

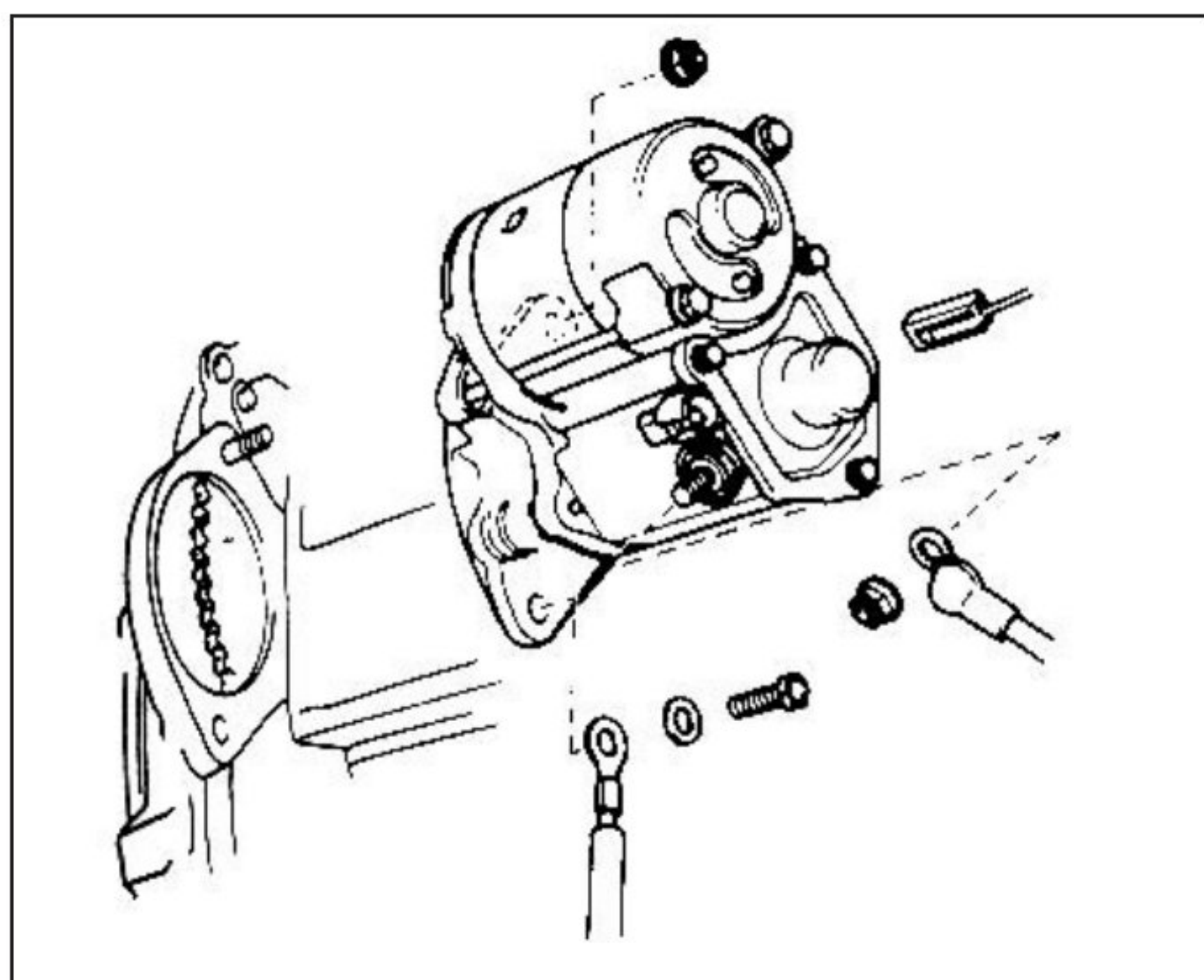
Tackling 1991 Land Cruiser Starting and Charging Systems Part I

Toyota Motor Corporation

STARTER

Removal of Starter

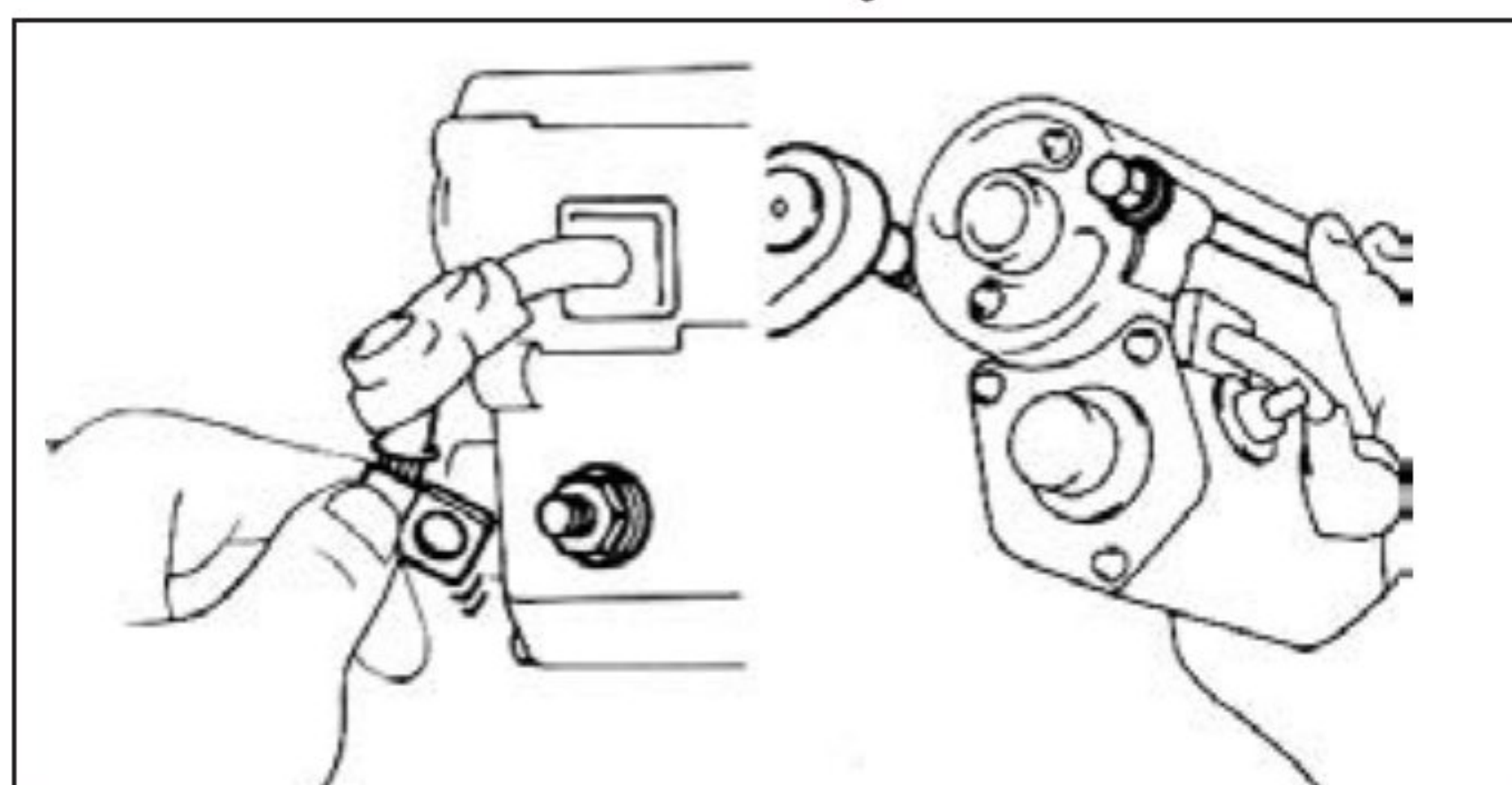
1. Disconnect cable from negative terminal of battery.
2. Disconnect cable and connector. Remove the nut and disconnect the battery cable from the magnetic switch on the starter motor. Disconnect the connector from terminal 50.
3. Remove starter motor. Remove the bolt and disconnect the ground strap, then remove the nut and starter motor.



Disassembly of Starter

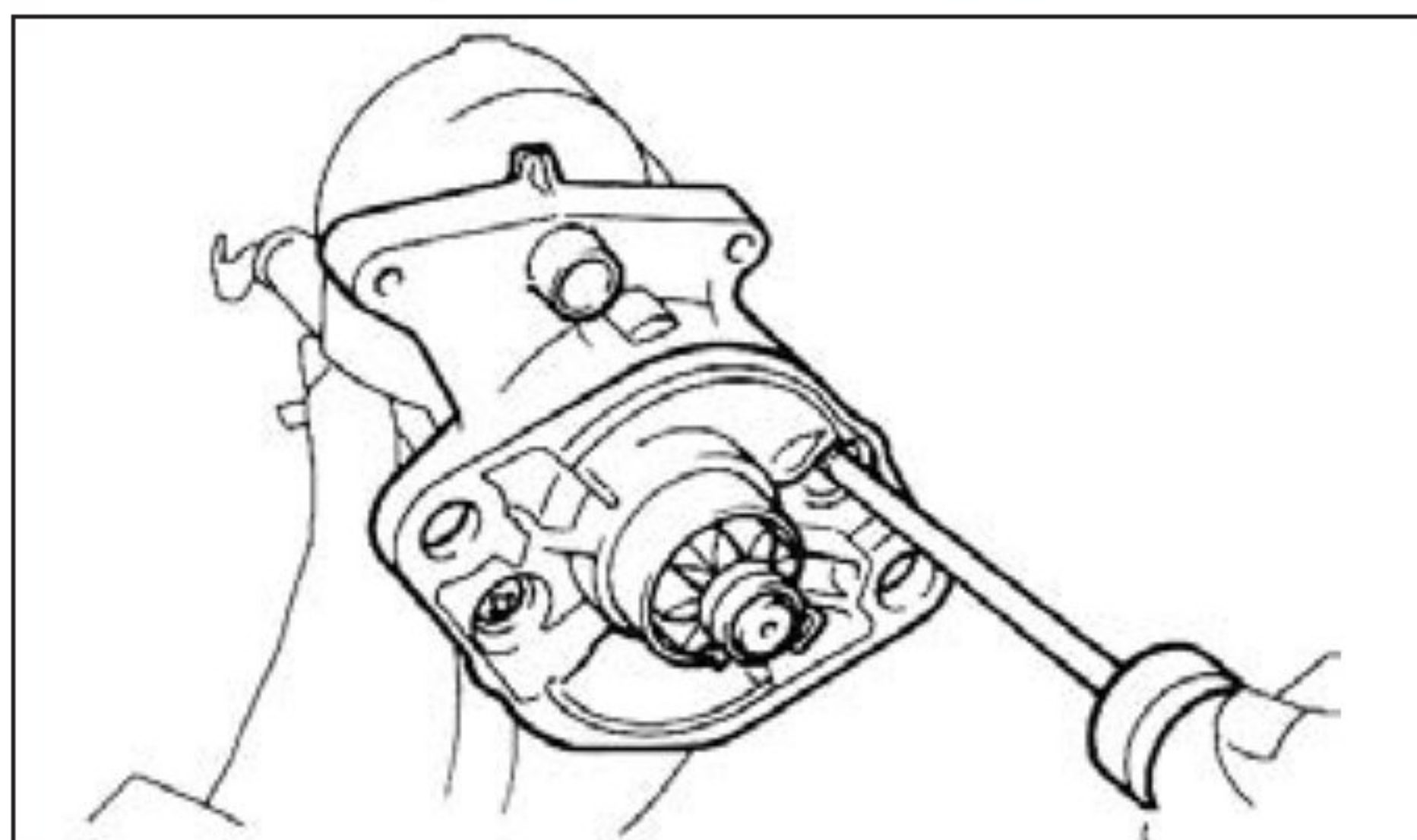
1. Remove field frame with armature from magnetic switch assembly.
 - Remove the nut, and disconnect the lead wire from the magnetic switch terminal.
 - Remove the two through bolts.
 - Pull out the field frame with

the armature from the magnetic switch assembly.

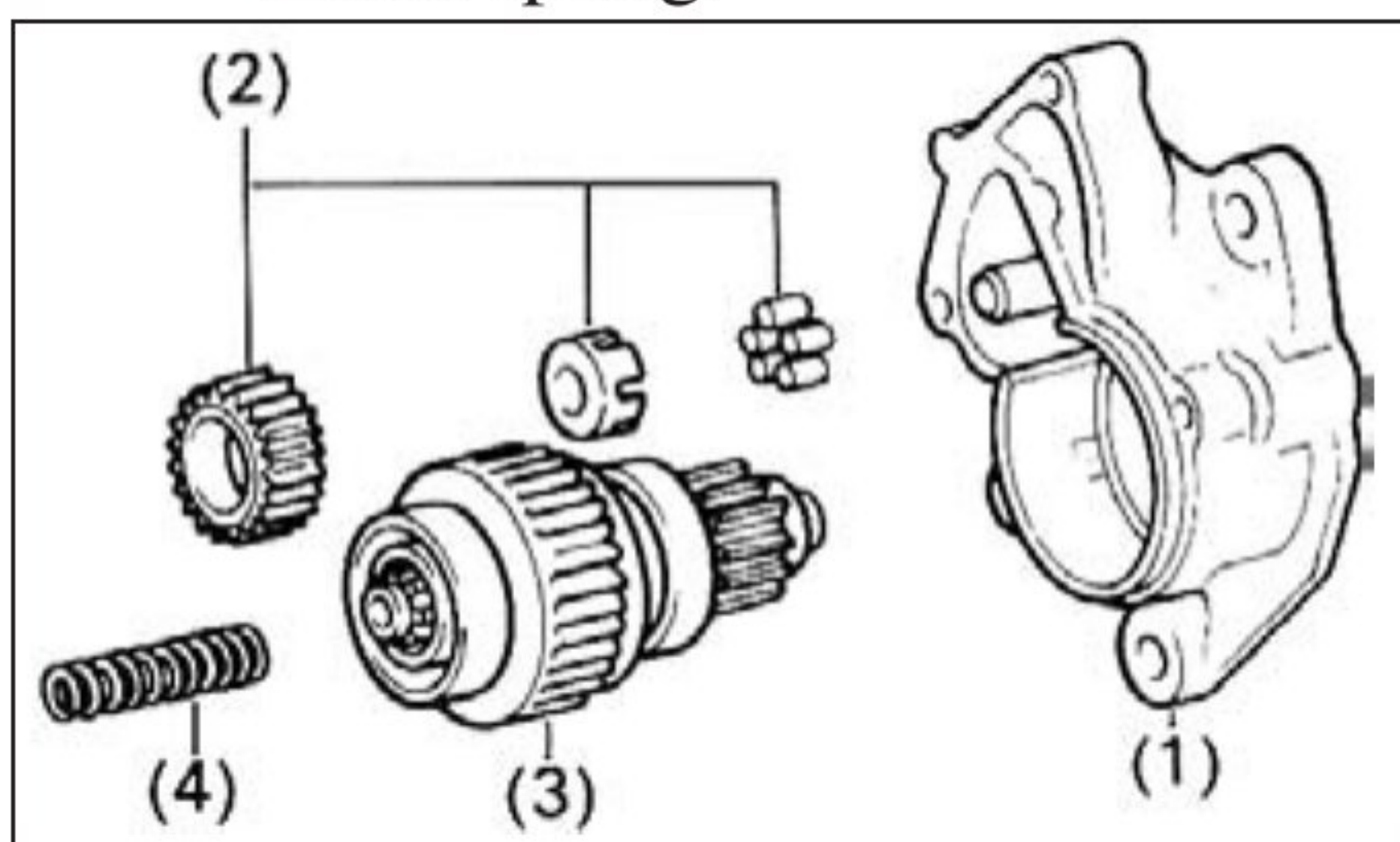


2. Remove starter housing, clutch assembly and idle gear.

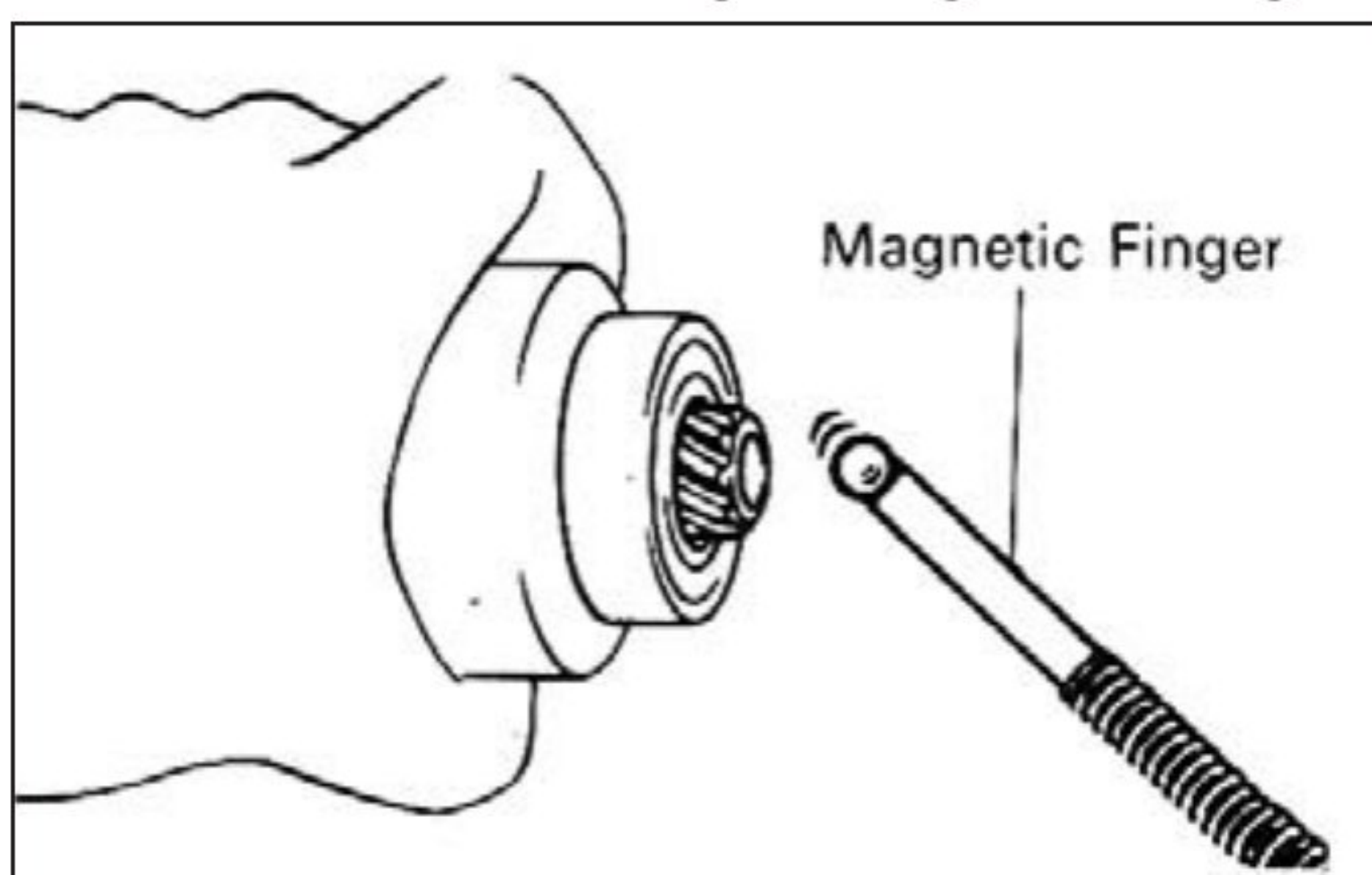
- First, remove two screws.



