Knowledge Domain: **Motors**
Unit: Brush Substitution
Skill: Filing Down

Tools and Parts Required:

1) **Motor with Carbon Brushes**
2) **Flathead Screwdriver**
3) **Pliers**
4) **File**
5) **Safety goggles**

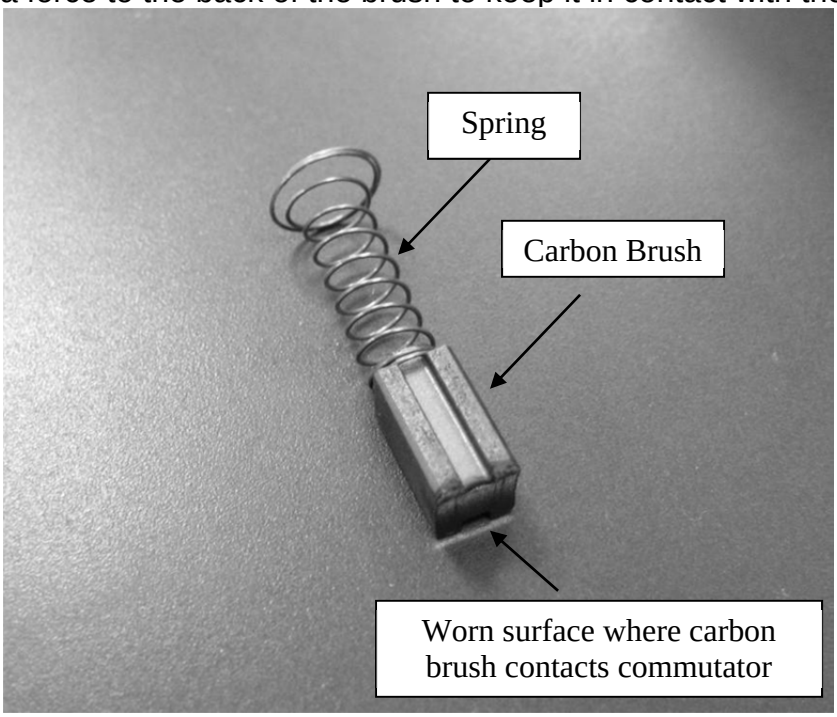
Introduction

Carbon brushes transfer electric current from the motor housing to the commutator on the motor shaft. The motor shaft is stationary. The commutator spins rapidly when the motor is on. Carbon brushes are continuously worn down where they meet the commutator. Worn carbon brushes can be too short to reach the commutator. Worn carbon brushes cannot transfer electric current. Worn carbon brushes cause motors to turn slowly or not at all. Worn carbon brushes must be replaced. Carbon brushes come in various sizes. Brushes for small motors are usually 1.5 cm long and 0.5 cm wide.

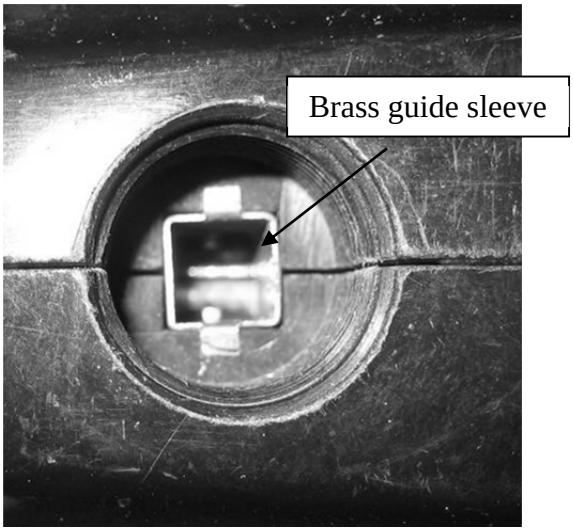
If you cannot find the exact size brush for the motor, you may substitute. A brush that is slightly too large can be filed down to the exact size.

