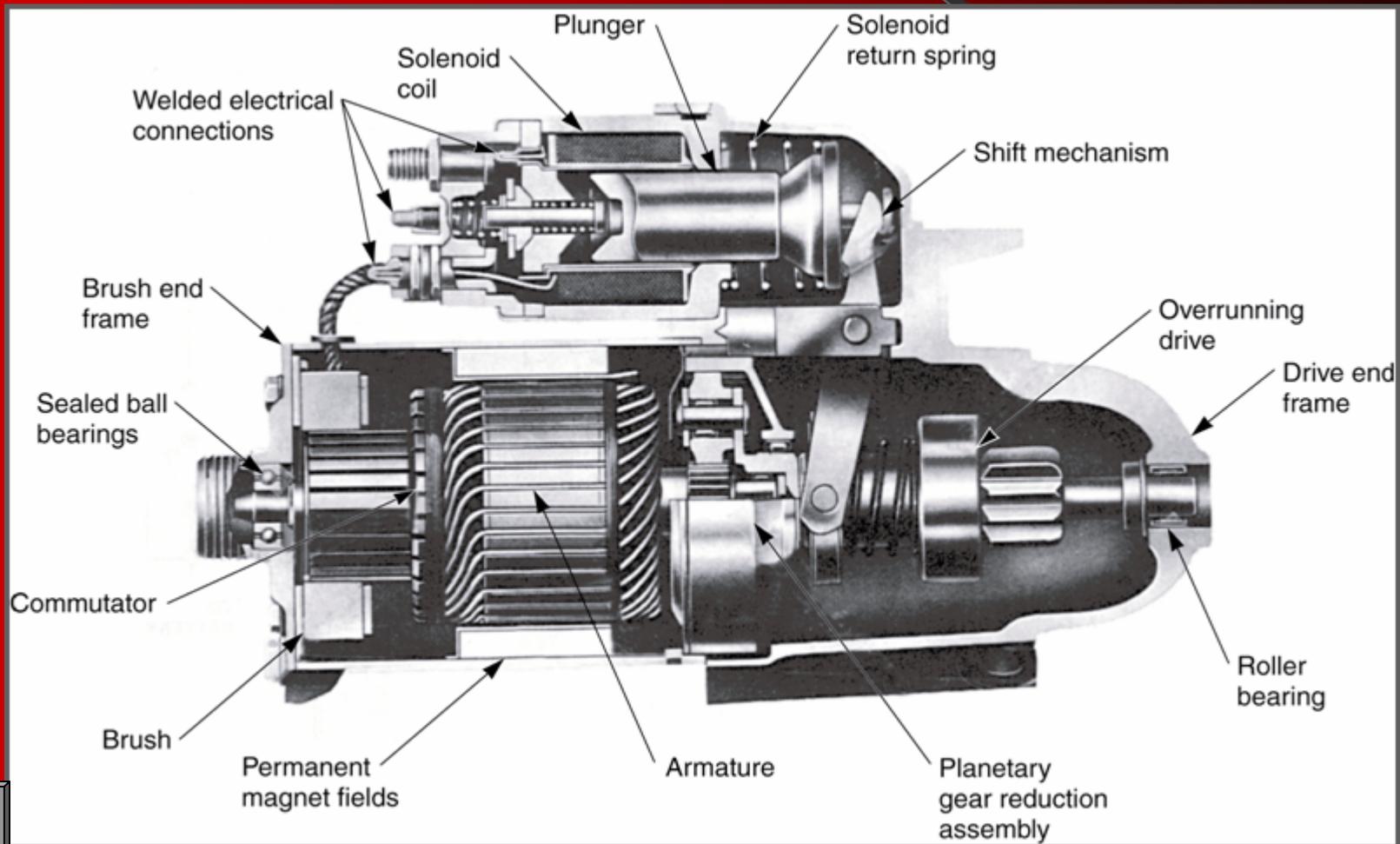


# Overrunning Clutch



# Permanent-Magnet Starter

Uses special high-strength magnets in place of conventional field windings

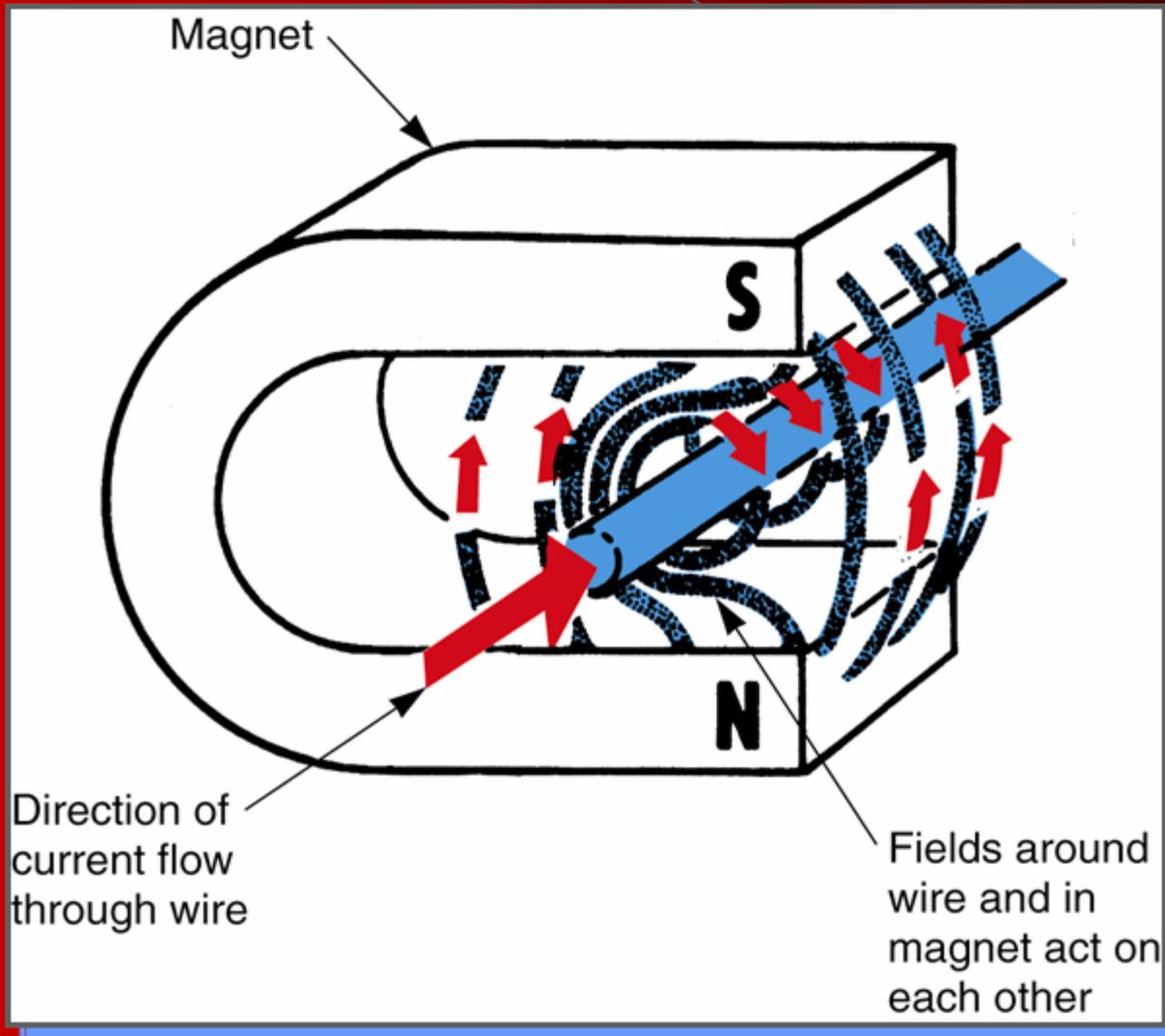


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6. A Magnetic Field is made up of invisible lines of force.
7. Starter Pinion Gear moves into and meshes with the flywheel ring gear any time the starter is energized.