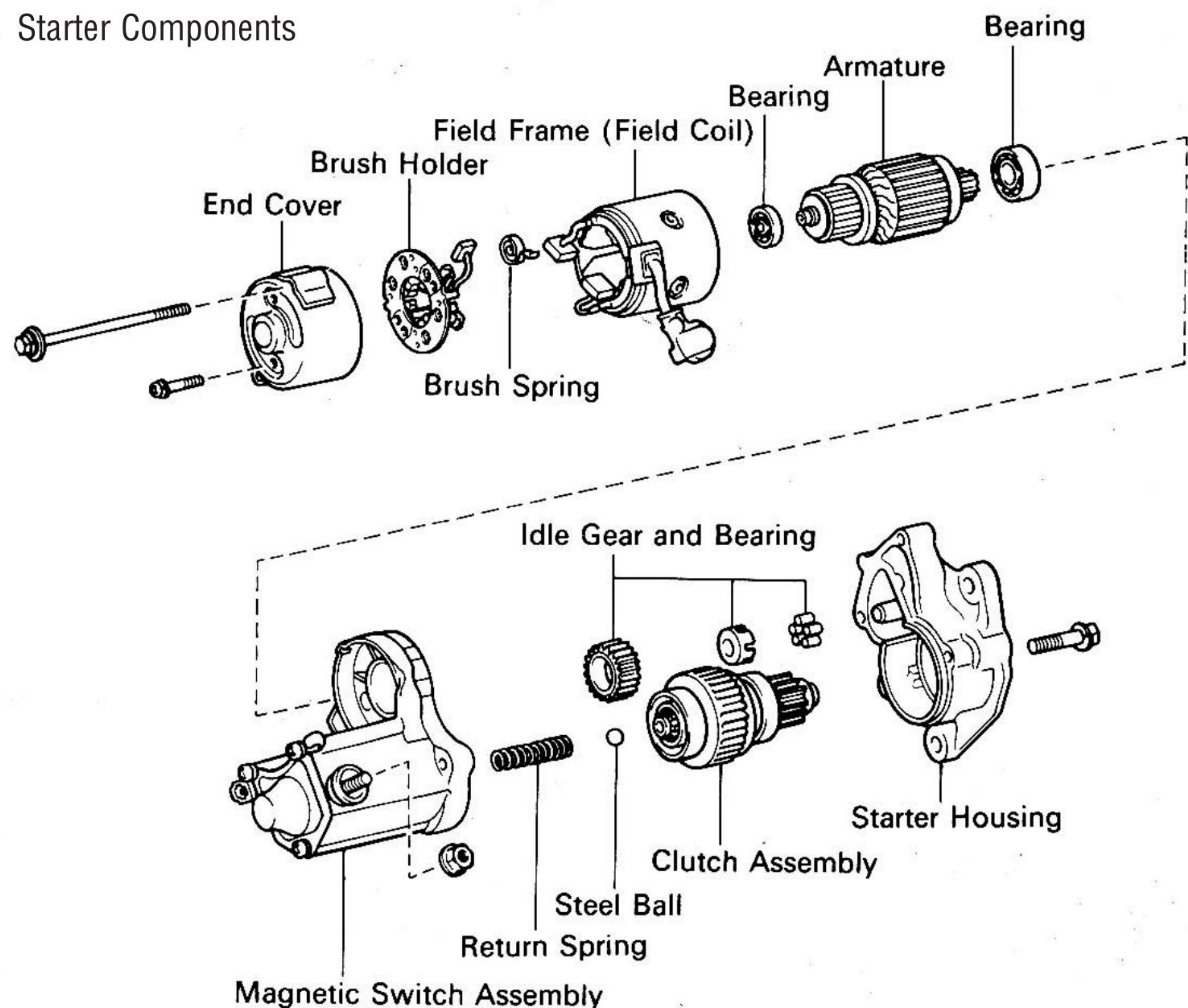
- Next, remove the following parts from the magnetic switch assembly: starter housing; idle gear and bearing; clutch assembly; and return spring.



3. Remove steel ball from the clutch shaft hole using a magnetic finger.

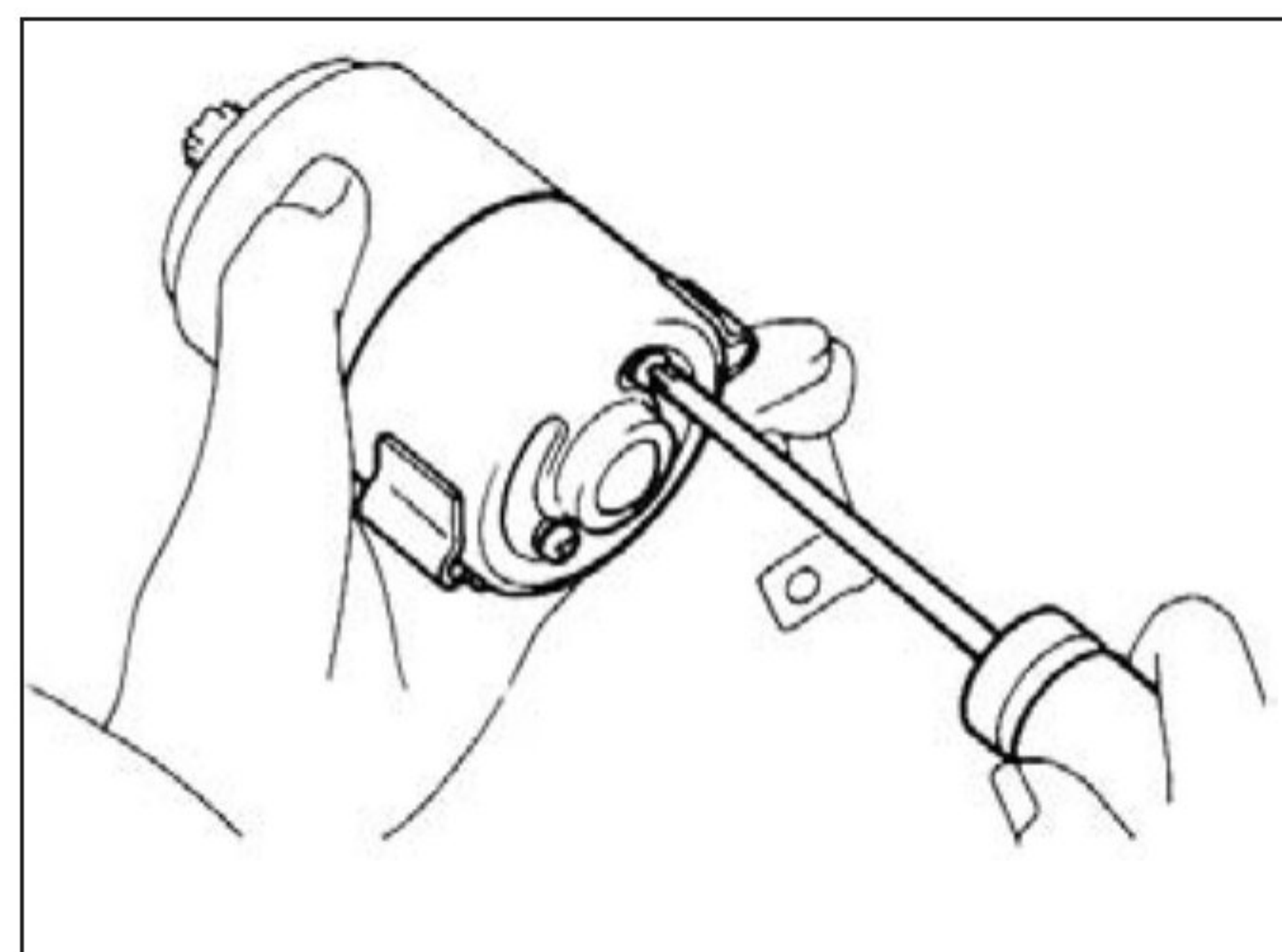


Starter Components



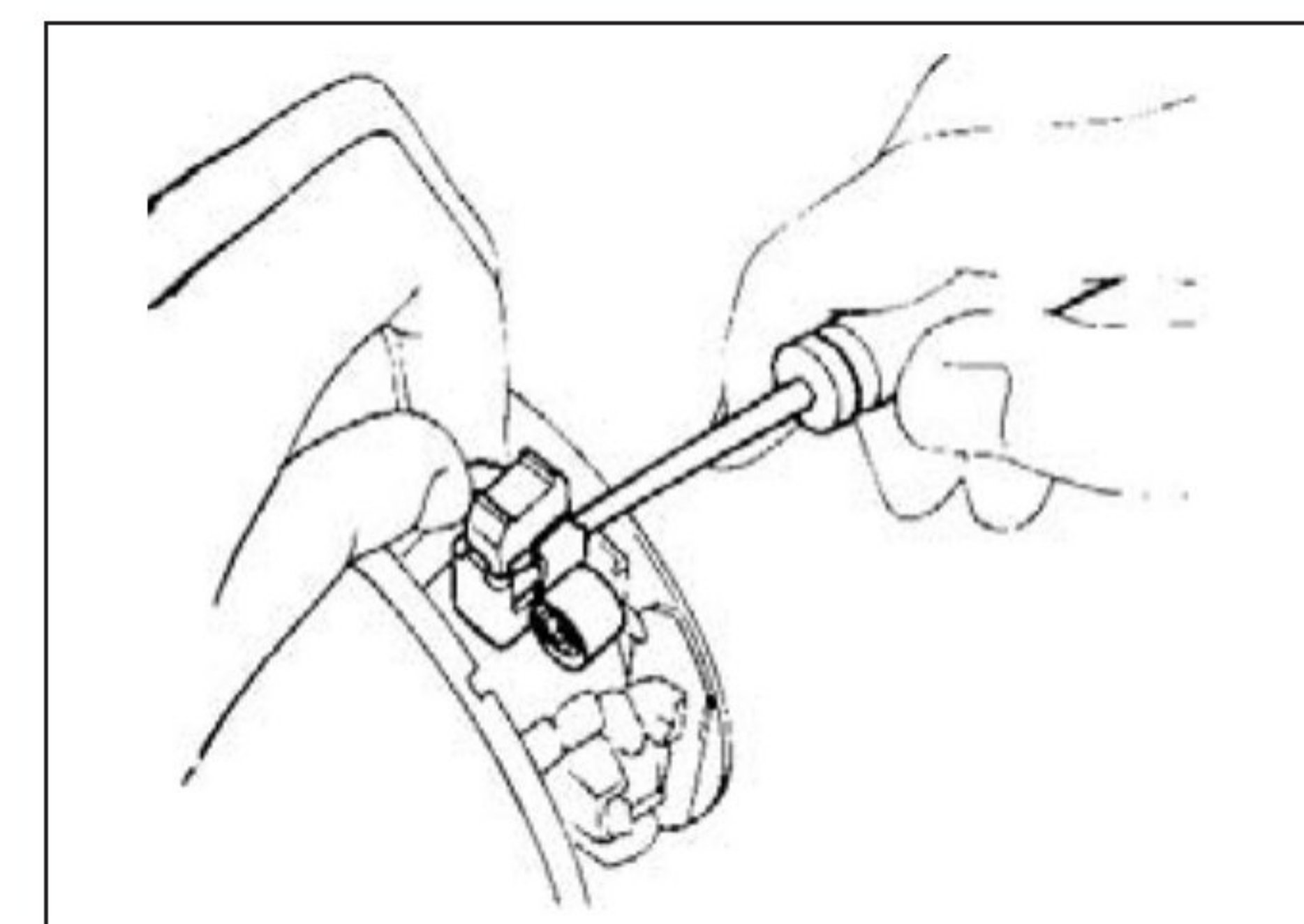
4. Remove brush holder.

- Remove the two screws and end cover from the field frame.



- Using a screwdriver, hold the brush back and disconnect the brush from the brush holder. Disconnect the four brushes and remove the brush holder.

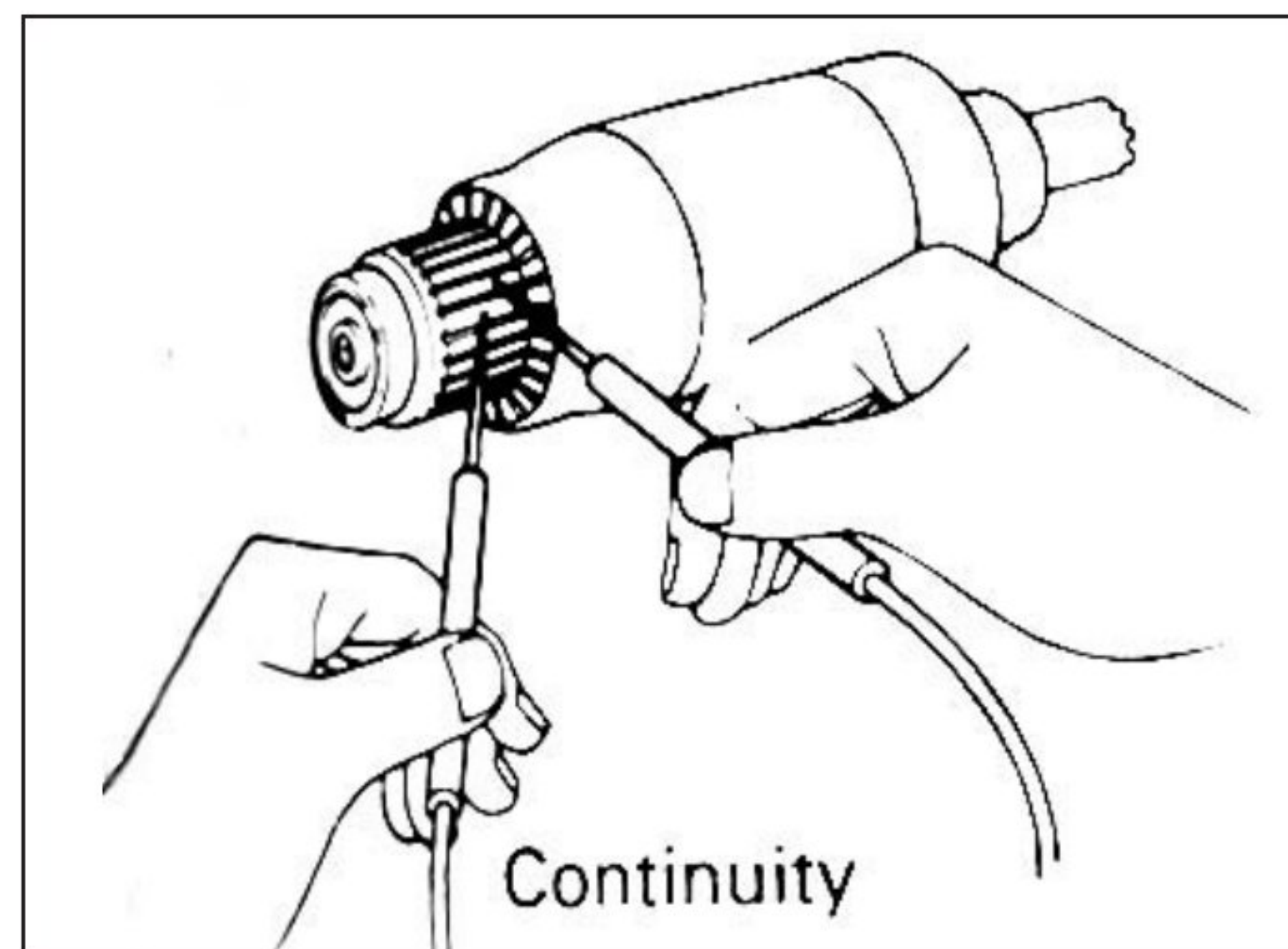
5. Remove armature from field frame.



