

Cleaning direct drive motors on Singer 301,401,404, 503 & 604

These motors are all basically the same but they have small differences that I will note as I go along. Most of the pictures will be of the 401 and 403. If there is a difference in another model I will comment about the difference.

I found that most of my Singer slants had a husky sound as they ran. By running it in bobbin winding mode, I determined that it came from the motors. I asked opinions about this huskiness and I found that the upper bearing was probably the reason for unpleasant sounds. I bought the proper bearing in order to learn how to change one out in a slant. I found that finding someone who had done this repair was hard because the repair was difficult, time consuming and one needs a special press to do it well. So even professionals shy away from switching them out because they can't recoup their time. Most prefer to just switch out the motor.

The main fix for a loud slant motor was to put a drop or two of heavy motor oil (30W) at the bottom of the upper gear where it goes through the bearing, in the hopes that it would get down to the bearing below it. I found this difficult to do because of the area where that gear resides. It gets a bit messy trying to get drop or two of heavy oil in the proper place. It is easier to do if you remove the motor from the machine.

But if you are going to the trouble of removing the motor anyway, why not go further and give the motor a proper cleaning and then oil the bottom of the upper gear so that it gets to the bearing that is right below the area. I will go through the steps to do this.

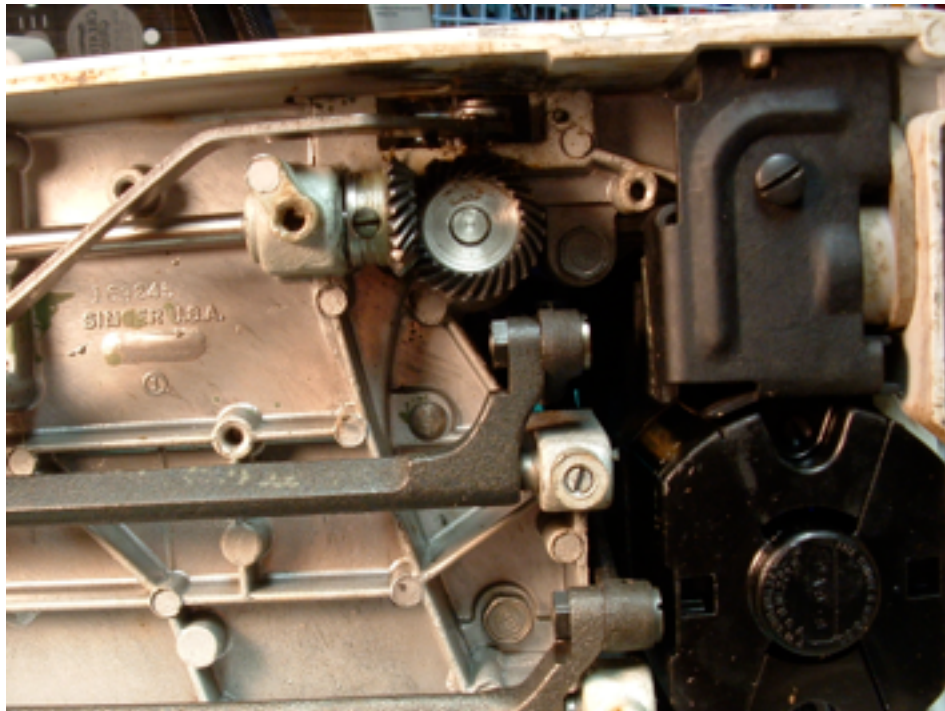
You will need medium and small size screwdrivers, rubber gloves and rags. An old toothbrush is handy at times also. You will also need a spray can of electrical cleaner that has a directional straw available for better aim of the spray. I found my spray at an auto parts store. Wal-mart probably has it as well. It comes in flammable and non flammable. Some people use it on running motors so they would use the non-flammable type. The first motors I cleaned several years back, I only took the brush caps off and sprayed up into the area the best that I could. I think you will get a cleaner motor if you dismantle it into 2 sections, leaving you with the top and bottom sections. You should spray it while outside over a pan, to collect the run off. It evaporates quickly on whatever you have sprayed and the collection pan.

To remove the motor from the machine

First unplug your electrical cords from the machine. Then remove the top lid and hand wheel to get them out of the way before you opened up the bottom of the machine.