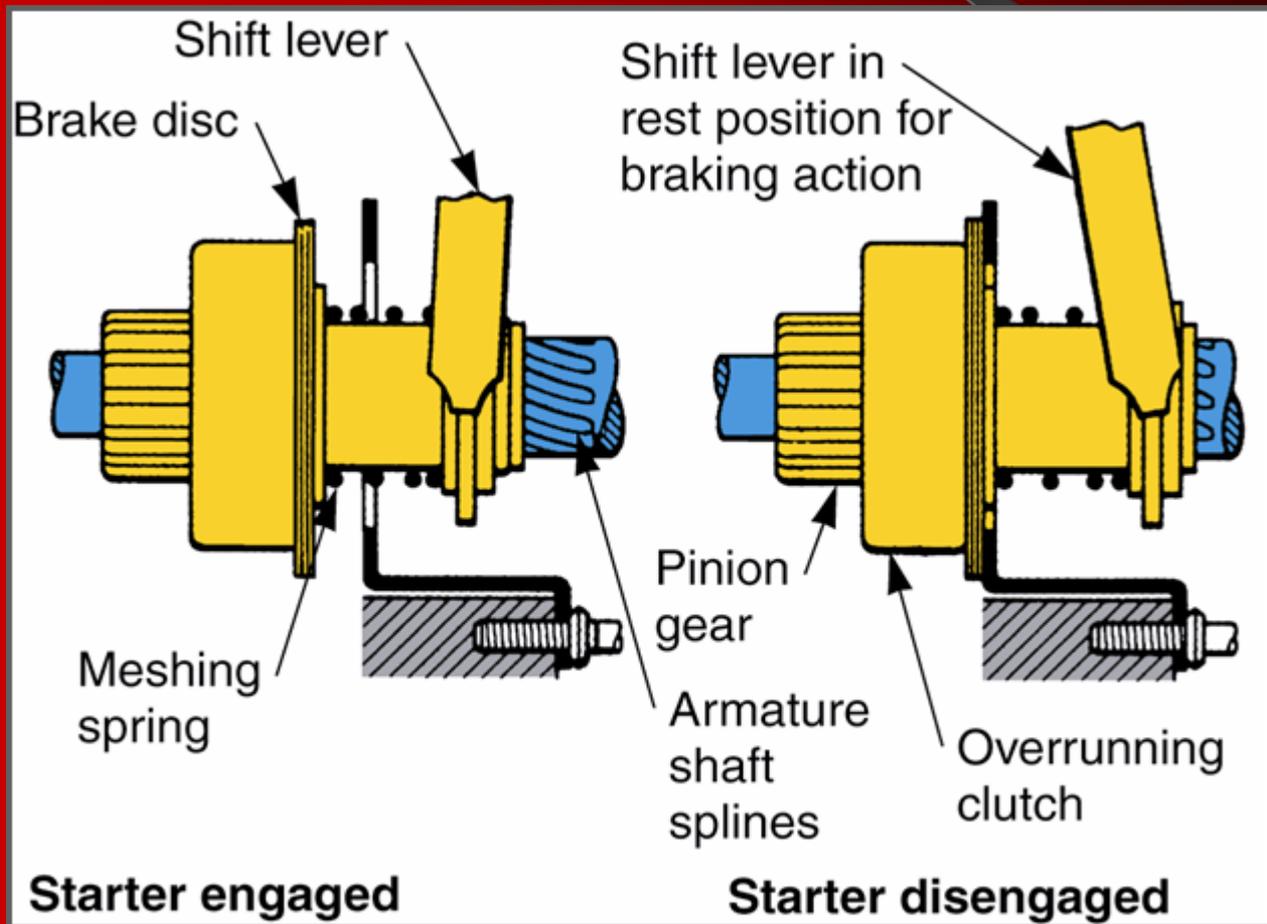


# Magnetic Field Action



# Pinion Gear Assembly

Pinion gear assembly slides on the shaft for engagement



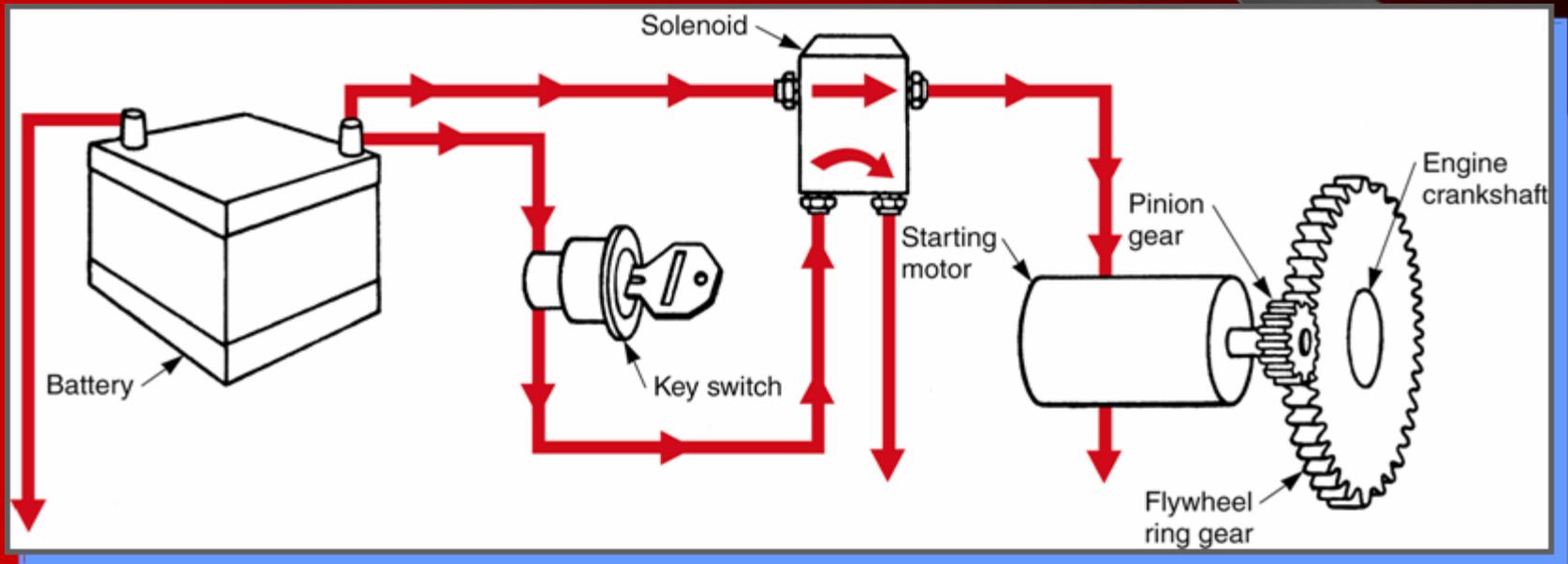
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8. An Ignition Switch allows driver to control starting system operation.
9. A Starting Motor is a high-torque electric motor for turning the engine flywheel or flex-plate.