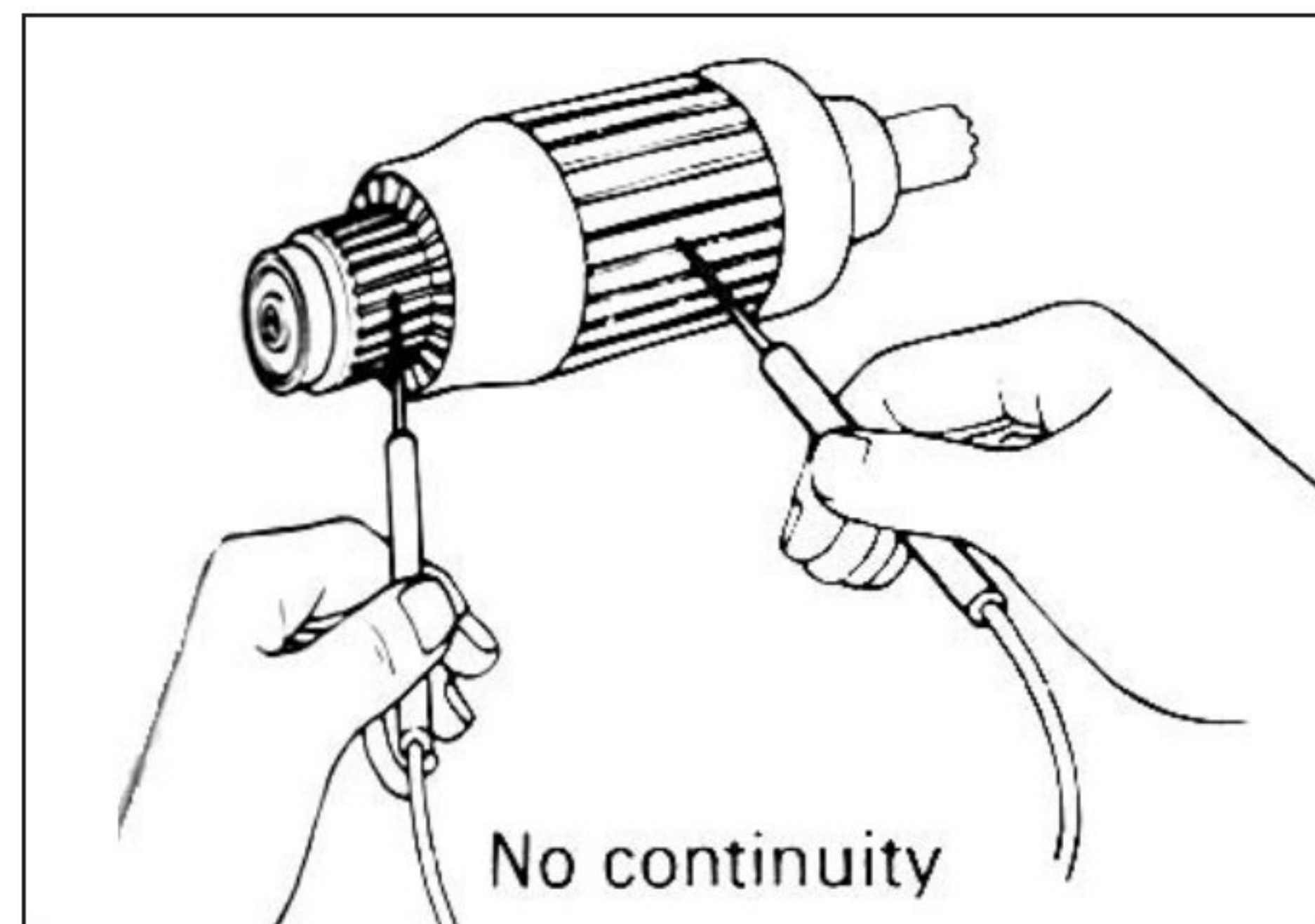
Inspection and Repair of Starter Armature Coil—

1. Inspect commutator for open circuit. Using an ohmmeter, check that there is continuity between the segments of the commutator. If

there is no continuity between any segment, replace the armature.



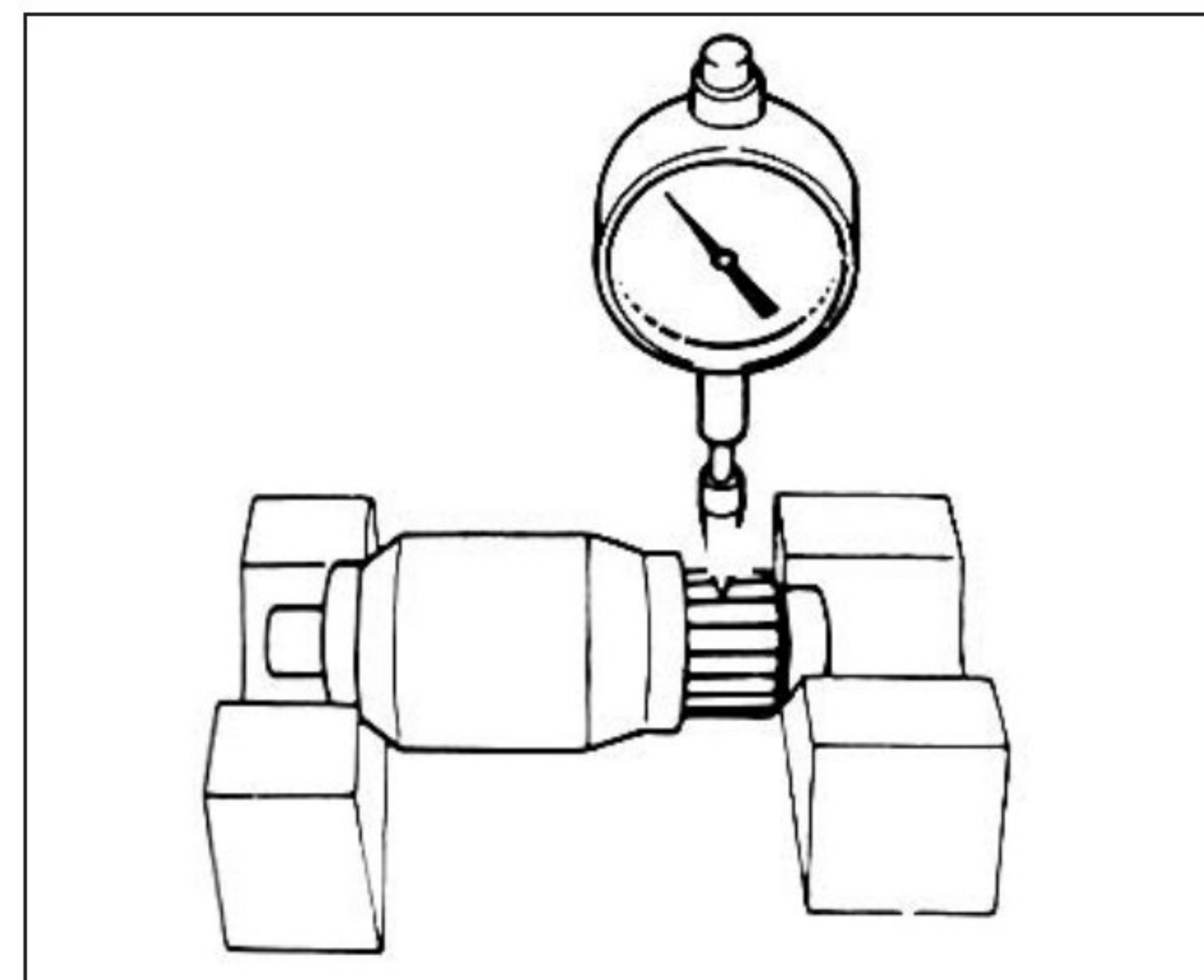
2. Inspect commutator for ground. Using an ohmmeter, check that there is no continuity between the commutator and armature coil core. If there is continuity, replace the armature.



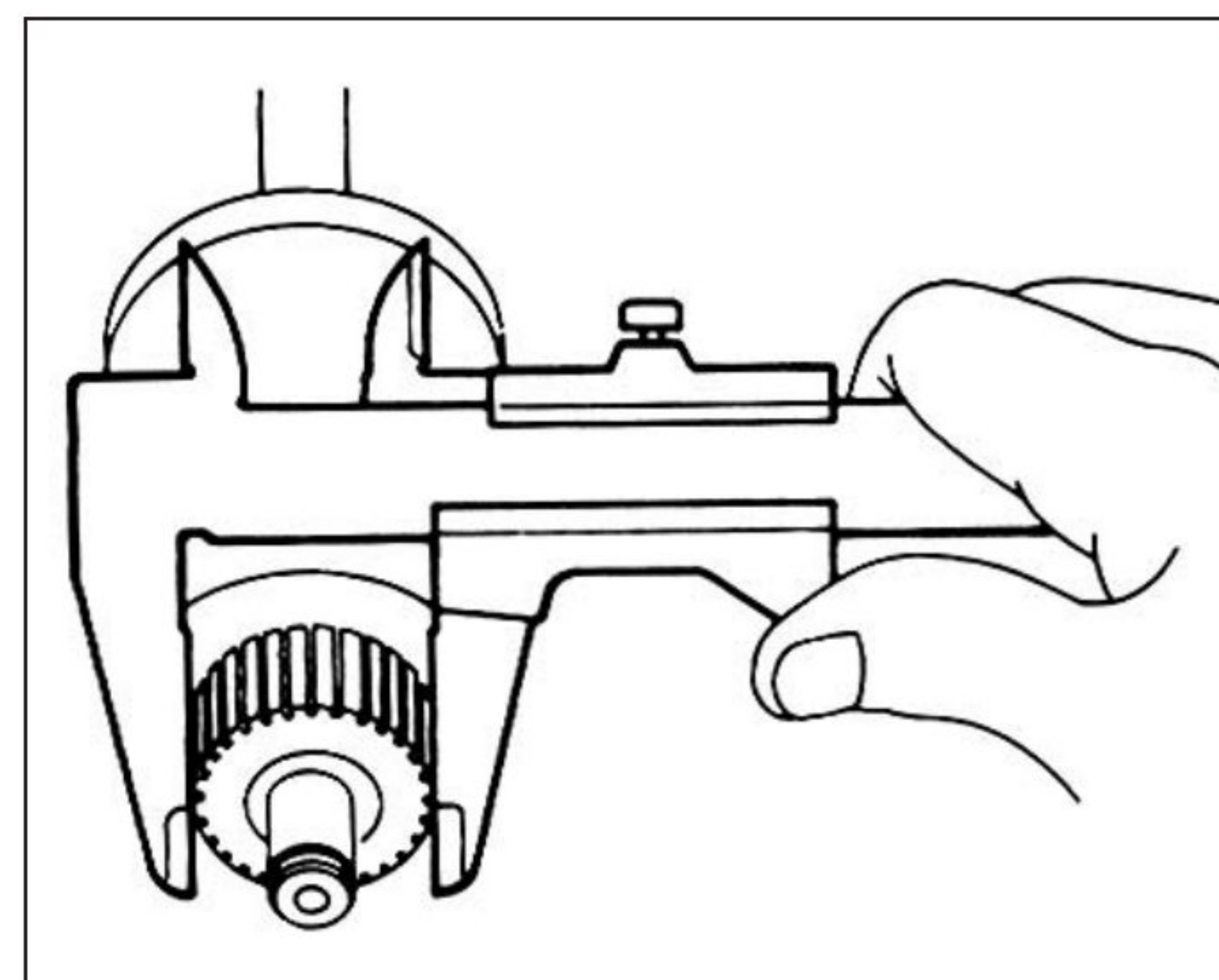
Commutator—

1. Inspect commutator for dirty and burnt surfaces. If the surface is dirty or burnt, correct it with sandpaper (no. 400) or a lathe.
2. Inspect commutator circle runout. Place the commutator on V-blocks. Using a dial indicator, measure the circle runout. Maximum circle

runout: 0.05 mm (0.0020 in.). If the circle runout is greater than maximum, correct it with a lathe.

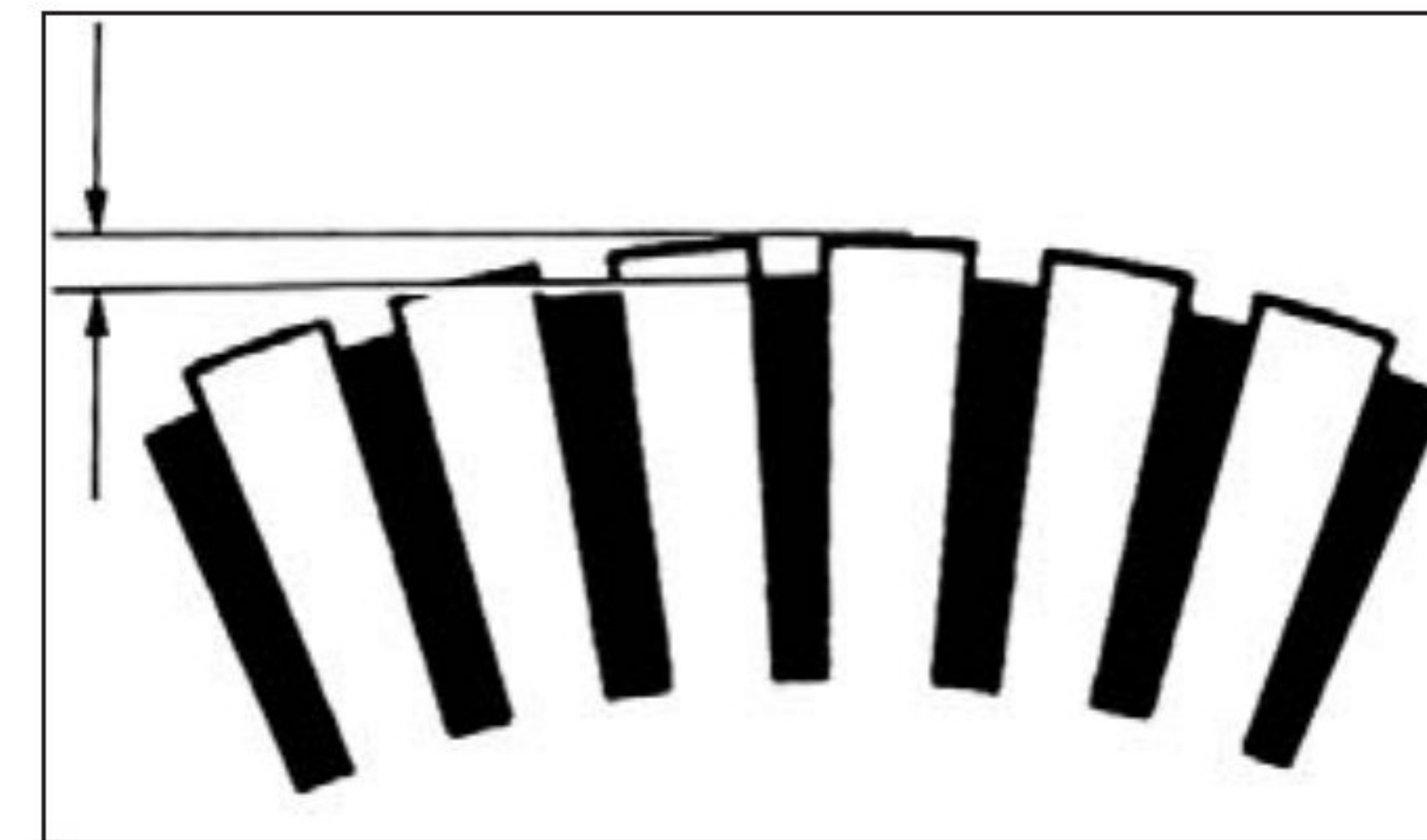


3. Inspect commutator diameter. Using calipers, measure the commutator diameter. Standard diameter: 30 mm (1.18 in.); Minimum diameter: 29 mm (1.14 in.). If the diameter is less than minimum, replace the armature.



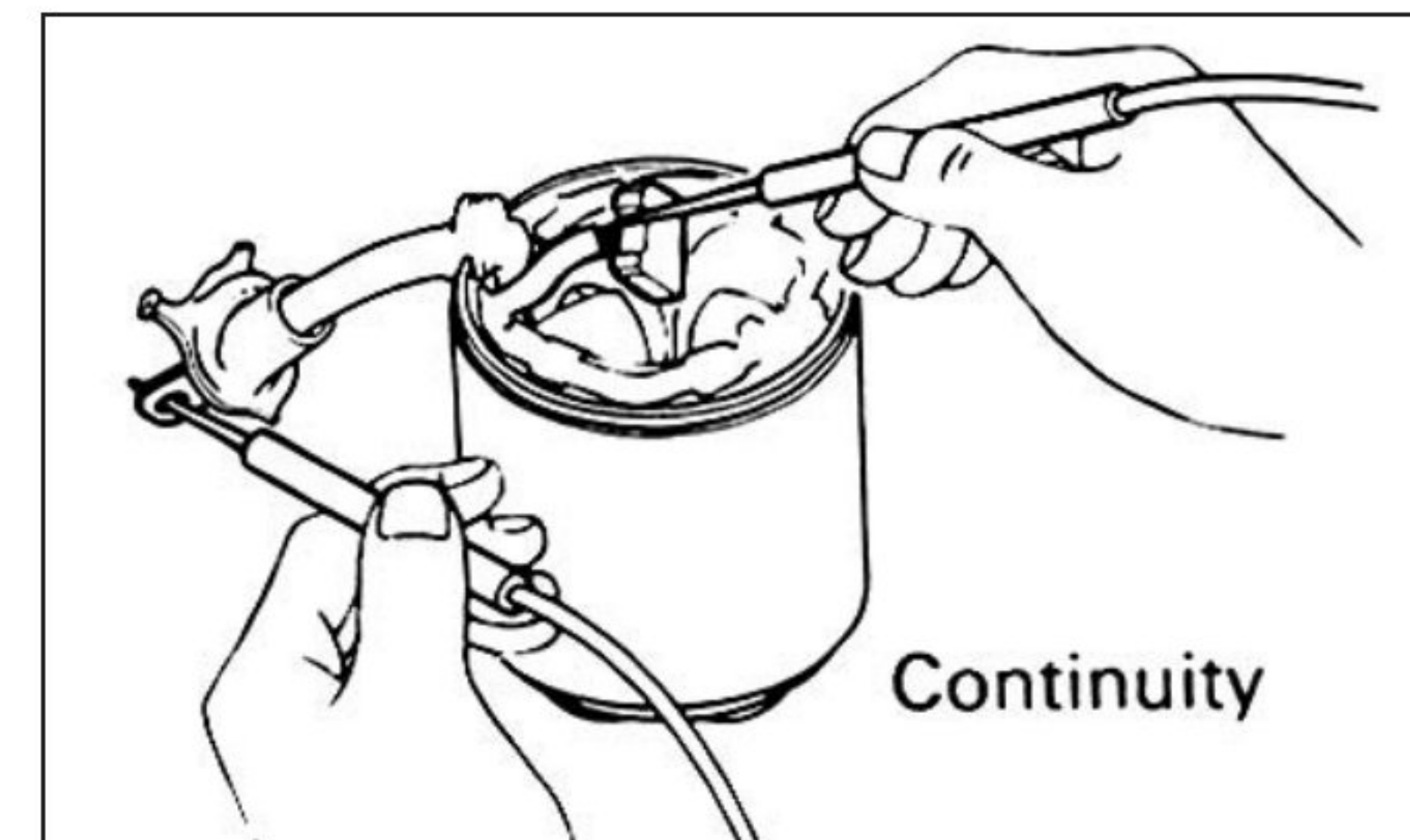
4. Inspect undercut depth. Check that the undercut depth is clean and free of foreign material. Smooth out the edge. Standard undercut depth: 0.6 mm (0.024 in.); Minimum undercut depth: 0.2 mm (0.008 in.). If the undercut

depth is less than minimum, correct it with a hacksaw blade.



