Ural (Урал) - Днепр (Днепр) Electric Starters for Russian Motorcycles

Part XI-2: Repair of Electric Starters

(See Also Part XI: Electric Starter Evolution, and Part XI-1: Hitachi Starter-Generators)

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02 / 2018
Electric Starter History

- Ural Was Only Kick-Start When Bikes Were Imported to USA in 1994 thru 1997
  - CSMI (Classic Motorcycles and Sidecars, Inc) Replaced 14-Amp Russian (Г-424) Generator with 18-Amp Hitachi Starter-Generator on Imported Urals in 1998
  - See Part IV: Hitachi Starter Generator
  - Did Not Work Well and Discontinued Almost as Soon as Introduced
    - Starter-Generator on Top of Motor, Working Off the Timing Gear Set
    - Inadequate Charging and Inadequate Starter
- Ural Added a True Starter-Motor in 1998-1/2
  - Modified Bell Housing of Gearbox to Accept a Real Starter
  - Starter Required Larger Battery and 35-Amp Alternator (14.3771)
  - Used Starter CT369, Originally Developed for Russian Outboard Engine
  - '98 Models Sold With and Without Starters until Non-Starter Inventory Depleted
  - 35-Amp Alternators (Russian Hand-Grenade) Started Failing, but There Wasn't Any Replacement at that Time
    - In 2004, 55-Amp Nippon Denso Alternator Replaced 35-Amp Russian Grenade
- Starter-Motor Design Changed to CT369Б Version around 2006
  - Lengthened by 22 mm (approx. 1”) for 30% Reduction in Current Consumption
  - Production Bikes Equipped with Proper Kick-Start Levers (1” Kink in Lever)
  - Problem Only for Older Replacements: Need to Modify Levers
    - Interference Fit with Kick-Start Lever
    - F2 (England) and Gene Holopaw Offered Modified Levers
- Schematics of Urals with Starters Included
  - See Part IV for Hitachi Starter / Generator Schematic
- Dnepr Never Manufactured a Bike with Electric Start, Only Retro-Fits
Ural Starter / Generator / Alternator Timeline

**Engine Size**

- 650 cc
- 750 cc Engine

**Year**

- '94
- '95
- '96
- '97
- '98
- '99
- '2000
- '2001
- '2002
- '2003
- '2004
- '2005
- '2006
- '2007

**Start Relays (RY-115)**

- One Relay
- Two Relays

**Ignition Type**

- Type I
- Type II
- Type III Ignition
- Type IV
- Type V

**Voltage Regulator**

- PP-330 Mechanical (33.3720200 Solid-State)
- Regulator Internal to Alternator

**Gen/Alt**

- Kick-Start Only
- Electric-Start (E-Start) Option & Retrofit introduced by CSMI
- Factory Electric-Start Added

**Engine**

- 14 Amp Russian-Built Г-424 (G-424) Starter-Generator (200-W)
- 18-Amp Hitachi Starter-Generator (500 W, black-plastic rear cap)
- 35-Amp Russian Alternator 14.3771 (Hand Grenade) (770-W, metal rear cap)

**Voltage Regulator**

- Voltage Regulator internal to Alternator

**Ural Starter / Generator / Alternator**

- 55-Amp Nippon Denso Alternator

**Ural imported to U.S. by CSMI (Classic Motorcycles and Sidecars, Inc.)**
Repair and Operation of VAZ-1111 (Oka)

Starter:
1. Drive Cover
2. Gear
3. Armature Shaft
4. Housing
5. Collector (Commutator) Cover
6. Pull-In Relay (Solenoid)

The repair of starter-motor V1111 or 391.3718, used in the Russian VAZ-1111 car, is very similar to the Ural starter-motor.
Troubleshooting Starter Details: Repair and Operation VAZ 1111 (Oka)

1. Loosen the nut of the lower pin bolt pulling the starter relay...
2. ...remove the washer and remove the tip of the coil.
3. Remove the two nuts pulling the starter relay (one shown).
4. Remove the traction relay of a cover of the drive.
5. Remove the core of the solenoid cover from the drive, moving it out of engagement with the lever actuator.
6. Remove the palm lever by prying with a screwdriver.
7. Loosen the two clamping screws and ...  

8 .... remove the cover from the cover of the collector.  

9. Remove the seal housing.  

10. Remove the brush holder spring brushes.  

11. Remove the lock washer with the felling anchor starter and ...  

12 .... shims.
13. Disconnect the starter housing and the cover of the commutator (if you cannot make your hands, use a screwdriver).