Example

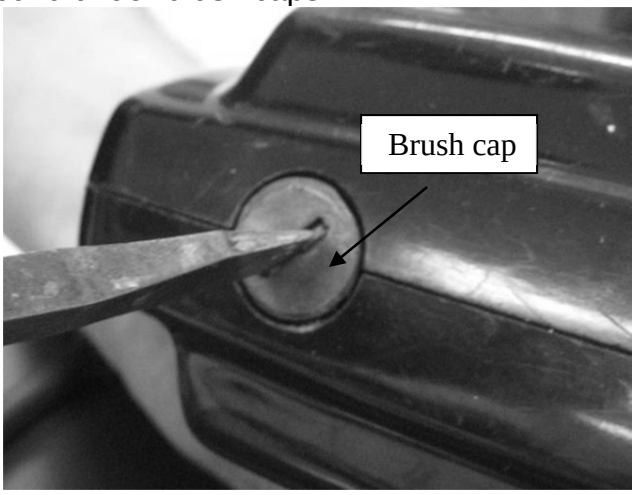
Below is a picture of a carbon brush. Carbon brushes are attached to coil springs. The spring applies a force to the back of the brush to keep it in contact with the commutator.



Identification and Diagnosis
Carbon brushes are rectangular pieces of carbon. Carbon brushes slide into brass guide sleeves on opposite sides of the commutator. The brass guide sleeves align the carbon brushes with the motor.

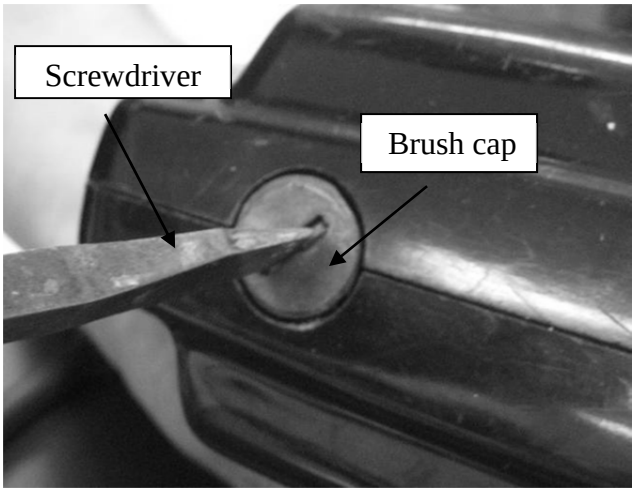


Carbon brushes are found under brush caps.



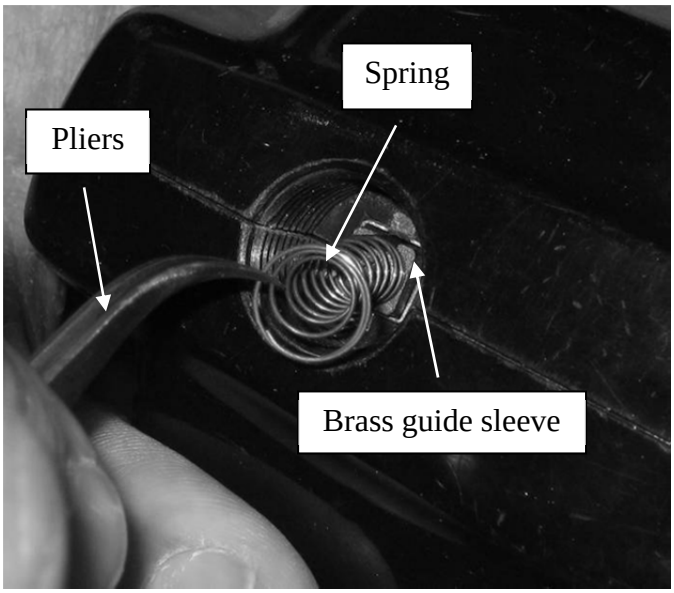
Check the carbon brushes if the motor is turning slowly or not at all. Carbon brushes that are too short to provide full contact with the commutator must be replaced.

Procedure
Unplug the motor. Never work on a motor that is plugged in.
Locate the brush caps. The brush caps are located on opposite sides of the motor.
Use a screwdriver to unscrew the brush caps.