Field Frame (Field Coil)—

1. Inspect field coil for open circuit. Using an ohmmeter, check that there is continuity between the lead wire and field coil brush lead. If there is no continuity, replace the field frame.

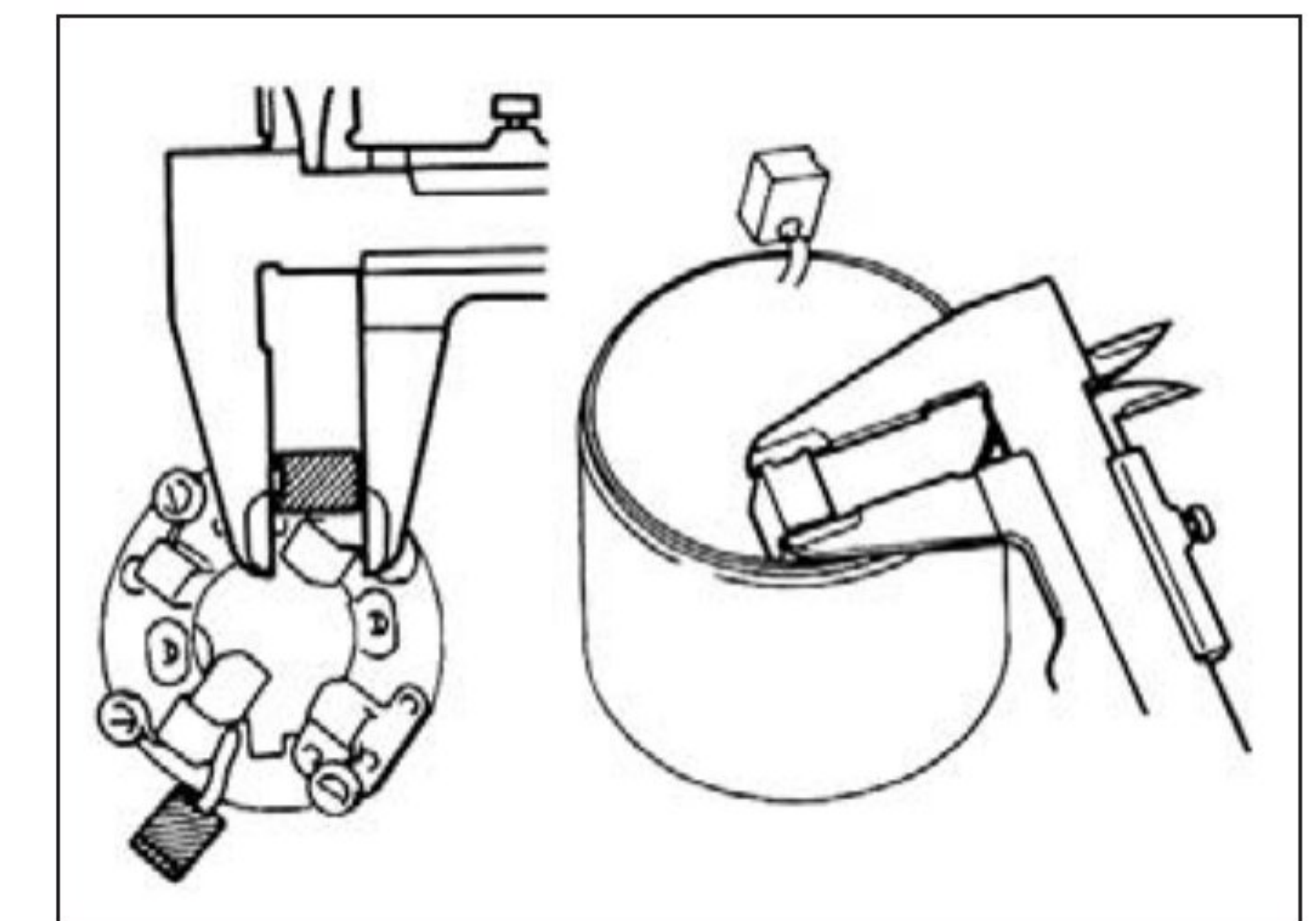


2. Inspect field coil for ground. Using an ohmmeter, check that there is no continuity between the field coil end and field frame. If there is continuity, repair or replace the field frame.

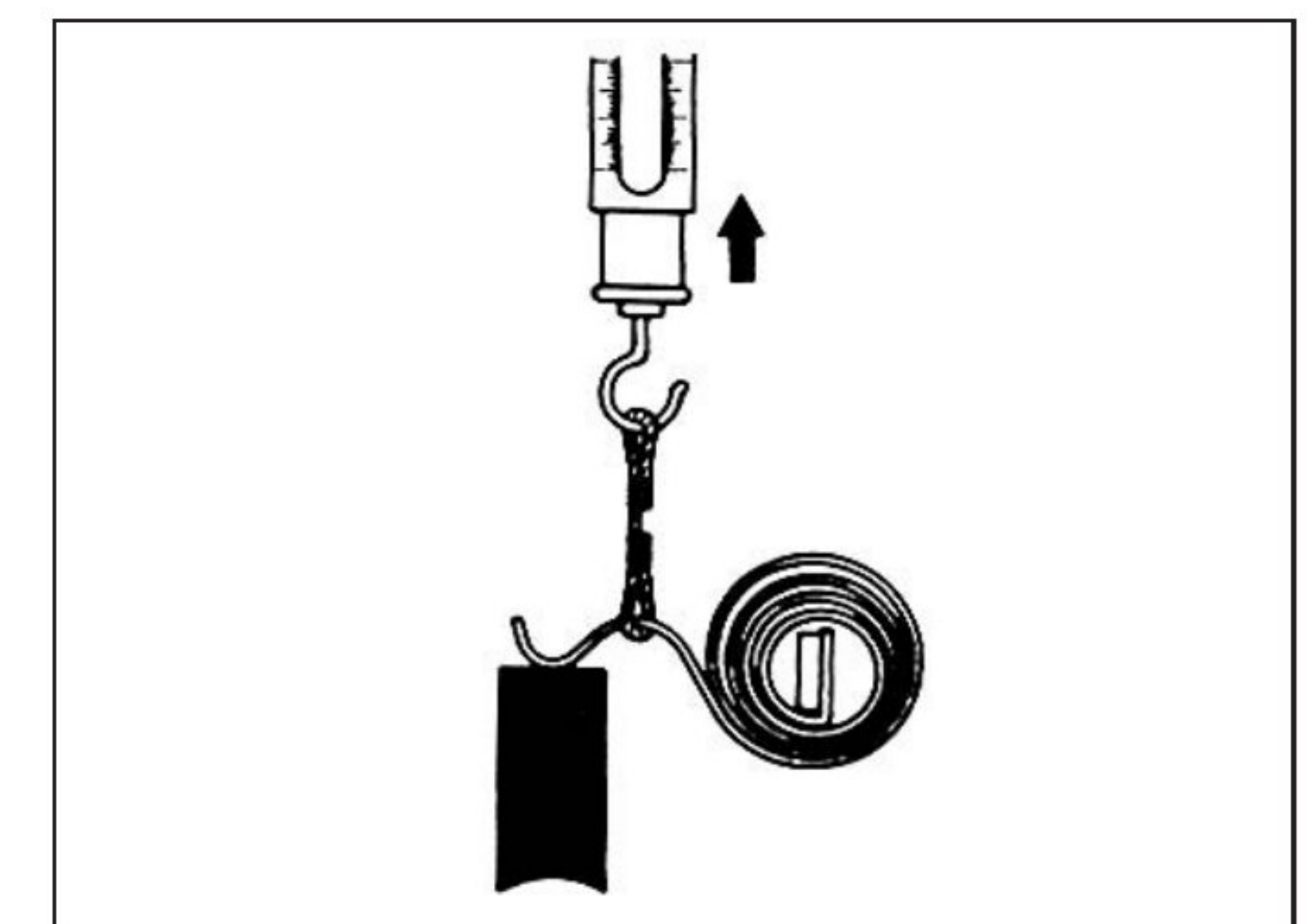


Brushes, Springs, Holder—

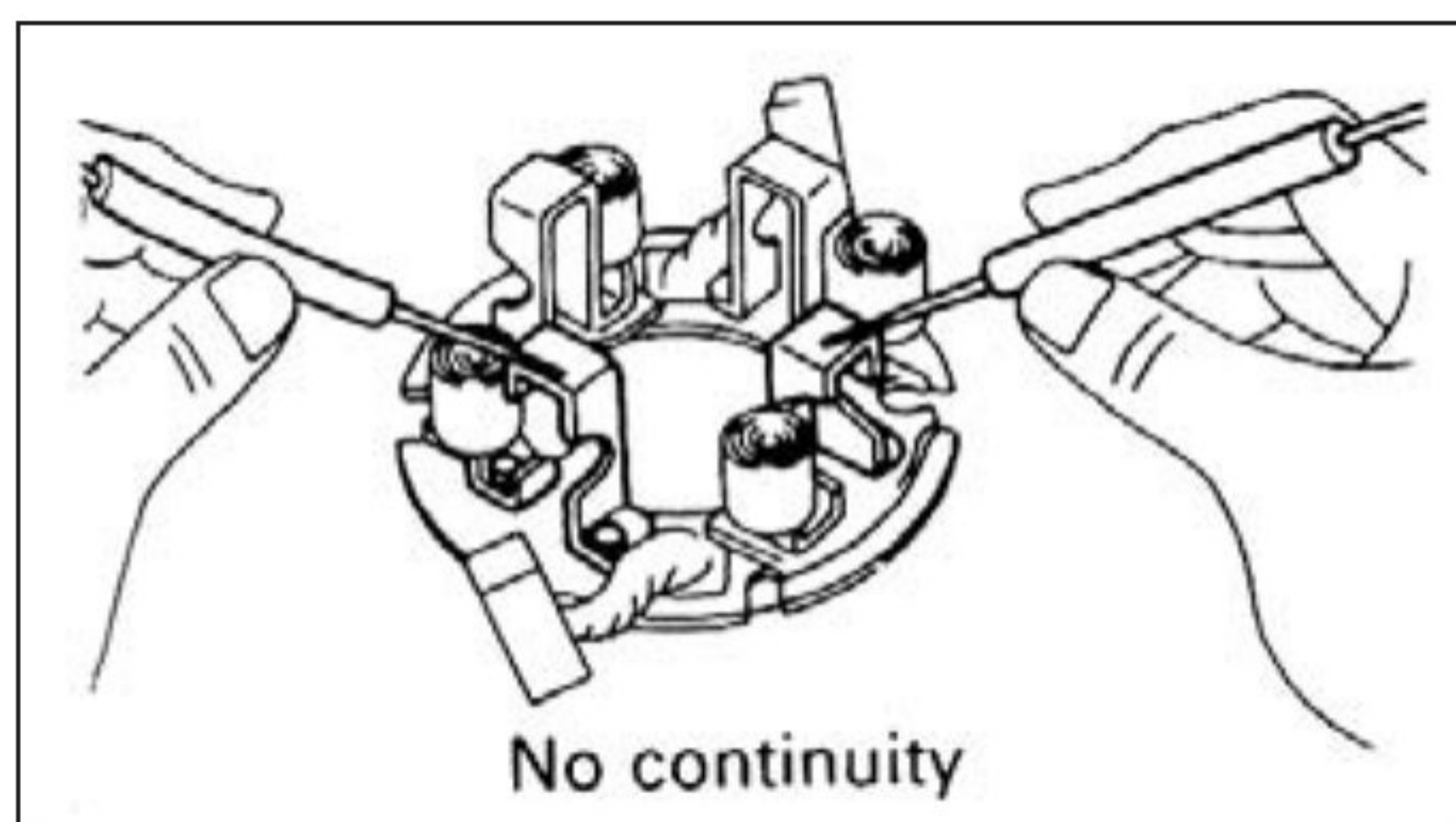
Using calipers, inspect and measure brush length. Standard length: 13.5 mm (0.531 in.); Minimum length: 8.5 mm (0.335 in.). If the length is less than minimum, replace the brush holder and field frame.



Inspect brush spring load. Take the pull scale reading the instant the brush spring separates from the brush. Spring installed load: 1.79 to 2.41 kg (3.9 to 5.3 lb., 18 to 24 N). If the installed load is not within specifications, replace the brush springs.



Inspect brush holder insulation. Using an ohmmeter, check that there is no continuity between the positive and negative brush holders. If there is continuity, repair or replace the brush holder.



Clutch and Gears—

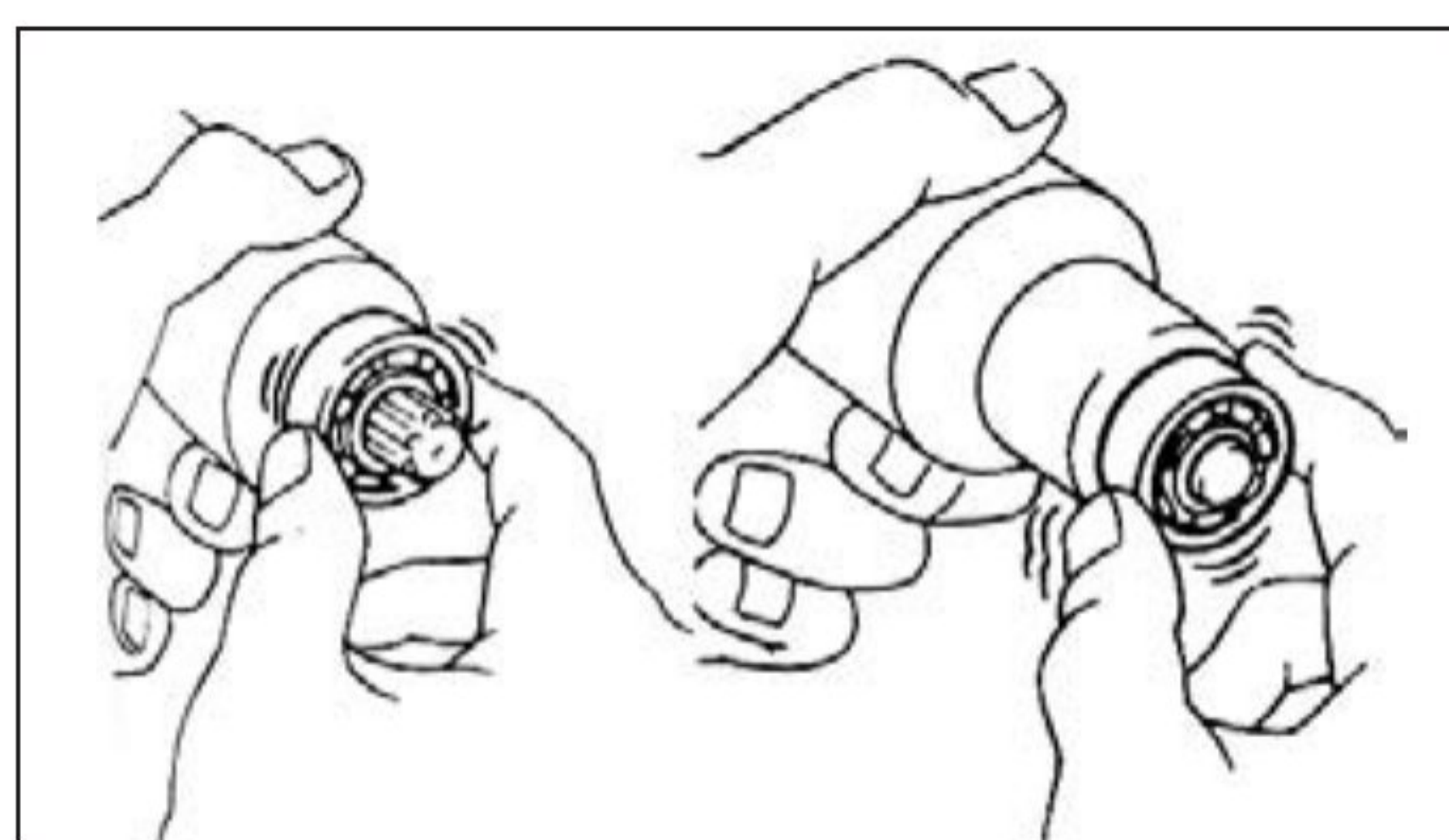
Inspect gear teeth. Check the gear teeth on the idle gear and clutch assembly for wear or damage. If damaged, replace the gear or clutch assembly. If damaged, also check the drive plate ring gear for wear or damage.

Inspect clutch. Rotate the clutch pinion gear clockwise and check that it turns freely. Try to rotate the clutch pinion gear counterclockwise and check that it locks. If necessary, replace the clutch assembly.