# Ignition Switch

- Ignition switch energizes the solenoid
- Solenoid energizes the starting motor

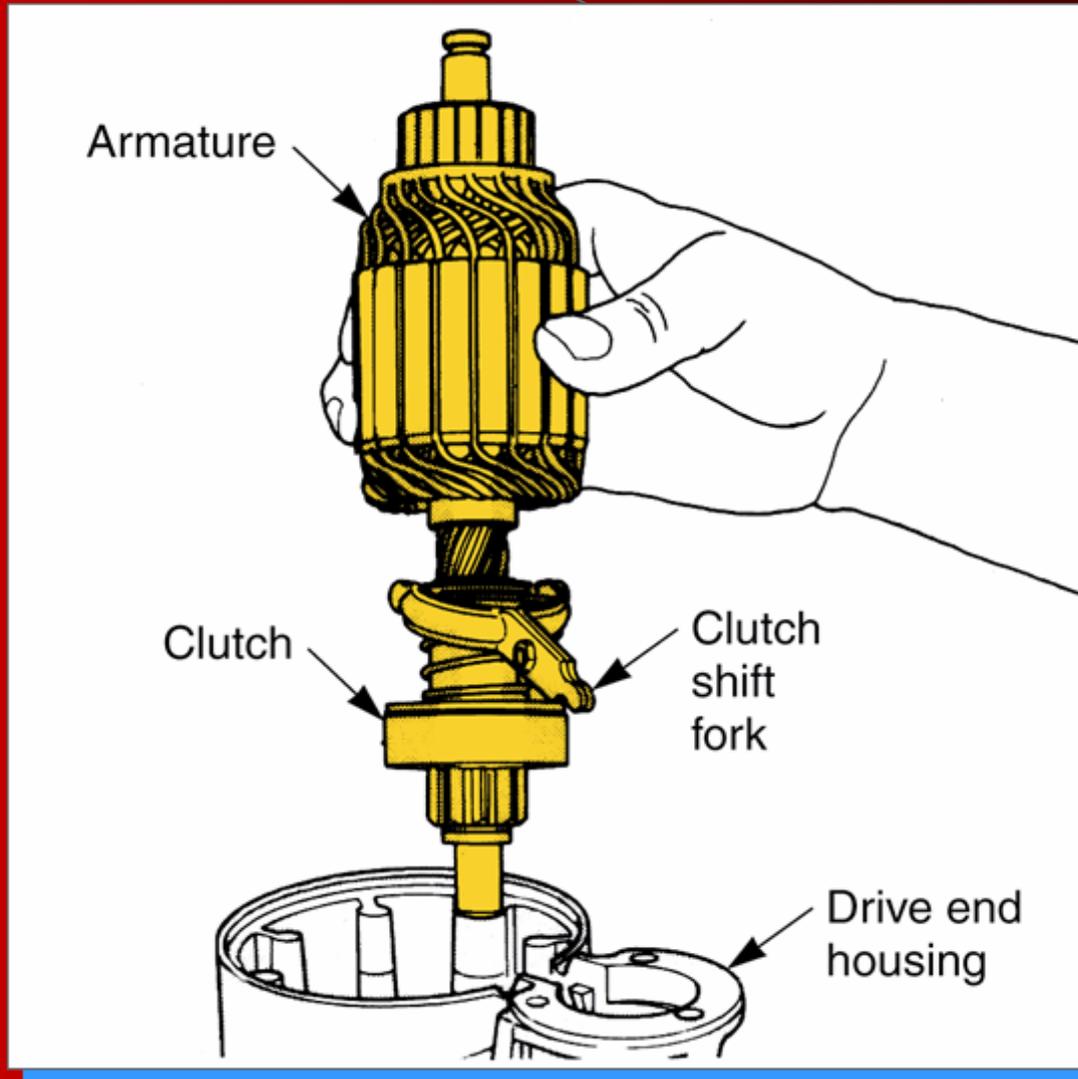


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10. The Armature is composed of windings, core, starter shaft, and commutator assembly that spins inside a stationary field.
11. The Commutator serves as a sliding electrical connection between the motor windings and the brushes.