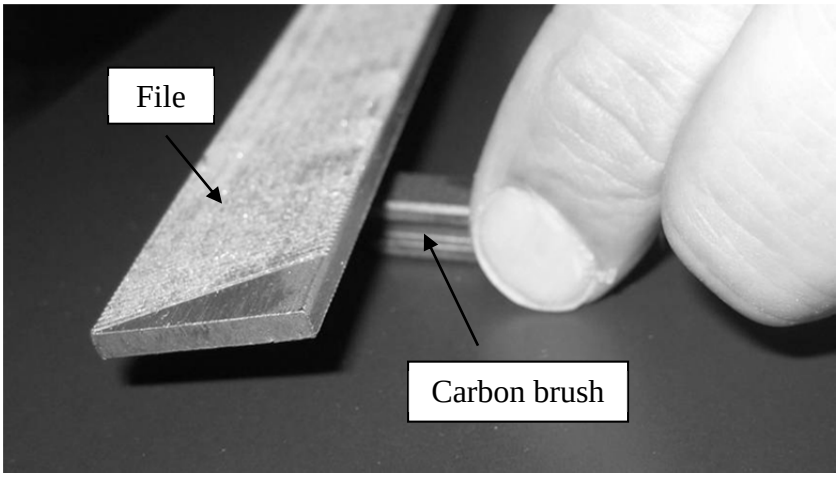
Remove the brush caps carefully. Wear safety goggles because the spring may pop out of the guide sleeve. If the spring does not pop out of the guide sleeve, remove it slowly with a pair of pliers. If the spring is stuck, rotate the shaft of the motor by hand to free the spring.

Remember the correct orientation of the brush when you remove it. The brush should be replaced with the same orientation.

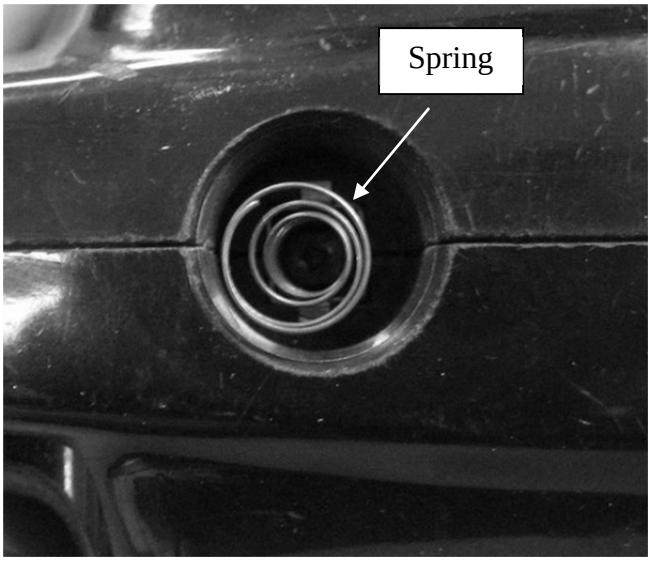


Determine whether or not any of the brushes need to be replaced. Purchase a replacement brush if any of the brushes are too short to reach the commutator. Try to purchase a brush with similar dimensions to the original brush. If a replacement brush is not available, consult the *Motors-BrushSubstitution-Shim* skill to fix a short brush.

The new brush must be able to slide into the brass guide sleeve. If the new brush is too wide, file it down to the correct dimensions.



Slide the new brush into the brass guide sleeve. Insure that the brush has the same orientation as it did before you removed it.



Push the spring into the guide sleeve. Place the brush cap into the opening. Use a screwdriver to tighten the brush cap in place.

Plug the motor back in. Turn the motor on. Verify that the motor turns and does not make unusual noise.

Exercise

Your instructor will provide you with a motor. Insure that your motor is disconnected from the power supply before working on it. Locate the carbon brushes, determine whether or not they need to be replaced, and test the motor.
Your instructor must verify your work before you continue.

Preventative Maintenance and Calibration

Always calibrate every medical device before returning it to use.