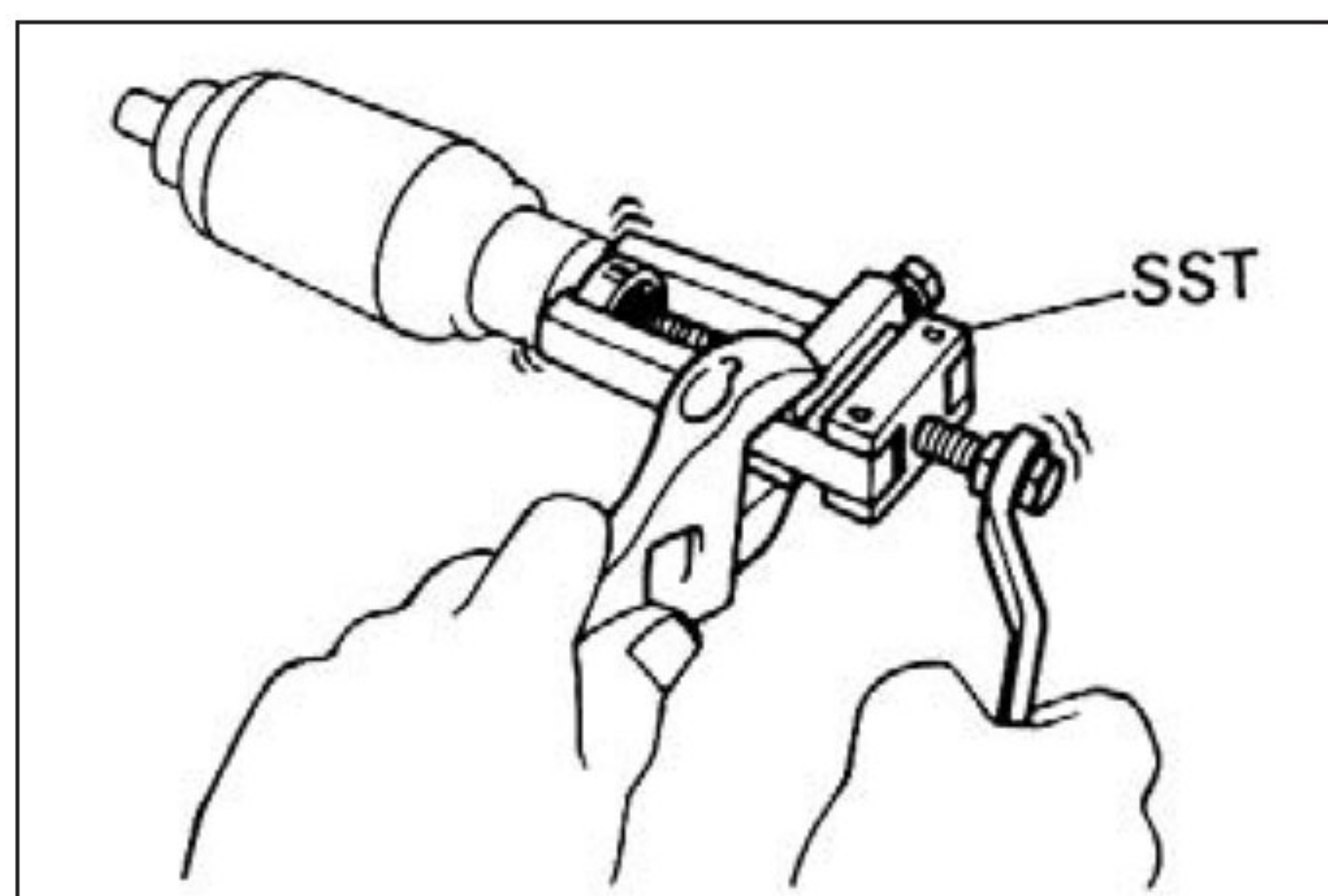
Bearings—

Inspect bearings by turning each bearing by hand while applying inward force. If resistance is felt or if the bearing sticks, replace the bearing.

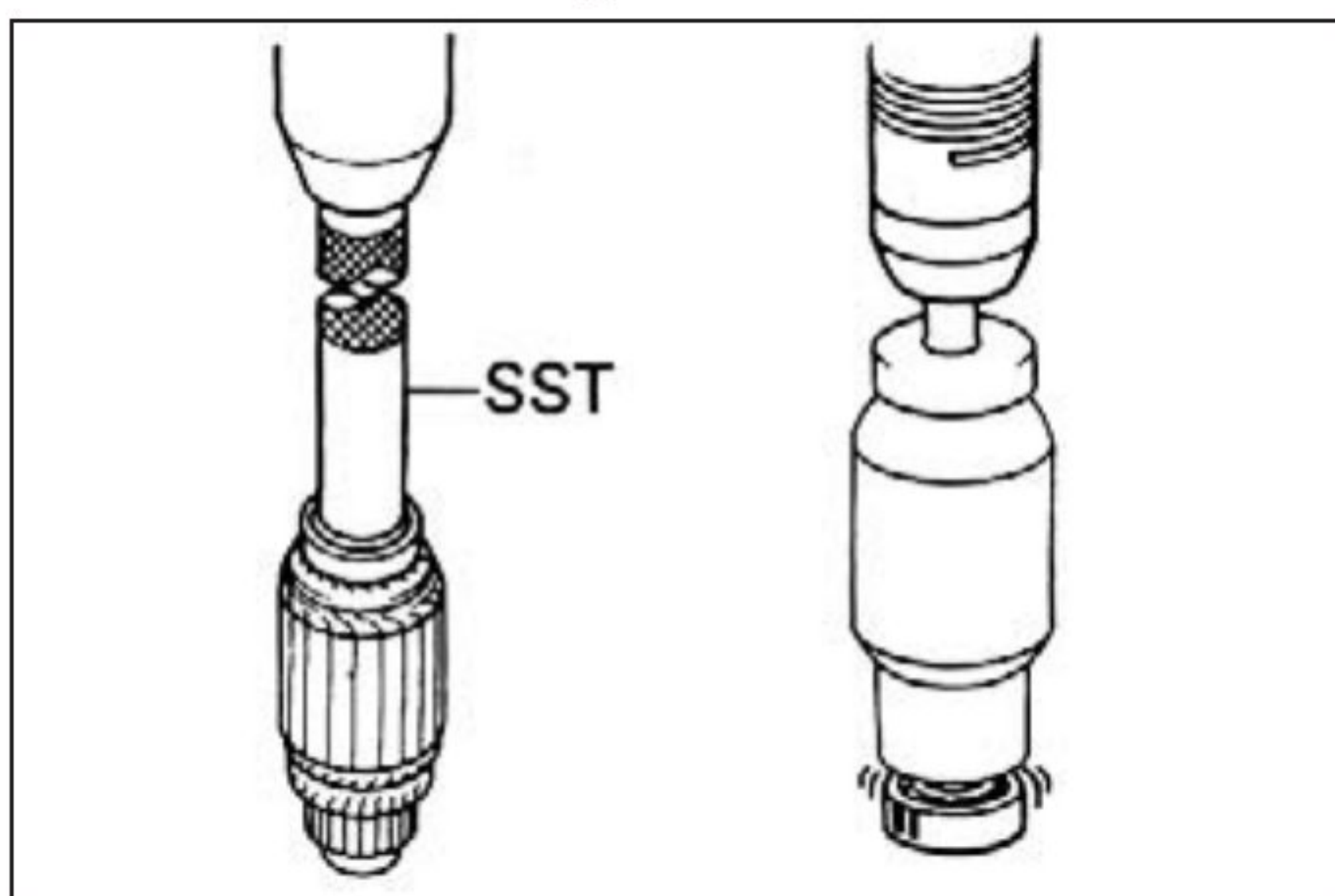


If it is necessary to replace bearings:

- Using SST, remove the bearing. SST 09286-46011.

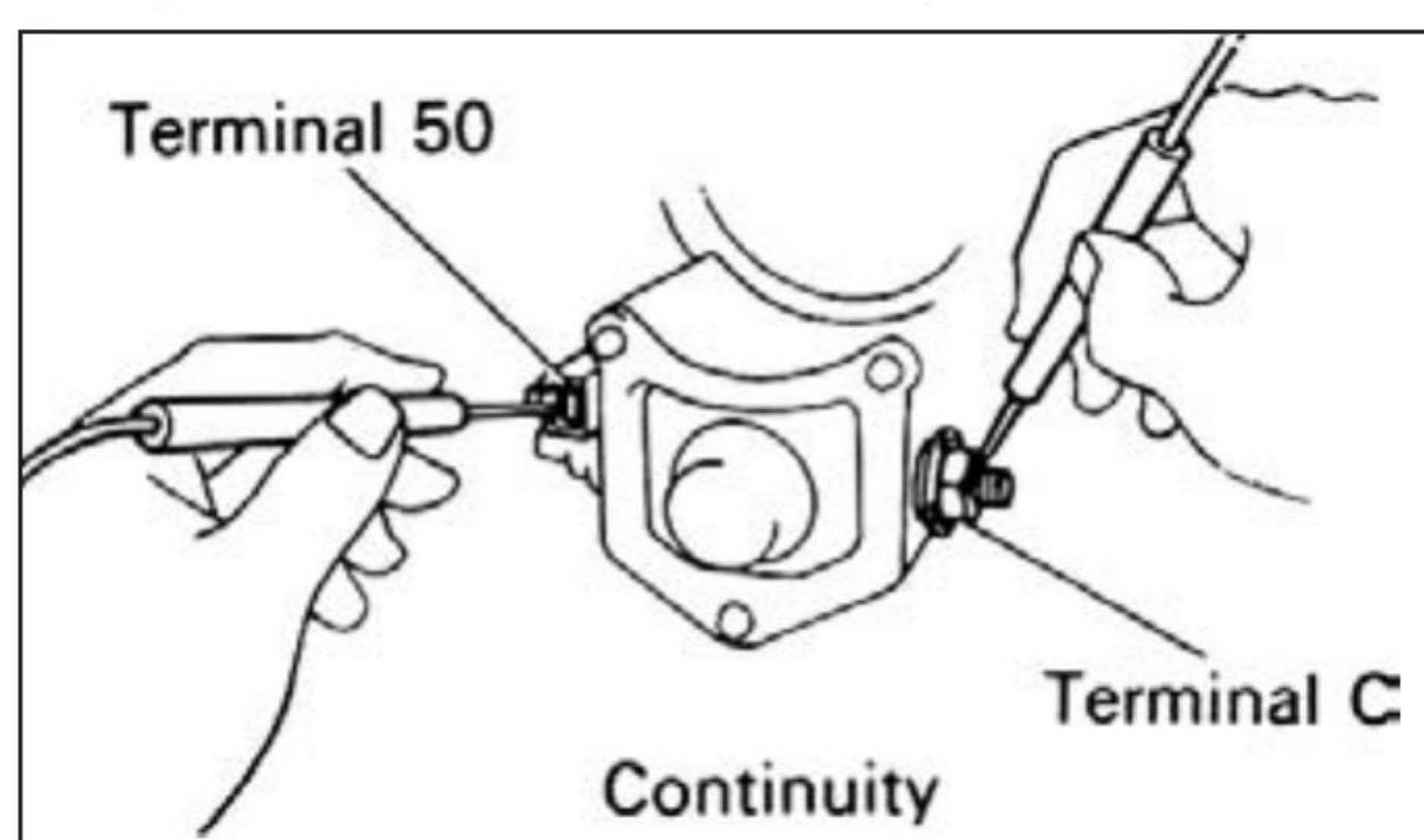


- Using SST and a press, press in a new front bearing. SST 09285-76010.
- Using a press, press in a new rear bearing.

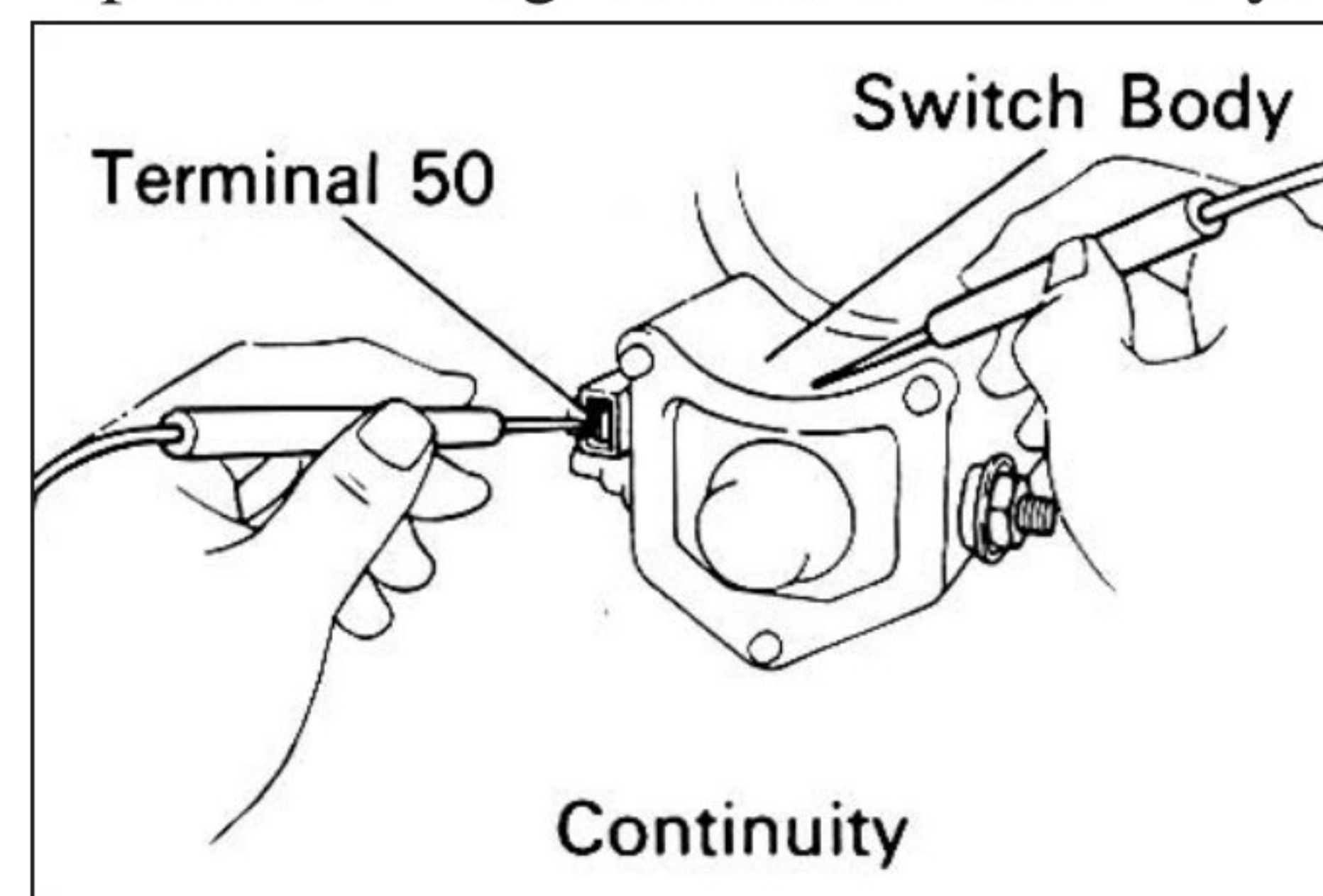


Magnetic Switch—

Perform pull-in coil open circuit test. Using an ohmmeter, check that there is continuity between terminals 50 and C. If there is no continuity, replace the magnetic switch assembly.



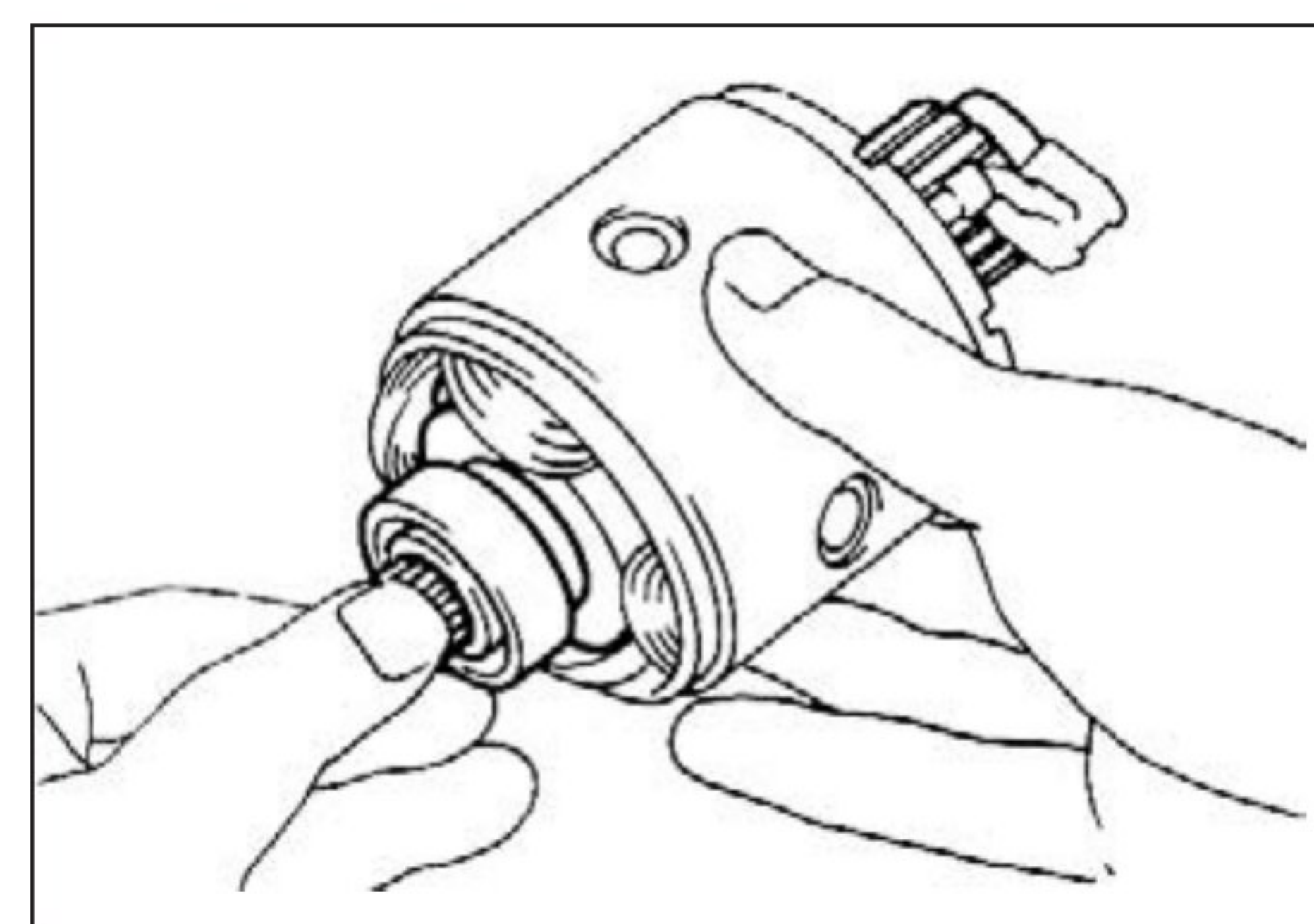
Perform hold-in coil open circuit test. Using an ohmmeter, check that there is continuity between terminal 50 and the switch body. If there is no continuity, replace the magnetic switch assembly.