14. Remove the isolated brush and brush holder ...

15. ... remove the cover from the starter commutator.

16. Remove the washer from the remote armature shaft.

17. Remove the cotter key that secures the axle lever starter, and ...

18. ... remove the pin from the cover of the drive.
19. Remove the cover from the drive.

20. Remove the lever of the starter motor.

21. Remove the rotor from the starter housing.

22. Slide the stop ring to stop.

23. Remove the retaining ring and restrictive with the armature shaft.

24. Remove the starter clutch assembly from the armature shaft.
25. Remove the solenoid spring

26. Replace brushes remove the insulating bracket ...

27 .... soldering iron to heat the place of the isolated brush with the stator and, opening his screwdriver bend stator ...

28 .... remove isolated brush.

29. Loosen the screws tips tires bare brush and remove the brush from the cover of the collector.

30. Check the insulation of the stator winding. To do this, apply 220-Volts AC and connect one wire of the coil, the other to the body. If the lamp is lit, winding insulation is damaged. Replace the coil or stator. Also check the other stator winding. When checking the voltage of 220 V with care. Do not touch the stator under tension.
31. Inspect the surface of the armature shaft for bearings. If you notice on the shaft of the rotor yellow plaque bearing remove it fine sandpaper. Slots on the surface of the shaft should not be damaged (scratches, nicks, pitting of the teeth, and visible signs of wear.)

32. Check the soldering pins armature winding to the commutator plates.

33. Starter housing gasket must not be damaged (breaks, cracks, etc.).

34. Check the starter-motor, turning the wheel (it should rotate in the same direction). If the drive parts are worn or damaged, replace the drive. If you notice nicks in the teeth, polish then with fine-grained sandpaper or emory cloth.

35. Check the solenoid’s spring. Replace any broken springs.

36. Pinch bolt starter should not have severely damaged the threaded part and heads.
37. Check the starter cover from the drive. Cracks are not allowed.

38. Inspect the surface of the armature magnetic switch. Risks and deep scratches are not allowed. Anchor should move in the magnetic switch easily without sticking.

39. Forks lever starter should not be bent.

40. Check the starter brushes, measuring their height. It must be at least 12 mm.

41. Check circuit contact bolts magnetic switch plate. To do this, connect an ohmmeter to contact bolt and press the stem of the magnetic switch (on the flange). If the ohmmeter shows "infinity", replace the magnetic switch.

42. Check the inner surface of the magnetic switch. Risks scoring etc. are not permitted.
Assembling the Starter

43. Clean the surface of the collector armature starter.

44. Apply engine oil to the splined portion of the armature shaft.

45. ...-bearing bushing cap from the reservoir and ...

46. ... sliding face the starter motor.

47. Stop ring pressed after setting the lock ring on the armature shaft.

1. Use 13 mm wrench to remove a nut of the lower pin bolt.

2. Remove the tip of the wire.

3. Remove two screws of the solenoid with slotted screwdriver.

4. Remove the starter (pull-in) relay (solenoid) and spring.

5. Connection of the solenoid and the front cover is sealed with a rubber ring.

6. Remove the solenoid core.

The repair of starter-motor V1111 or 391.3718, used in the Russian VAZ-1111 car, is very similar to the Ural starter-motor.
7. Place the starter vertically and strike a hammer on the end of a 14 mm, compressing limiting ring.

8. Prying with a screwdriver locking ring ...

9. Remove it ...

10. ... and limiting ring.

11. Use the 8 mm wrench to remove two nuts on the tie rods.

12. Remove the front cover with over-running clutch housing and rotor.
13. Take out the cover.

14. Removing the studs.

15. Take out the rubber plug.

16. Use the 10 mm wrench to remove the axle nut lever, hold the axis of slot screwdriver.

17. Removing axis screwdriver from the housing ...

18. ... and remove it.
19. Take out the drive with the lever of the front cover.

20. Remove the plastic hinge lever.

21. Dilute the snap ring pliers ...

22. ... and remove it.

23. Shoot the puck ...

24. ... and lever with a plastic sleeve.
25. Located under the plastic sleeve snap ring. To retrieve the anchor from the housing, and access to site of brush ...

26. Blade screwdriver ... Loosen the two screws ...

27. ... and remove the cover from the seal.

28. hooked screwdriver lock washer ...

29. ... And remove it.