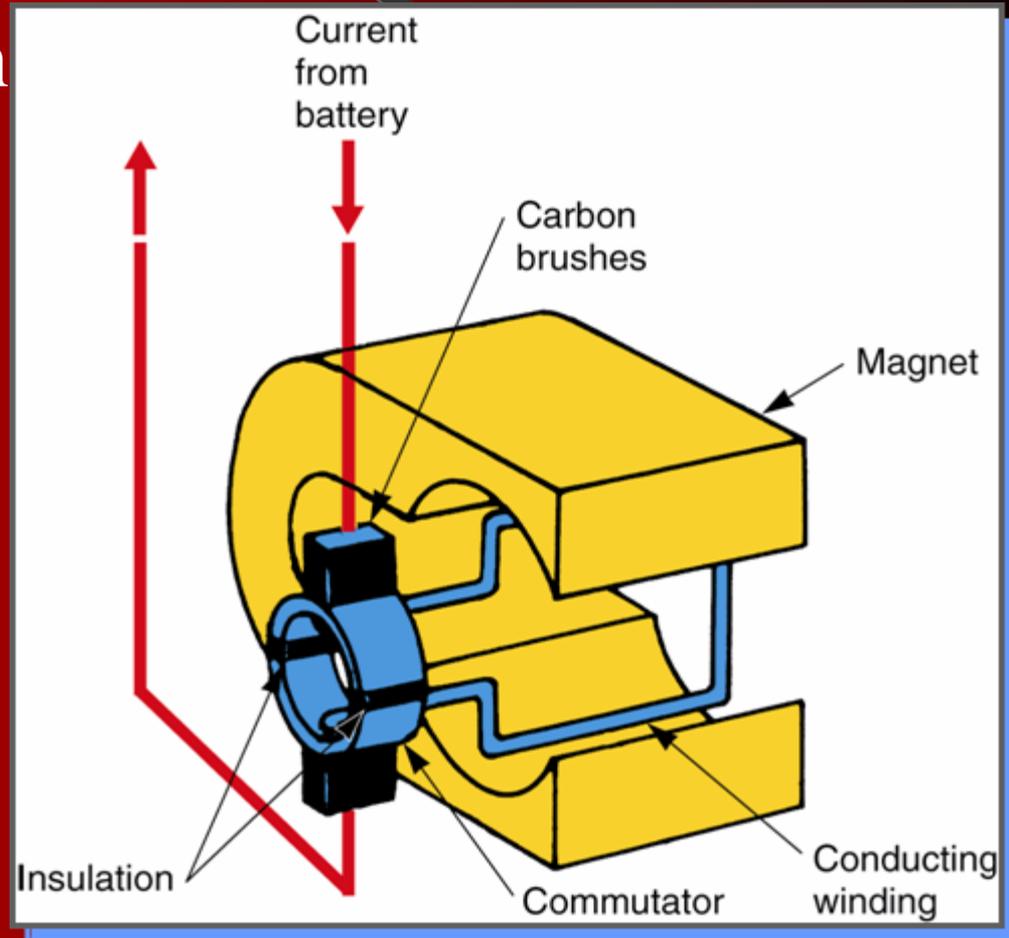


# Armature



# Commutator and Brushes

Commutator reverses the electrical connection when the loop rotates around

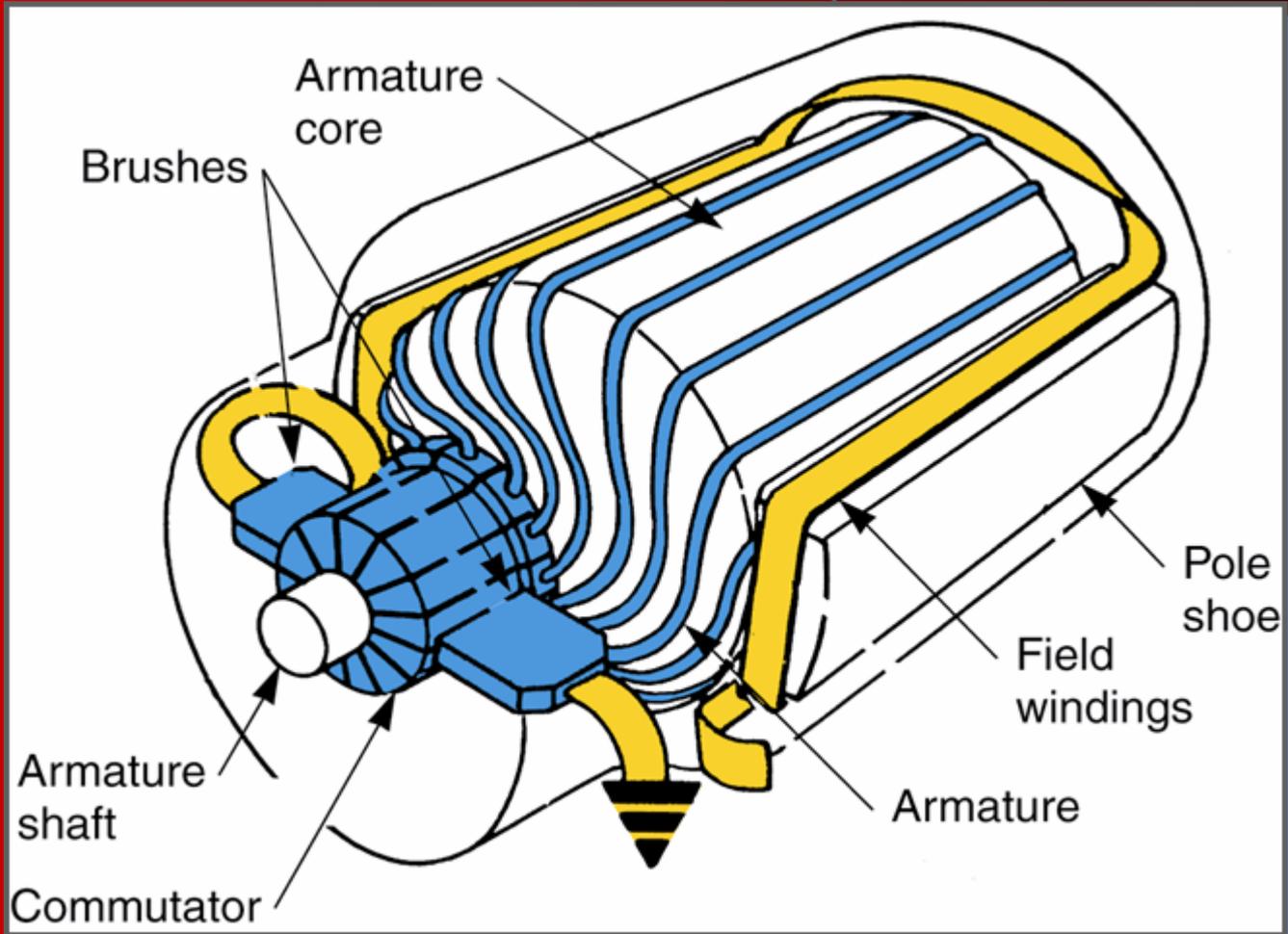


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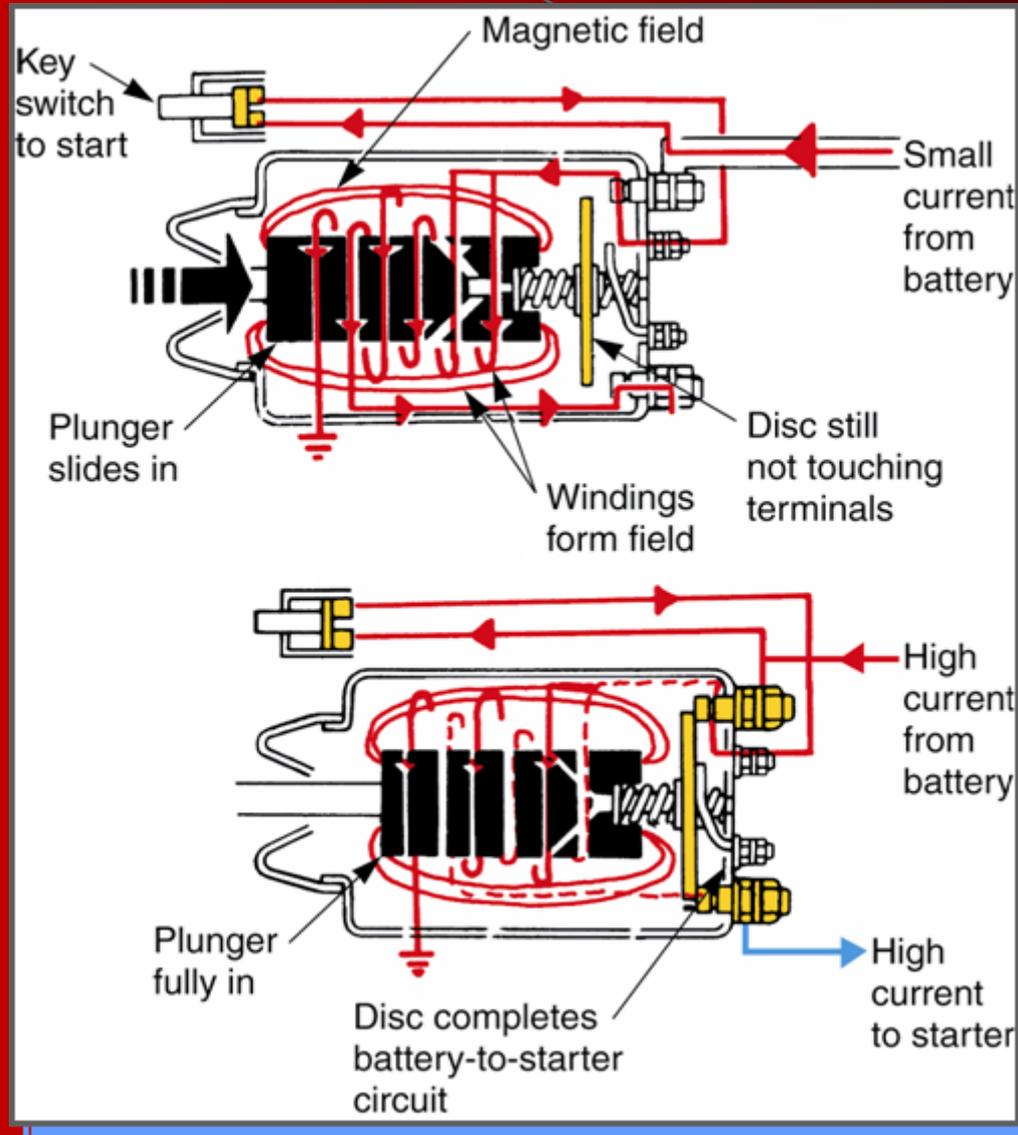
12. The Field Winding is a stationary set of insulated wire wrapped in a circular shape.
13. The Starter Solenoid is a high-current relay that makes an electrical connection between the battery and the starting motor