Assembly of Starter

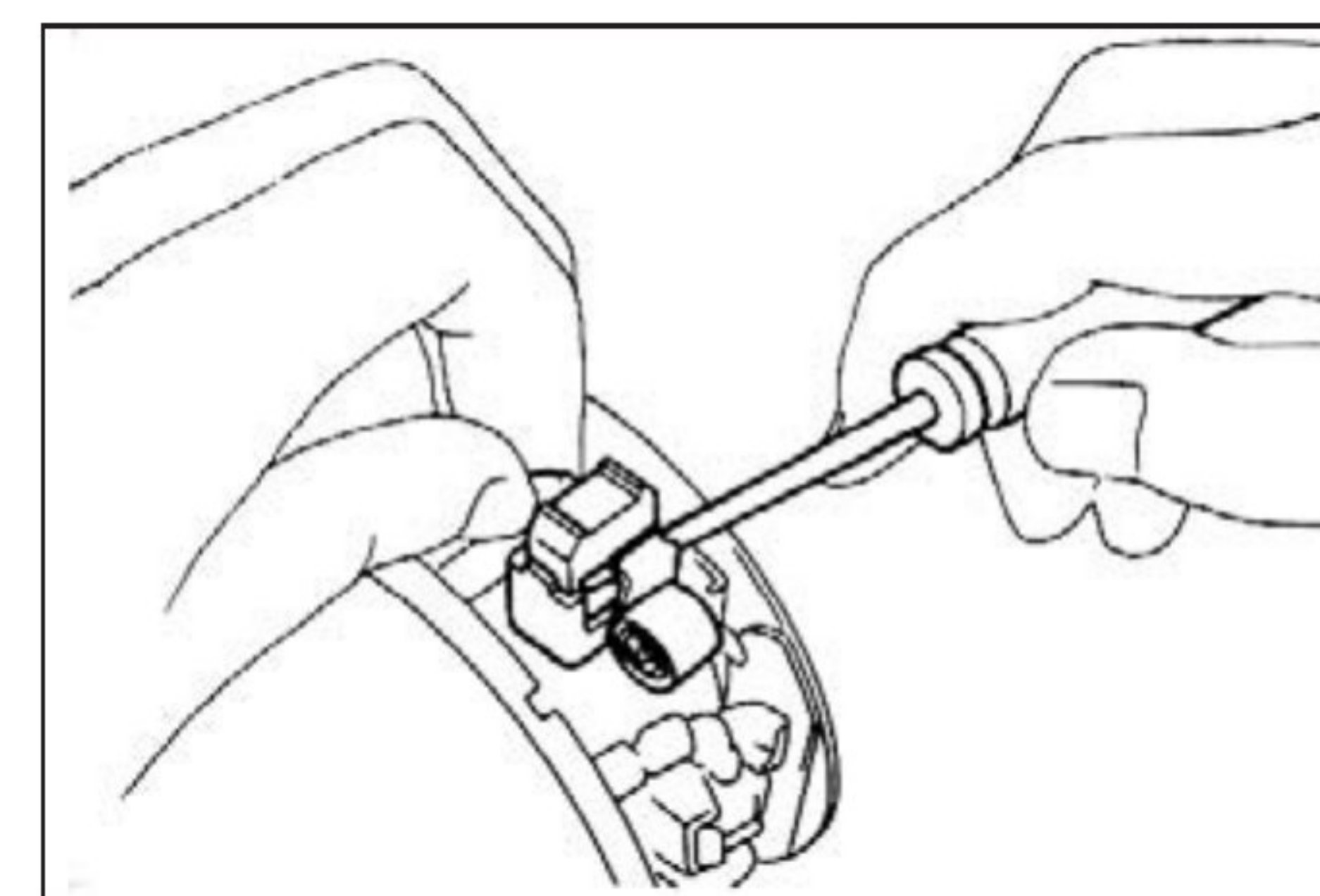
Hint: Use high-temperature grease to lubricate the bearings and gears when assembling the starter.

1. Place armature into field frame. Apply grease to the armature bearings and insert the armature into the field frame.

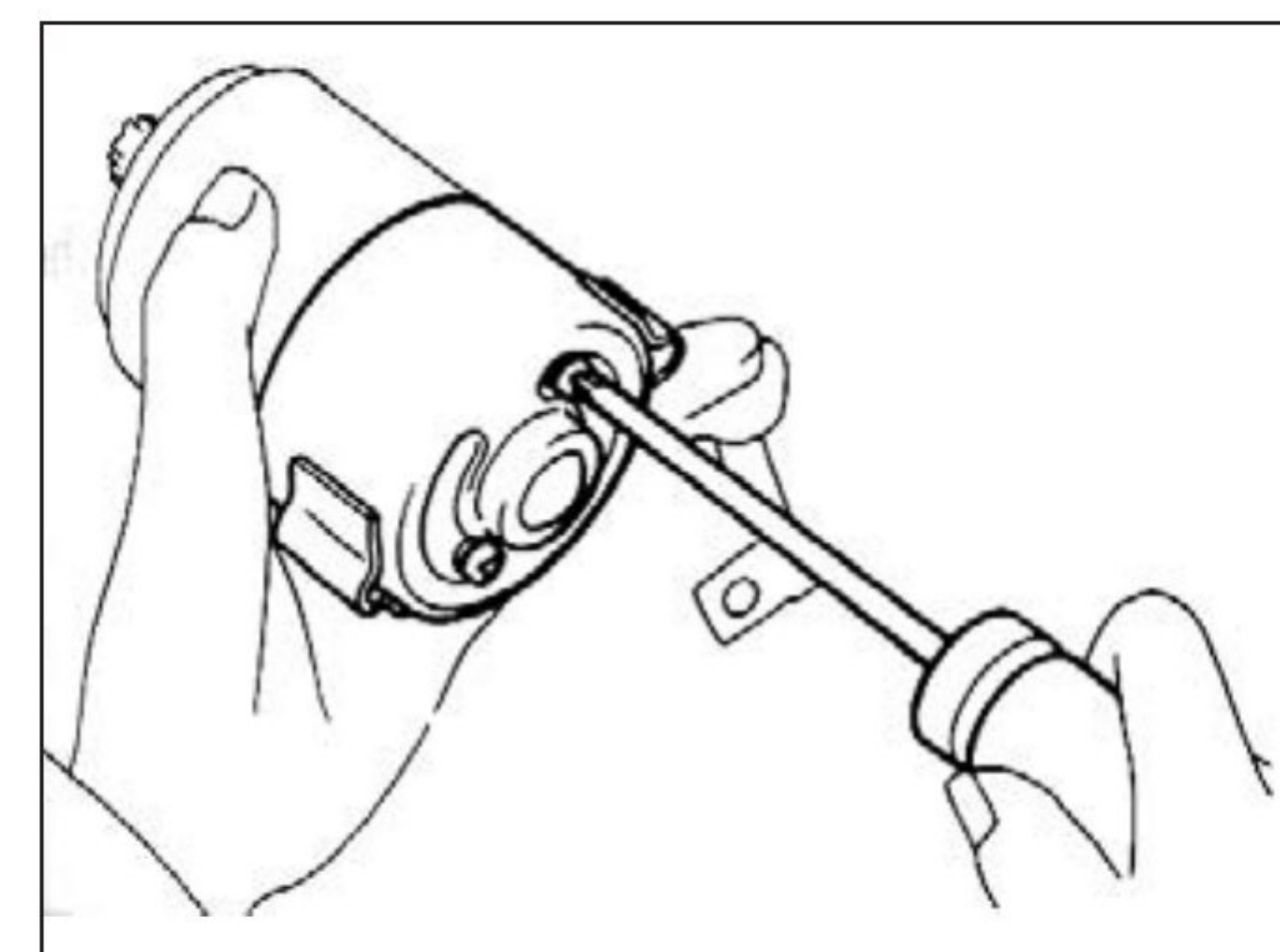


2. Install brush holder.

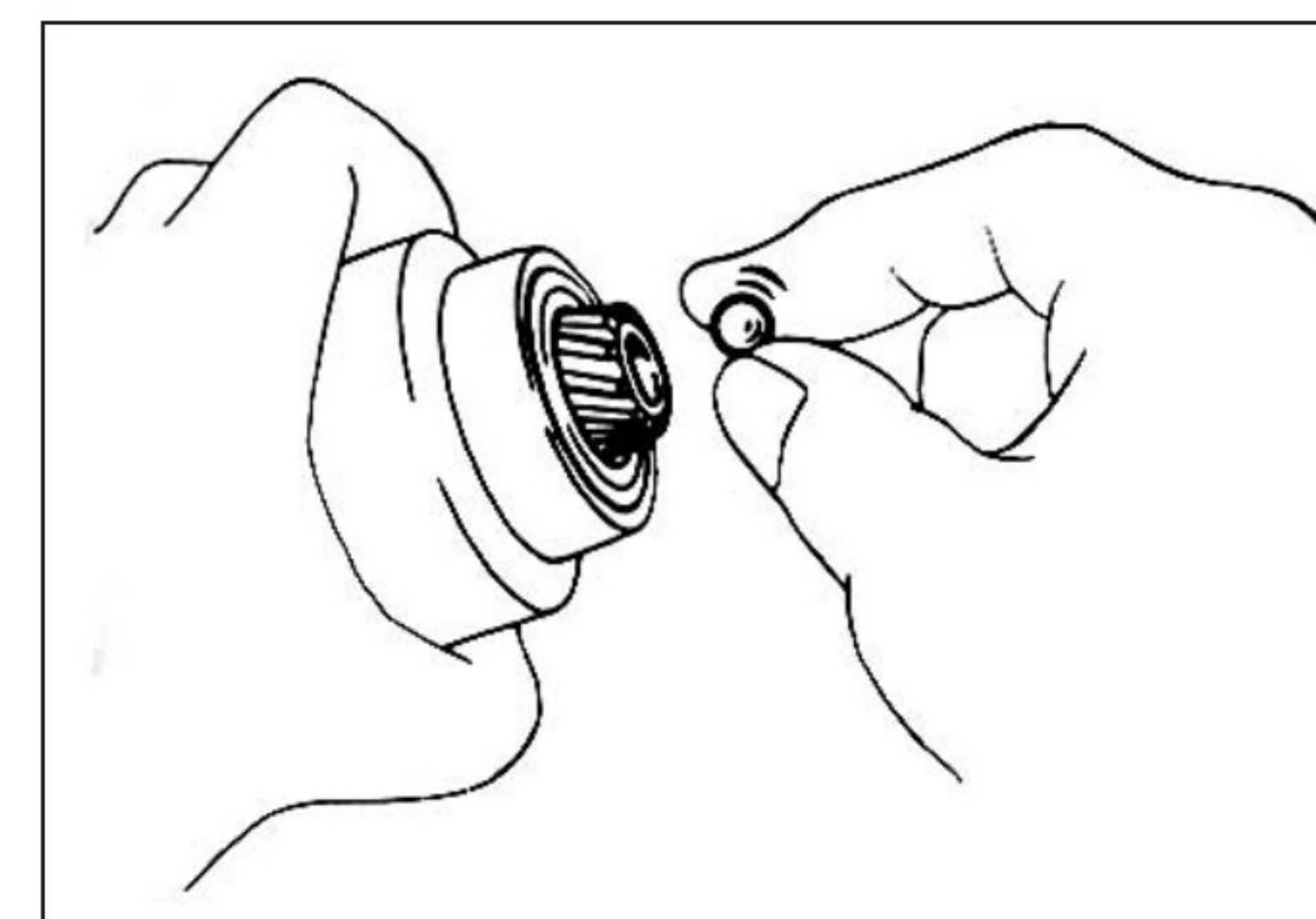
- Place the brush holder on the armature. Using a screwdriver, hold the brush spring back, and connect the brush into the brush holder. Connect the four brushes. Hint: Check that the positive lead wires are not grounded.



- Install the end cover to the field frame with the two screws.



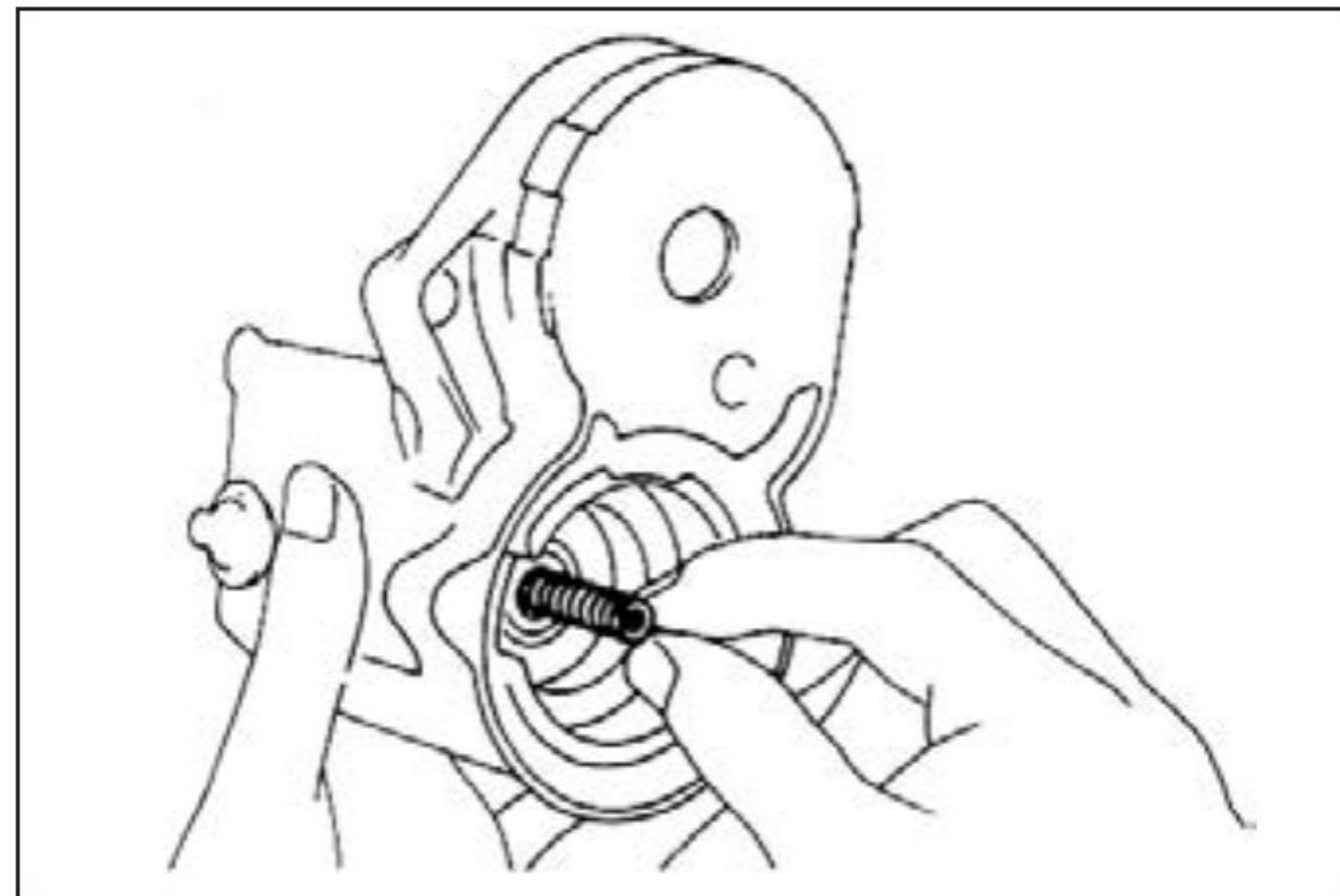
3. Insert steel ball into clutch shaft hole. Apply grease to the steel ball. Insert the steel ball into the clutch shaft hole.