30. Under the lock washer is a package of shims.
31. Remove the back cover.  
32. Remove the brush holder.  
33. Wire release, along with two brushes.  
34. Take out the spring brushes.  
35. Use the 8 mm wrench and slotted screwdriver to remove the screw the other two brushes ...  
36. ... and take out the brush.
37. Remove the inner brush holder.

38. Remove electrical insulating board.

39. Remove the rotor (anchor) from the body.

40. In the body are six permanent magnets held by two plastic holders at the ends. Holders are oriented relative to each other over the holes for the tie rods. Dismantle holders and magnets manufacturer does not recommend. Starter assembly perform in reverse order of disassembly.

Armature shaft splines, sleeve back cover lubricates the engine oil. Flanged sleeve grease lubricated drive Lithol-24.

41. When assembling a spring set with brushes. Before operating the starter assembled advisable to check for a short circuit. When installing the axle lever, turn the axis so that the flight gear when the starter was the highest and lock nut, otherwise the drive gear may just not get to flywheel. Before installing the starter on the car should also lubricate the bushing is pressed into the clutch housing.
Tools Needed: 13 mm wrench, 8mm Allen wrench, 6" or longer ratchet extension and bungee cord.

Note: If removing the starter while on the bike, TURN OFF THE BATTERY MASTER SWITCH OR DISCONNECT THE BATTERY GROUND unless you want to practice welding a wrench to your motorcycle. You have been warned.

1. This is the starter motor.
2. If removing while on the motorcycle, remove the 13mm nut holding the positive battery wire and two other wires. Put nut and washer back on post so they do not get lost.

3. Next, you will need to remove these two 8 mm Allen head bolts. The upper bolt also double as the fastener for the air cleaner housing.

4. I prefer the long shank Allen wrenches with a ball tip at one end. These are especially handy if removing the starter while the engine is still in the frame. I use an 8" ratchet extension as a cheater bar on the short arm of the Allen wrench to break the bolts loose.

5. If removing the starter while the engine is still in the frame; use a bungee or your knee to hold the kick start lever down and out of the the way.
6. With the two 8mm Allen's removed the starter will fall off...be careful.

7. There will be one or two spacers on the front of the starter. No particular order, just put them back on or the starter will bind and the engine will not turn over. If you are upgrading a starter...be on the look out for this problem if spacers are not provided.

8. Visually inspect the teeth of the Bendix gear. Damaged teeth need to be addressed.

9. With the starter removed you can inspect the flywheel teeth and clutch screws. Use the kick-start lever to slowly turn the flywheel around and check condition of teeth/screws. Installation is the reverse steps shown above.
Perform the following tests either outside or in an area where there is adequate ventilation, and ensure that there is no source of ignition near the motorcycle!

1) Turn on the master switch. Turn the ignition switch to the middle “on” position. Turn the fuel petcock to the “on” position. Pull out the choke knob on each carburetor. Press the electric start button. Did the electric starter motor do anything?
   – No - Go to step 2.
   – Yes - Go to step 3

2) Press the starter button again. Listen for a click sound under the seat. Did you hear a sound?
   – No - Go to step 10.
   – Yes - Go to step 10.

3) When the motor was turning over, could you hear either cylinder fire at all?
   – No - Go to step 4.
   – Yes - Exchange the spark plugs and leads between cylinders by reversing the positions of the spark plug leads at the ignition coil. If the problem follows either the spark plug or lead to the other cylinder, then replace the defective component as required. If the problem remains with one cylinder then suspect either the carburetor or valve adjustments. Go to step 5.

4) Pull the spark plug from each cylinder and lay the plugs on top of the cylinder heads so that the threaded part of the plug makes electrical contact with the bare metal of the cooling fins. Press the electric start button again and look for sparks jumping across the spark gaps. Did you see sparks on either of the spark plugs?
   – No - Go to step 7.
   – Yes - Go to step 5.

5) Remove the fuel supply hoses from each of the carburetors. Did you see an unrestricted flow of gasoline pour out from the ends of the hoses?
   – No - Go to step 6.
   – Yes - Let the engine sit with the spark plugs removed for 30 minutes to dry out. The cylinders may be flooded.

6) Momentarily remove the fuel supply hose from the fuel petcock under the fuel tank. Was there an unrestricted flow of fuel from the fuel petcock? (Make sure the fuel petcock is turned on)
   – No - Fill the fuel tank with fuel and go to step 1
   – Yes - Check the fuel supply hoses and fuel filters for restrictions. Reconnect the fuel lines and filters and go to step 5.
7) Use a voltmeter and check for +12 volts on the red wire of the ignition module located under the front engine cover. Did you measure +12 volts with the other lead of the voltmeter connected to the metal of the engine?
   – No - Check the fuses and look for poor wire connections in the fuse holder assembly. Also make sure that the kill switch is in the run position. Repeat step 7.
   – Yes - Go to step 8.