Lay your machine carefully on its back on paper or cardboard. Remove the large bottom metal shield with the one screw in the middle. This will expose the bottom guts of your machine. This would be a good time to clean, lube and oil the other stuff down there as well.

Below is a 604e. The black thing at the bottom right is the motor. The black metal plate above it is what holds the motor in place and protects the wiring and I call it the motor shield.



The metal motor shield is fastened with one screw. The 301 has a short screw that goes to a column of aluminum where the other models have a longer screw that fastens to the back wall. My 301's screw had become permanently stuck in the aluminum column. I tried every way I could to loosen it but finally sheared off the head in my endeavor. The shank had to be drilled out to receive another screw. If your 301's screw is easy to come out, put a bit of grease on it to keep it from getting stuck in the future. It is the only model I have had that problem with.

Once the screw has been removed, the plate comes off and exposes the wires and the rest of the motor. Unplug only the two wires that connect directly to the motor. On some models the connectors are red, and some are white. I mark one of them and the side they go on with liquid paper or a marker so there is no confusion which connection goes on which peg when I'm plugging them back in. They just pull off and push on. Pull the plugs and not the wires to maintain the integrity of the wires. Push them out of the way once they are off. The plug that you plug your exterior cord to, on the right side in the wall, may come out as well. It is usually just a 'push in the hole' type. Move it out of the way to remove the motor if needed, being careful of its attached wires.



Below are the two red plugs off their pegs and the brown thing on the upper left is the plug for the exterior cord. It goes in the hole you see on the right.



Sometimes the motor will just slide out of its area and sometimes you have to be a bit more forceful because of old dried oil in the hole where it resides. If it does not come out easily, I usually sit the machine upright on the table and I use a soft handle screwdriver to tap gently on the top of the gear with the soft handle. This straight gear is the one that you see when the top lid removed and it engages the hand wheel gear which is a round textolite gear attached to the hand wheel. Usually a couple of taps will make it come on out. Do not pick up the machine to try to shake it out as it may end up falling out on your floor or your foot.

The 301, 401 & 404 all have a nut at the top of the gear. The 503 and 604 just has threads and no nut. Below is the 401's motor.



The first thing I do once I have the motor out is to remove the brush caps on the bottom of the black part, to expose the brushes. Each side has one screw. I use a pin magnet dish to keep up with my screws while I work. Some screws are hard to come by if you lose one. The next picture shows the end with the two screws in the brush caps.



The picture below shows the cap off one side and the brush tube exposed. That is the tube in the middle of the picture with a slit in it. You can actually see the level of the brush inside the tube and that is the reason the slit is facing you. I always mark the level with a marker for future reference. Remember to replace it in the same direction.



The curved wire on the right of the tube is what holds the tube in place and also makes electrical contact for the motor. You have to remove the tube and take the brushes and

springs out for now. Some times when you remove the brush tube, the curved piece of wire will fall out of its position but it just goes back in place easily. Just be careful with the connecting wires if you have to push it back in place.

To remove the brush tube, I use a small screwdriver and pry it forward from its top. Once it is free of the wire holder, it will fall on out. Since the brushes are on springs, they may pop out of the tube so put them back in their tubes and put them somewhere safe.



This is the empty brush tube. Take a q-tip moistened with alcohol and clean out the inside of the tube while the brushes are out.

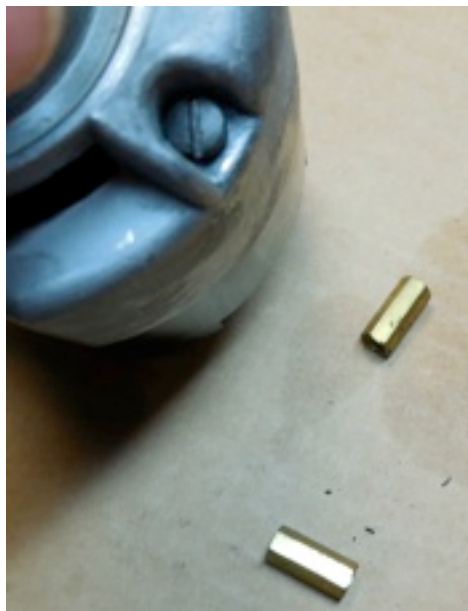


Below are the tubes, springs and brushes. If the brushes are less than $\frac{1}{4}$ " , it is best to replace them. If you can't find the right size, you can sand down larger ones to fit the tube. They need to be able to slide up and down in the tube so they can't be too snug. Notice the

curve in the end of the brush that runs on the commutator. This curve has to match up with the commutator's curve when you put them back in place.