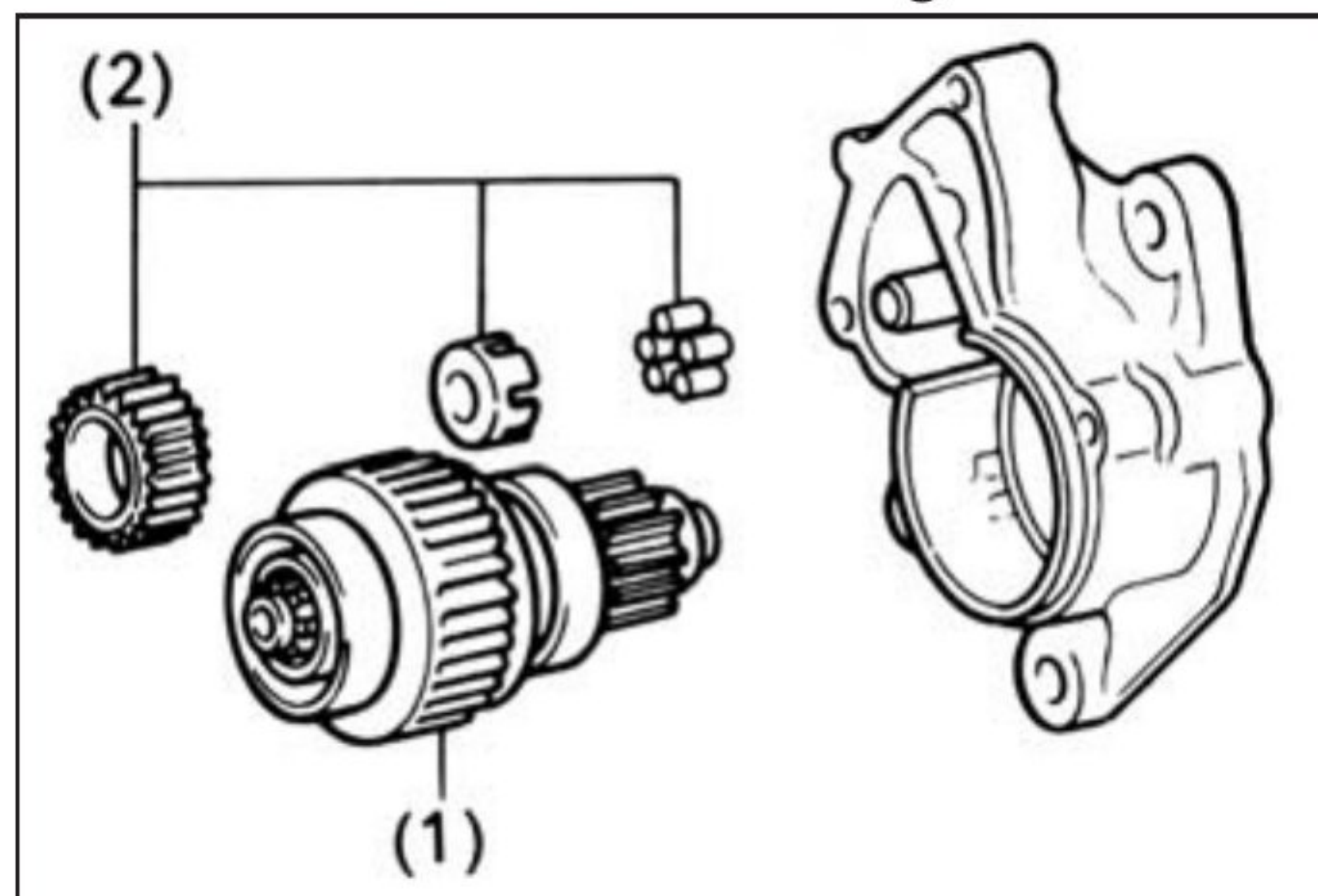
4. Install clutch assembly, idle gear and starter housing.

- Apply grease to the return spring, the clutch assembly, idle gear and

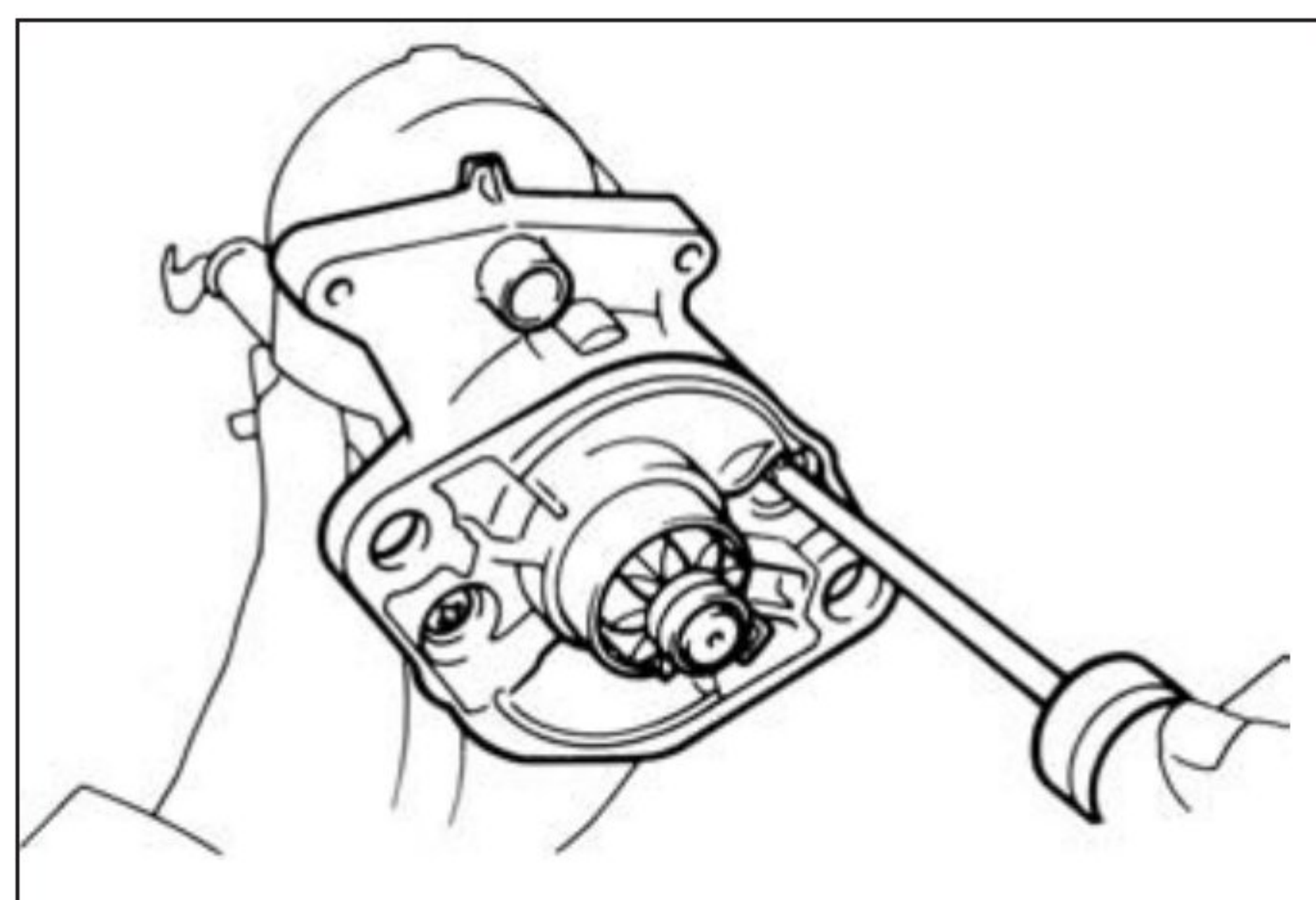
bearing. Insert the return spring into the magnetic switch hole.



- Place the clutch assembly and idle gear and bearing in position on the starter housing.

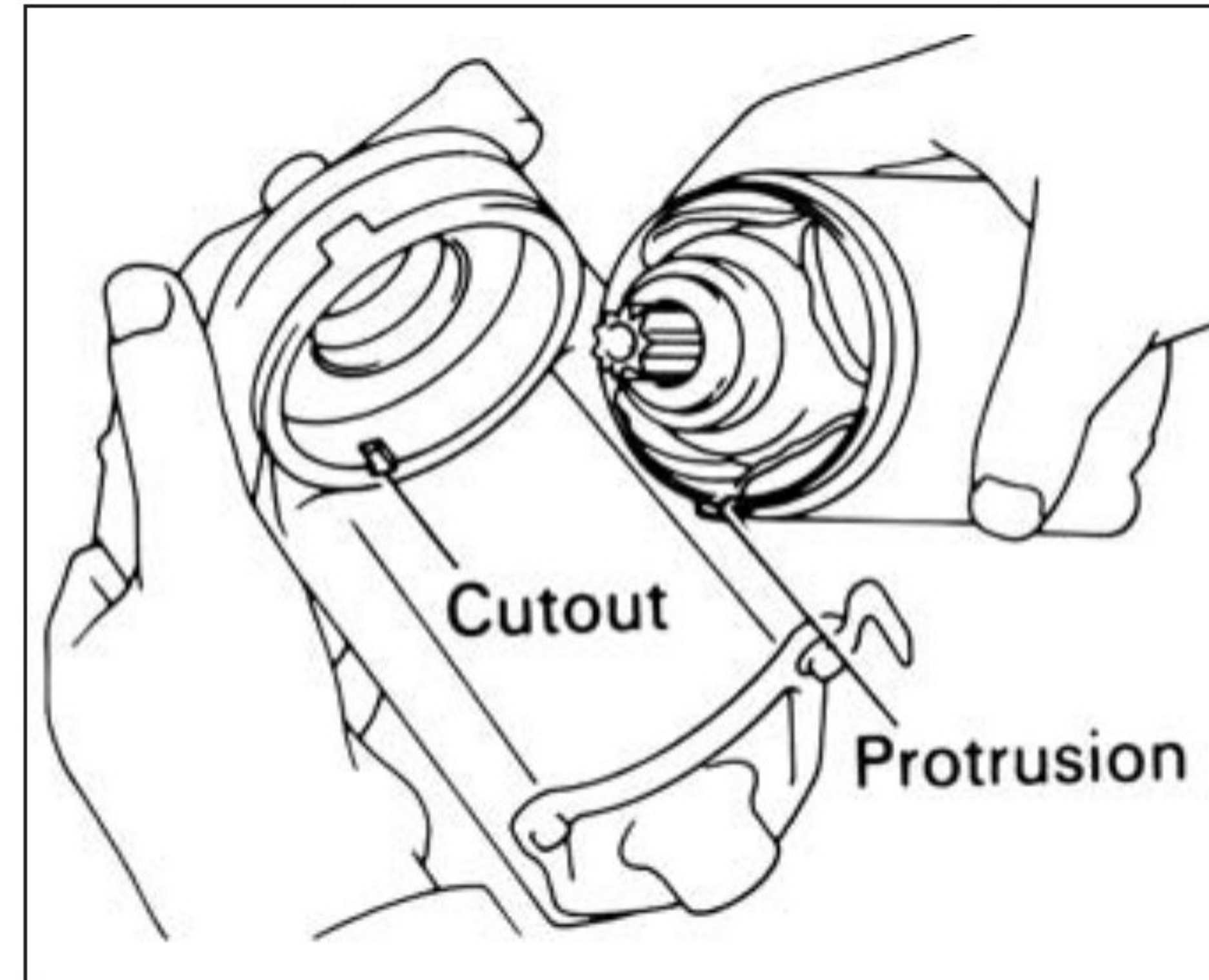


- Assemble the starter housing and magnetic switch assembly and install the two screws.

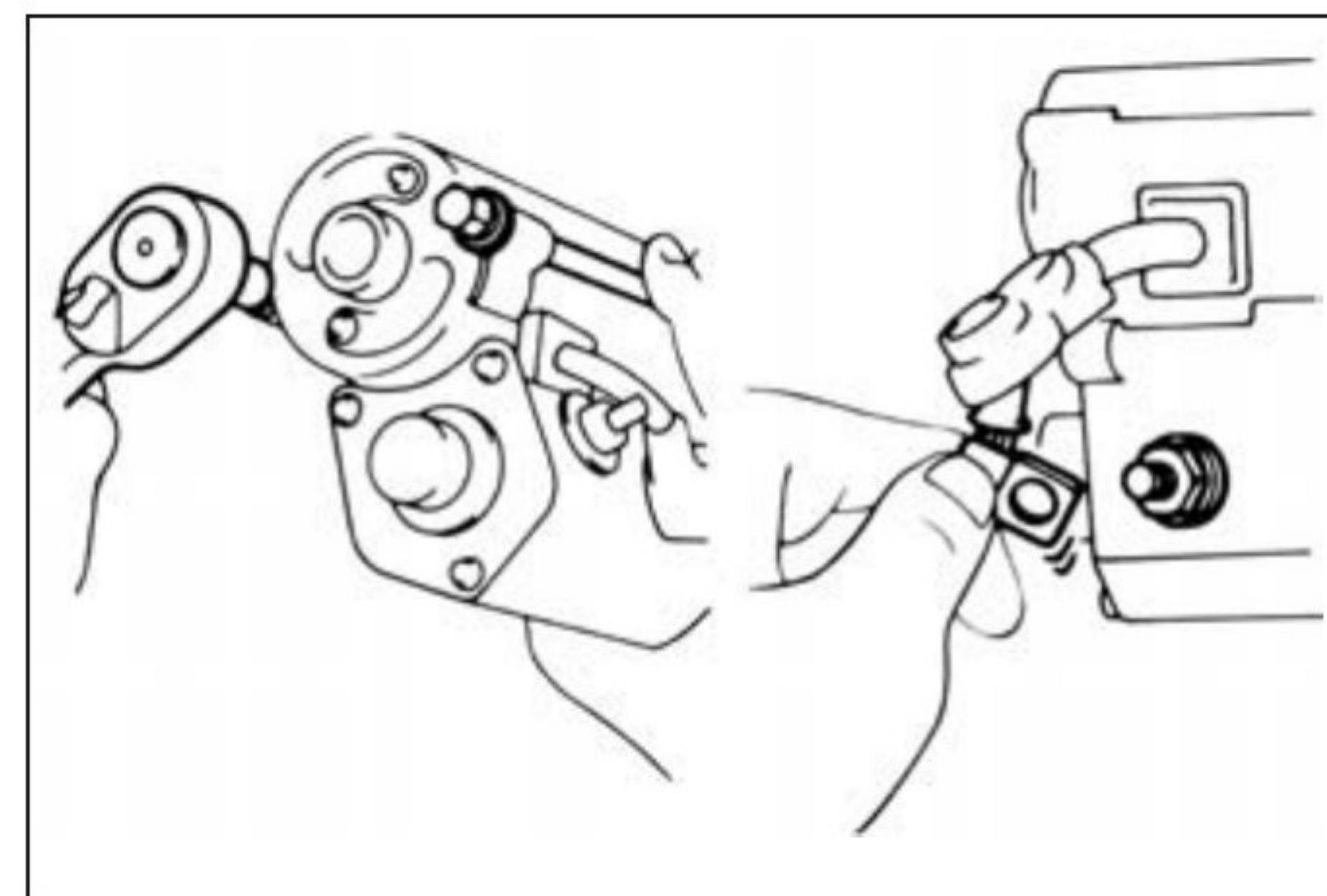


5. Install field frame with armature to magnetic switch assembly.

- Align the protrusion of the field frame with the cutout of the magnetic switch assembly.



- Install the two through bolts. Connect the lead wire to the magnetic switch terminal C, and install the nut.



Performance Test of Starter

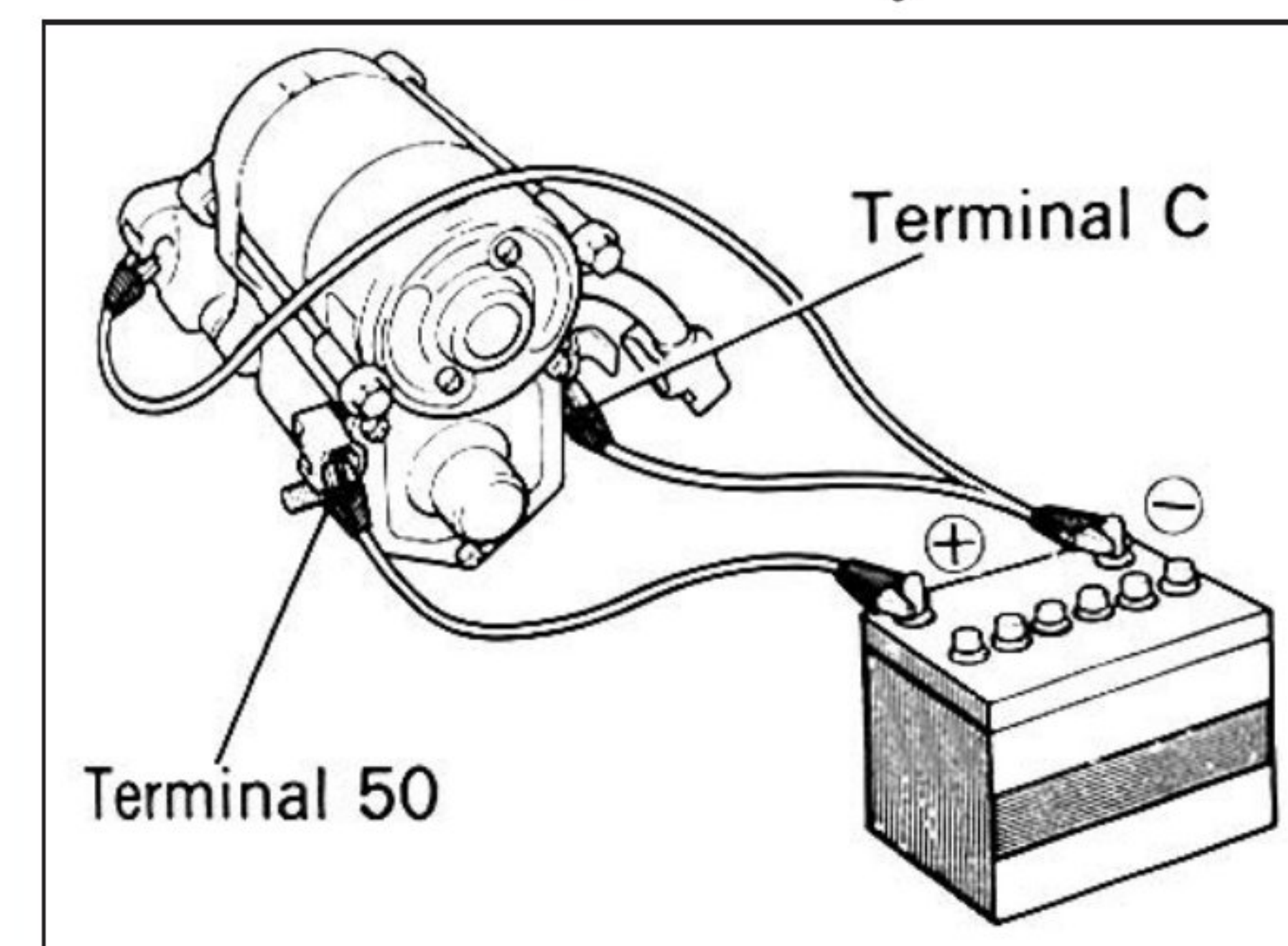
Notice: These tests must be performed within three to five seconds to avoid burning out the coil.