8) Use an ohmmeter to check the ignition coil. Measure the resistance of the primary winding by attaching the ohmmeter leads to the outside studs of the ignition coil. The meter should read approximately 1 ohm. Now measure the resistance of the secondary coil by connecting the ohmmeter between the two extending high voltage output connectors of the coil. The resistance should be approximately 7,700 ohms. Are the resistance characteristics of the ignition coil close the above values?
   – No - Replace the ignition coil.
   – Yes - Go to step 9.

9) Check the electronic ignition assembly for any loose wires. The disk with the steel pins must spin with the motor crankshaft. The gap between the timing disk and the timing sensor must be .010 inches. Are there any visible problems?
   – No - Replace the electronic ignition module.
   – Yes - Correct the problems and if required, return to step 3.

10) Locate the starter relay mounted under the rider’s seat. Connect a voltmeter to the two connectors of the starter relay. Press the start button and measure the voltage at the relay’s connectors. Did you measure 12 volts?
    – No - Check the wires going to the relay for loose connections or a break in the wire. Check the electric start switch for correct operation. Replace the switch if required.
    – Yes - Check the wire that carries the 12 volts from the output of the starter relay to the starter solenoid. Look for loose or dirty connectors or a break in the wire. Go to step 11.
11) Use a screwdriver to carefully form a jumper between the starter solenoid tab and the starter solenoid stud which has the wires connected to it. Did the starter solenoid motor activate?
   – No - Go to step 12.
   – Yes - If the starter motor activated with the screwdriver bypass but not with the electric start button then there are several things which need to be checked. Start with the fuse holder assembly. Look for any blown fuses or poor wire connections on the ends of the fuse holders. Look for green corrosion or loose wires. Remove the electric start switch from the bike & look for internal signs of broken switch contacts. Look at the switch connector also and make sure that it makes good contact. Look under the rider’s seat of the bike behind the master switch. There you will find a small relay which is controlled by the electric start switch. When activated, the relay sends 12 volts to the tab on the starter solenoid. Check for loose connections on the relay or broken wires going to / from the relay. If you are unable to find a problem with the start switch, fuses, or wiring then replace the relay. Otherwise, replace as required.

12) Turn off the master switch. Remove the heavy wire that leads to the battery from the stud connector on the starter solenoid. Hold it in your fingers so that there is no possibility of it touching anything metal on the bike!! Turn the master switch back on. Briefly tap the metal connector in your fingers to the other metal stud connector on the starter solenoid that is closest to the starter motor. Did the motor start momentarily? Turn off the master switch and return the heavy wire to its original terminal.
   – No - Replace or repair the starter motor.
   – Yes - Replace the starter solenoid.
Cleaning Solenoid Contacts on a Ural Starter (cont.)

http://www.russianiron.com/Cleaning%20solenoid.htm

• Symptoms began as intermittent functioning of the starter when the button was pushed. Sometimes it cranked over, sometimes, nothing.
• I had heard of this and so knew what needed to be cleaned.
• To do this you need to remove the starter motor from the bike.
• To do that you need to unbolt the air-box:
  • Accessing/removing the Starter-motor:
  • Loosen the rubber manifolds between the carbs and the air-box. Removing the left side manifolds altogether will improve your access. The air-box is held in place by a metal bracket that is, in turn, bolted to the engine/gearbox casings in two places.
  • The first is one of the starter motor bolts and is loosened with a 8mm Allen wrench or socket. For the wrench, the long arm is needed to reach the bolt and hence some sort of lever is needed on the short arm in order to loosen the bolt. If a socket is used, some extension arm in the region of 5 cm/2 inches will be needed. Personally, I used the socket.
  • The second bolt also retains the clutch cable-tensioning bracket and is a 13mm nut. This can be reached with a spanner, just, but a deep reaching socket and the same 5 cm extension bar work well for me.
  • You don’t have to remove the air-box, but doing so will make life that bit easier and is not a major task once it has been unbolted.
  • Once the air-box is more or less out of the way you can turn your attention to the starter motor. In order to save your casings from weld marks, and your nervous system from surprises, disconnect the negative cable from the battery. Then unbolt the battery cable from solenoid on the starter and remove it (the cable) entirely from the bike, or it will just dangle in the way… Also do not forget to disconnect the single blade connector from the solenoid cap.
  • At this point, you might want to at least loosen the bolt that retains the white solenoid cable. It’s easier than trying to do so holding the starter motor in your hand.
  • By now the only thing keeping the starter attached to the bike is another 8mm Allen bolt, located under the starter toward the outside. This is easier to reach, but here I used a long extension bar to preserve my knuckles should the bolt suddenly jump loose.
  • When you remove the starter some “oval” shaped metal shims will come away too. These should be retained for reassembly. Don’t bend them...
  • Now your starter motor is off.
Dismantling the solenoid:

The starter motor is comprised of two parts, the motor itself and the solenoid that branches off to one side. The solenoid is what we will focus on. Fully disconnect the white cable, if not done already. Loosen the two slotted screws recessed in the red solenoid cap. One may have been dabbed in red paint. No need to remove them entirely yet.

Before the next stage, look at the starter/solenoid assembly head on so you are looking down at the top of the red solenoid cap. Take a photo, draw a diagram or make a mental note of how the solenoid is orientated, so that upon reassembly you can ensure that all is back in the right place, especially that the single blade connector is orientated in the correct direction.

Now use a 8mm spanner and a screwdriver to undo the coupling bolts midway down the solenoid body. This means that the solenoid can be removed from the starter. Once undone, the solenoid will come away. Dismantle with care as a spring is located inside and this will fall out. Put it to one side, and ensure that the metal cylinder that resides in the starter motor (which the spring is recessed in) does not fall out as it is hooked to a lever that slides the starter motor back and forward when being operated.
Cleaning the Solenoid:

Now you can return to the solenoid: Undo the two loosened cap screws and place them to one side, taking care not to lose the washers. With gentle pressure, you will feel the solenoid cap move. You will feel one section is not moving as freely as the rest. Under the cap a small white wire is soldered to the cap, so DO NOT PRISE THE CAP OFF COMPLETELY. In fact, use as little pressure as possible to ease one side of the solenoid away from the body so that you have between 5-7 mm of access, whilst putting the white wire under as little pressure as possible. Here a pen-touch/head torch is useful.

However, if you have access to a decent soldering-iron and are competent with using it you can melt the solder that holds the above-mentioned wire (it resides in the blob of solder that sits adjacent to the thick, white, negative heavy duty cable that runs between the solenoid and the starter motor) and this way the cap will come clean away from the solenoid to give you free and easy access to the components: based on information posted by Russian Iron member, Ron Cichowski.

Under the cap you will see (just) two discs recessed in the cap itself (these are the contact terminals of the two threaded bolts the power cables are bolted to: called cap-discs from now on). Then, attached to the solenoid yet mobile, there is a large copper disc that has a spring in its centre pushing against the cap. This disc also has a small section cut out of its circumference on one side. This disc is what bridges the gap between the two cap-discs mentioned above, when the starter button is pushed, allowing the current to reach the starter motor and crank the engine.

The disc can be tilted lightly, this way and that, as well as rotated about it’s central axis. First I used a flat, but wide, precision file that I gently rubbed over the surface of the large rotating disc. A nail file would also do the job.
• Rotate the disc, sand a bit, rotate some more, sand etc. Finally, stop when the cut section of the disc was back where it has started. You should just see a fresh surface of shiny copper, using the torch. When you stop ensure that the cut section is not directly below one of the cap-discs as it may result in a bad contact when operating the starter.

• To clean the cap discs, I put a small filing bit (as used with “Dremels” and the like) into my cordless screwdriver and gently removed any oxidation until fresh shiny copper was visible. This is fiddly but not too bad, however, a head torch is definitely advisable. A hand held file would be far trickier. Throughout the sanding phase, be sure not to over-stretch or nick the white soldered wire in the cap. If you go down the de-soldering route, then your choice of abrasive is much greater!

• Once this is done, you may want to get a cotton bud, put a dollop of silicon grease on the end and smeared some grease over the cap-discs, and over the surface of the sprung disc (keeping the cut where it was supposed to be).