Now stand the motor up on its big end with the gear part at the top. There is a screw on either side that connects to the bottom black part with long nuts that you don't notice until they drop out when the screws are removed. Put them and the screws in a safe place.



Keep the motor in this position and gently pull the top part up off the bottom part. There are 2 pieces that may drop out when you do this so don't panic. I will show you where they go. One is a bent piece of metal that provides a snug fit when the top part is put down on the bottom part. The other piece is a small black rectangle piece and it goes into the indentation where the electrical connections are. That was only different on the 301 where

it had something like cardboard there but stiffer. The 301's connectors were soldered and looked different from the others as well. These black pieces hold in position and insulate the connections so they will not move when you plug in those original red (or white depending on the machine) plugs you took off to initially remove the motor.

Here is that area without those two items and the next pictures shows the 2 items in place.



The motor will come apart more if you want to but it involves dealing with the wires more and then getting them back in their proper place. I feel I can adequately clean the motor with just dealing with the top and bottom parts.

I take them outside and over a glass dish, I spray inside each half with the electrical cleaner using the directional straw. Black carbon dust will come off with the liquid. I spray until it drips fairly clear. I spray from the outside top of the upper gear as well. My 503 was very messy in that area for some reason and my 401 had a slight feeling of grittiness in movement of that upper bearing on that top gear when I hand turned it. I find it best to try to wash that area out with the electrical cleaner from the top and from the inside, the best I can. The fan is in your way, somewhat, on the inside but I turn the gear with my fingers as I spray.

The below picture is my 503 and shows you how much debris was down in its cavity where the gear comes up through the wall to meet the hand wheel gear. Some machines had a lot of old grease in that area as well. Not much grease is needed on this gear and its connecting gear, so clean all the old off, including the cavities in which they fit. I put a bit of grease on my finger and rub it on the gears lightly. On one machine, I had to scrape a lot of old grease off and on others, there was hardly any grease there. It just depended on who maintained it originally.



I also spray the bottom area where the motor shaft rotates on a bushing. When reassembling it, I put just a bit of Vaseline or Triflow grease in that area. The 301 has an exterior grease tube to that area but the others do not. The next picture shows that bottom area and it is the hole in the middle where the shaft rotates.



Once you are satisfied that everything is pretty clean, reassemble the top part to the bottom part. Make sure you have that bent metal piece in its proper place as well as that black piece of insulation. Line the protrusion on top and bottom where the connections go and gently push it all together until there is no space between the two pieces. Slip the 2 long screws in their holes and place the long nuts in their holes, one at a time. I hold my finger on the bottom of each until the screw catches it and then I tighten the screws.

Replacing the brush tubes and brushes

The first picture is the brush area before I start my replacement of the tubes. Both of the wires that hold the tubes in tightly are in place.



I put the spring in the tube and the brush will still be out since the spring is not compressed at this point. I make sure the curve of my brush matches the curve of the commutator before I push it all into place.



Using just my finger, I push on the top of the brush tube and gently push the tube down over the brush spring and then over the brush until all is in its proper place as shown in the next picture

The tube should not touch the commutator but it has to be down pretty far or the cap that covers this area will not be able to be closed up. The tube also protects the brush since it is soft. You want the tube to hold the brush firmly against the commutator but still have brush showing at the end of the tube.



I do the 2nd tube and brush the same way and then close both sides up with their caps and screws. Before I put the motor back in my machine, I put a drop of 30W oil on either side of the shank as shown in the picture below.



Your motor is now ready to be put back into its machine. I usually put a little oil on the top smooth metal part and I also clean the cavity where it goes with a little kerosene to keep it from getting stuck there for the next time the motor is removed.

Repeat the process in reverse to put the motor back in and reconnect. After you have everything back on the machine, hook the cords up and run it for a while. Hopefully there will be an improvement in the sound of its motor.

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