1. Perform pull-in test. Disconnect the field coil lead wire from terminal C. Connect the battery to the magnetic switch as shown. Check that the clutch pinion gear moves

Troubleshooting

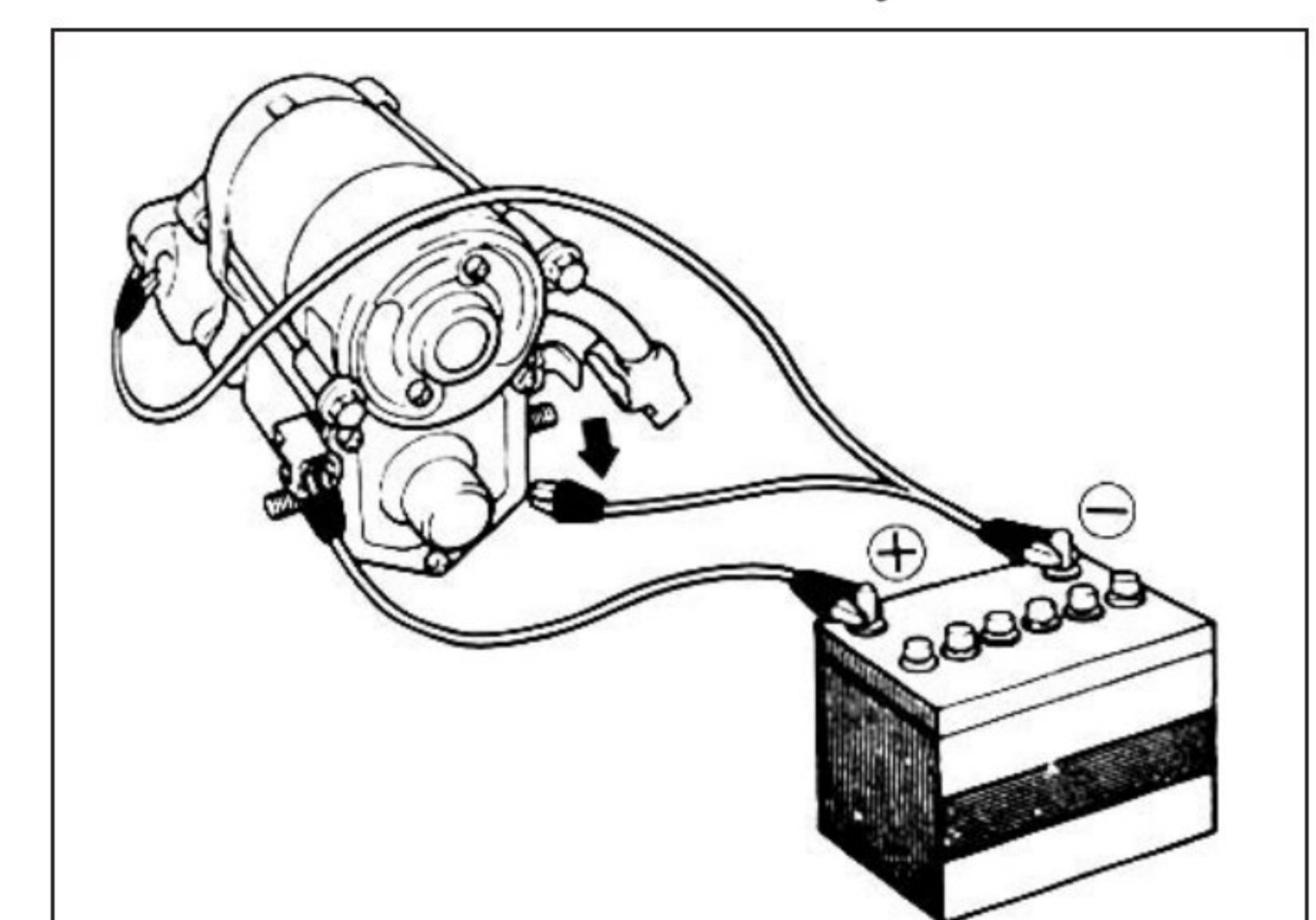
Problem	Possible cause	Remedy
Engine will not crank	Battery charge low	Check battery specific gravity Charge or replace battery
	Battery cables loose, corroded or worn	Repair or replace cable
	Neutral start switch faulty	Replace switch
	Fusible link blown	Replace fusible link
	Starter faulty	Repair starter
	Ignition switch faulty	Replace ignition switch
Engine cranks slowly	Battery charge low	Check battery specific gravity Charge or replace battery
	Battery cables loose, corroded or worn	Repair or replace cables
	Starter faulty	Repair starter
Starter keeps running	Starter faulty	Repair starter
	Ignition switch faulty	Replace ignition switch
	Short in wiring	Repair wiring
Starter spins but engine will not crank	Pinion gear teeth broken or faulty starter	Repair starter
	Drive plate teeth broken	Replace Drive plate

outward. If the clutch pinion gear does not move, replace the magnetic switch assembly.



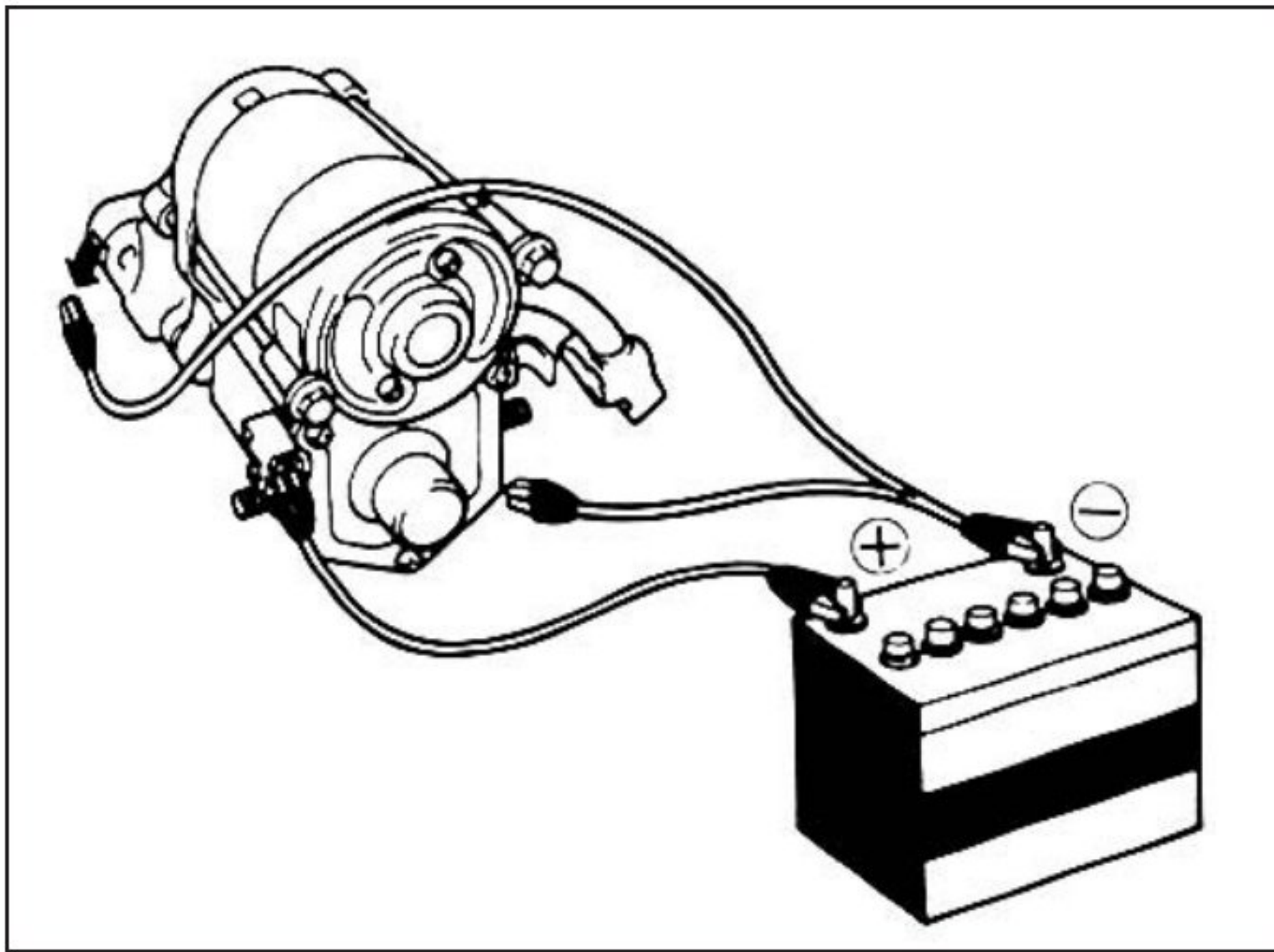
2. Perform hold-in test. While connected as above with the clutch pinion gear out, disconnect the negative lead from terminal C. Check that the pinion gear remains

out. If the clutch pinion gear returns inward, replace the magnetic switch assembly.

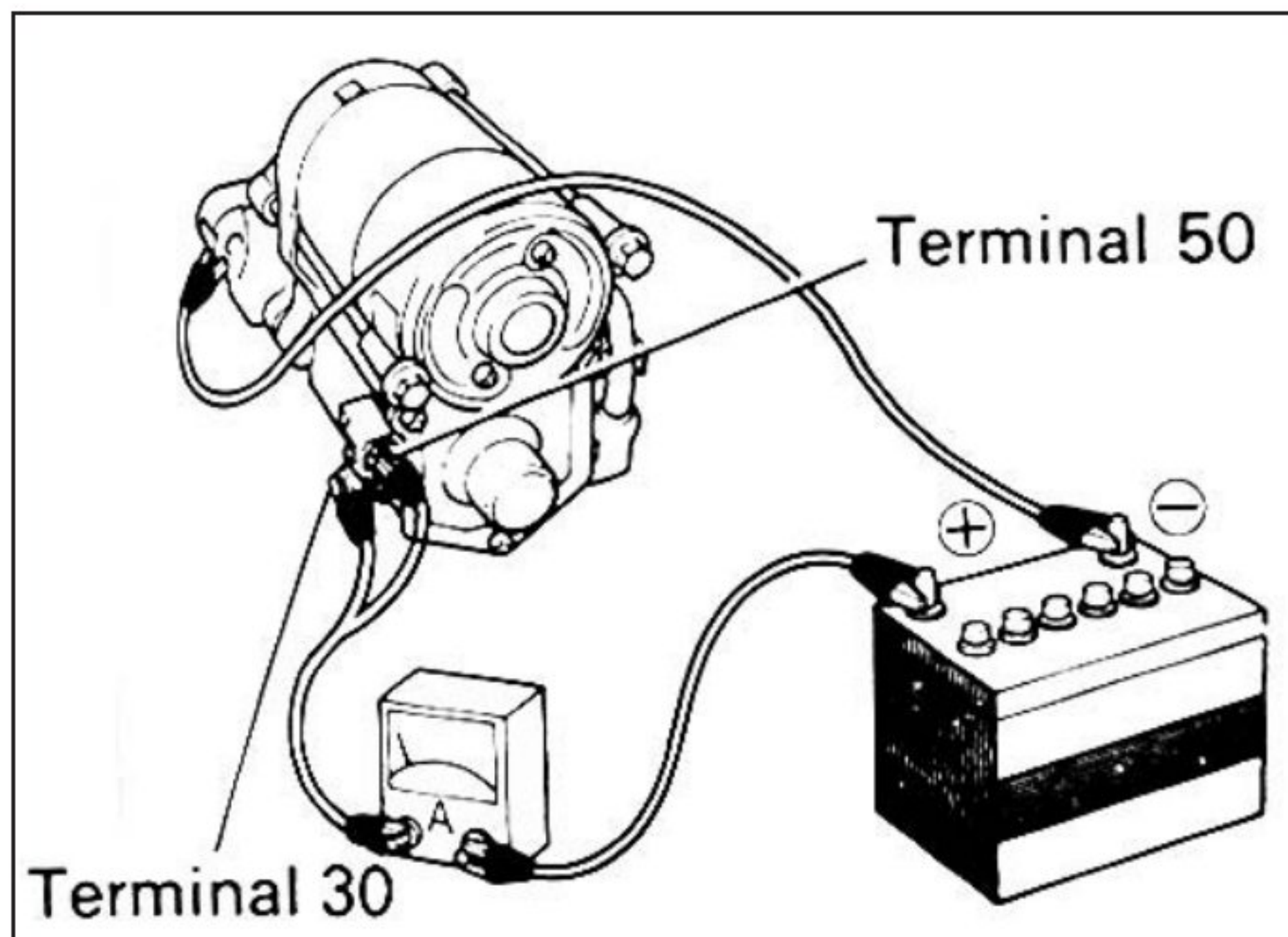


3. Inspect clutch pinion gear return. Disconnect the negative lead from the switch body. Check that the clutch pinion gear returns inward. If the clutch pinion gear does

not return, replace the magnetic switch assembly.



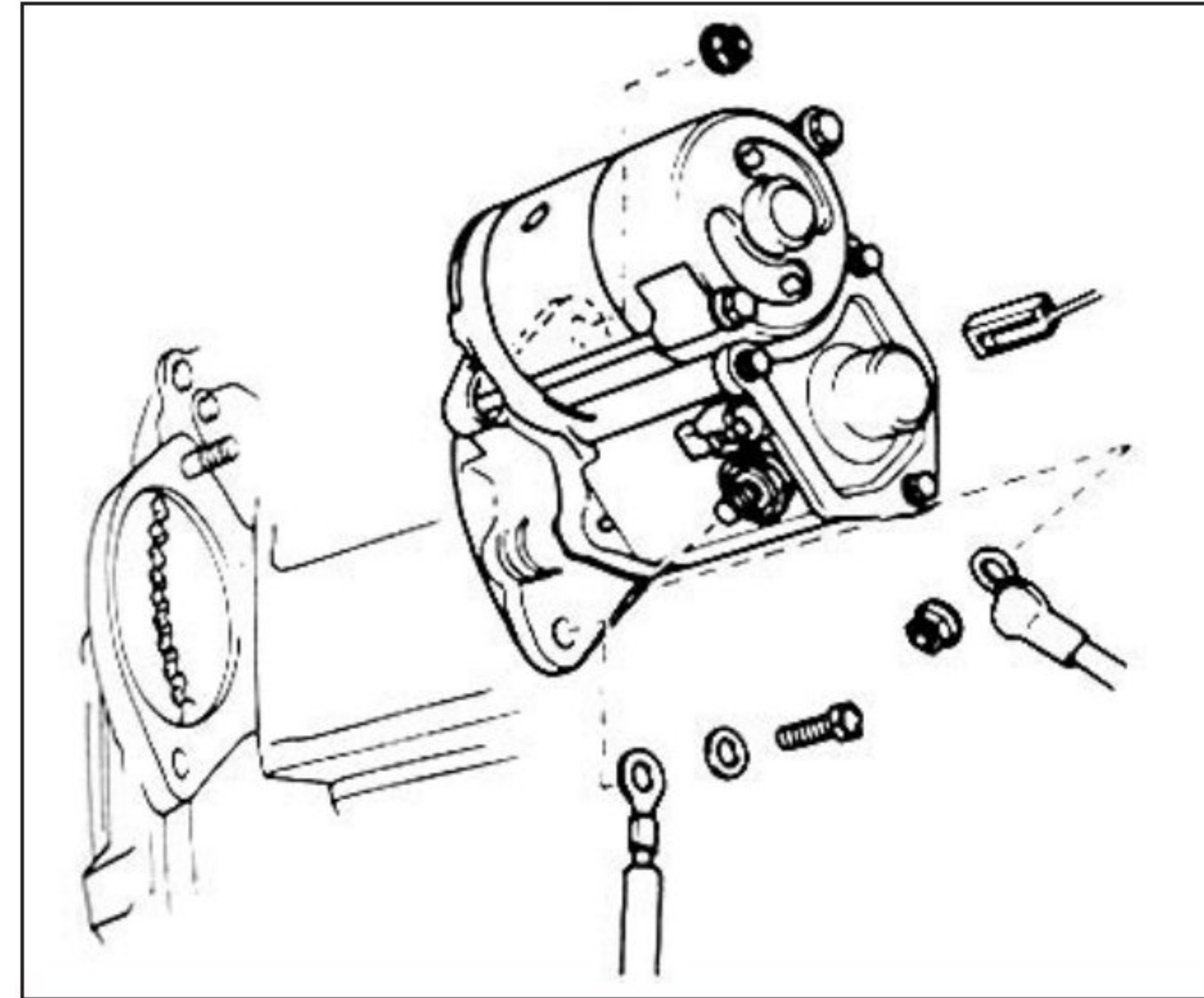
4. Perform no-load performance test. Connect the battery and ammeter to the starter as illustrated. Check that the starter rotates smoothly and steadily with the pinion gear moving out. Check that the ammeter shows the specified current. (Specified current: 90 amps or less at 11.5 volts.)



Installation of Starter

1. Install the starter and ground strap with the bolt and nut.
2. Connect connector and cable to starter.
3. Connect cable to negative terminal of battery.

4. Check that engine starts.



See Part II in the October issue.