• Screw the red cap back down. (If you opted to melt the solder on this wire, remember to re-solder it before completing the rebuild and mounting on the bike.) At this stage, I then found a suitable rod (like a drift), balanced the solenoid on it so that the rod that comes out for the back of the large disc could be pushed upward, against the cap spring, thus making contact between the large disc and two cap-discs. Whilst doing this (quite fiddly, now), I used a multi-meter to measure resistance to see that the grease was not too thick and that my cleaning had done the job. This process is optional, but better to know now if something has been damaged, than when you try the starter button…

• I also measured resistance to ensure that my work had not damaged the link between the exterior solder of the white wire (next to the bolt the white cable is bolted to) and the metal body of the solenoid.
• This done, re-bolt the solenoid to the rest of the starter motor, taking care to orientate it as remembered/picture. This first involves putting the loose spring back in the large metal cylinder recess on the starter motor side and seating the open end of the spring over the rod coming out of the back of the solenoid (connected to the large copper disc). You may want to also put a little silicone grease over the mating surfaces to limit the ingress of moisture later on.

• Once done, I used silicone sealant to seal the join between the red cap and the solenoid body. I have no idea if there will be any ill effects of doing this, but for me there is precious little seal between the red cap and metal body and moisture seems the likely culprit for the corrosion I had had to clean, so time will tell if this is a mistake. Therefore, do this using your own judgement only.

**Reassembly to the bike:**

• The starter motor is now ready for reattachment to the bike, taking care not to forget the use the metal shims, attached the power cable first to the starter and later to the battery, connecting the single blade connector, tightening all bolts nicely and giving everything a good coat of silicone grease to prevent corrosion.

• I, personally, used some PVC water piping of an adequate diameter to for a cowl around the cap electrode as corrosion had already cost me one power cable and a week of cold morning kick-starts.

• Once back in place the air-box can be re-mounted, clutch cable re-secured, all rubber manifolds reattached and made airtight. Finally the positive can be reattached to the battery.

• Finally, you can check if the whole process has worked by turning over a 750 boxer-twin using only your thumb...
Complaints of Starter-Motor Failing to Engage May Require the Following:

Step #1
- Test the starter motor to see if it requires modification or not. Apply 12-volts between the starter solenoid terminal and the case to activate the starter.

Step #2
- If the gear can be moved back from the fully extended position while power is applied, then the starter needs modification. There should not be a gap.

Step #3
- Remove the cotter pin and pivot pin from the starter body.

Step #4
- Remove the two bolts which hold the body of the starter together.
Starter Engagement Trouble-Shooting (cont.)

• Step # 5: Split the starter apart with a screwdriver and remove the body from the head.

• Step # 6: Remove the actuator arm from the head of the starter.

• Step # 7: When you remove the actuator arm, note that two sides of the arm are different. One side is curved, the other side is flat.

• Step # 8: Gently bend the actuator arm ½” in the same direction as the curved face.

• Step # 9: Reassemble and re-mount the starter on the bike.
Disassembling Starter-Motor 391.3708 (www.td-oka.ru)

1. Key "to turn away a nut 13, the lower contact bolt
2. Remove the tip of the wire.
3. While holding the key "to 8" nut, unscrew the screws to the front of the traction relay roof.
4. Remove the magnetic switch and a spring.
5. Lifting, take out the anchor.
6. Having established starter 391.3708 vertically hit a hammer on the open-end wrench "to 14" presses the stop ring.
7. Prying with a screwdriver locking ring, remove it and stop ring.
8. Key "to 8" turn away two coupling bolts.
9. We take out the locking screws.
10. Remove the back cover and take out the rubber gasket.
11. Remove the four springs brushes.
12. Dissociate the front cover and the housing.
13. Take out the drive with a freewheel.
14. To replace the lever rasshplintovyvaem axis of the lever and pull it out.
15. We take out the lever.
16. Poddevaem screwdriver, lock washer and remove it
17. Under the lock washer is a package of shims
18. We take out the rotor from startora
19. Poddevaem screwdriver to the back cover and remove it from the body, with two brushes out of the guide
20. Two brushes connected to the stator windings, you can disconnect is wired connection.
21. To replace the other two brushes with the blade screwdriver turn away two screws and remove the brush and brush guide.

- Starter assembly is performed in the reverse order. Splined shaft anchors, sleeve back cover lubricates the engine oil. Lead ring drive grease lubricated Litol-24.
- When assembling the body-from the front and rear lid is sealed with sealant.
- To replace the back cover on the housing cavity combine the cover with the tab body.
- When installing the front cover to the body cavity cover also combine with the tab body.
- When you install the snap ring on the restrictive convenient pull it sliding pliers.
- When installing the solenoid switch on the front cover-sealing compound sealant.
- Before operating the starter assembled advisable to check for a short circuit.
- Under the lock washer is a package of shims.