# Armature and Field Windings

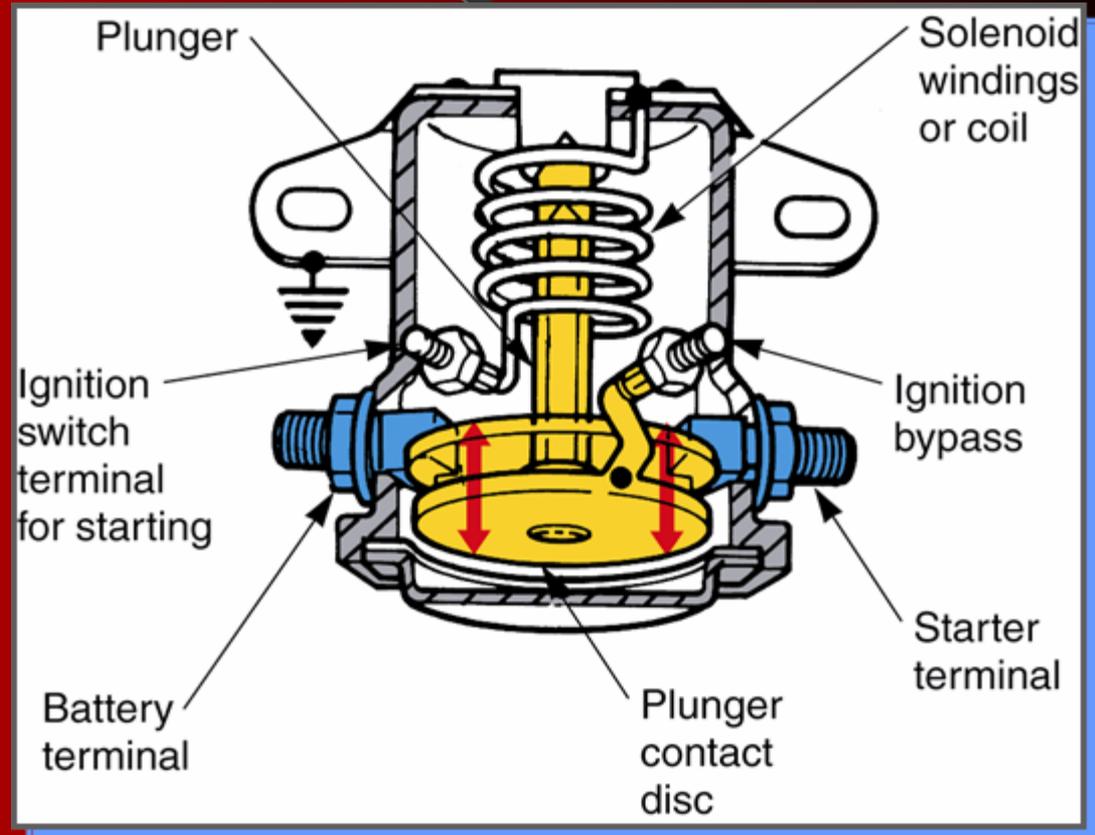


# Solenoid Operation



# Starter Solenoid

Plunger movement pulls the disc into contact with two battery terminals to activate the starter



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14. The Armature Core is made of iron and holds the windings in place.
15. The Shunt-Wound Motor is a type of motor with less starting torque but more constant torque at varying speeds.



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