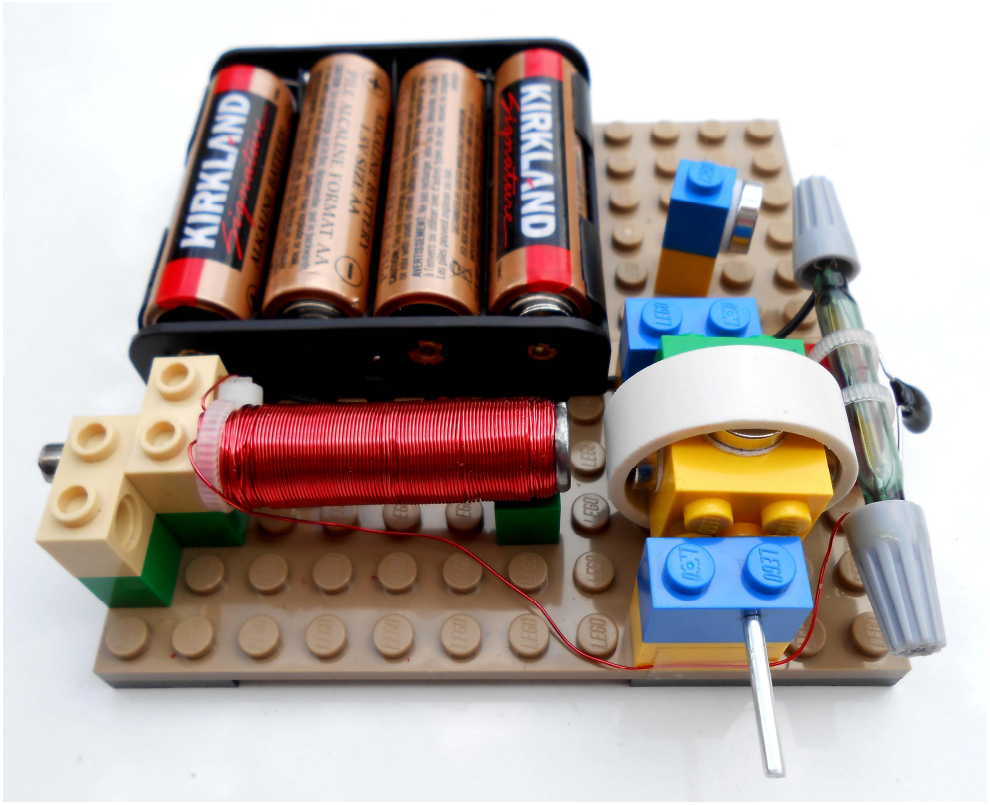
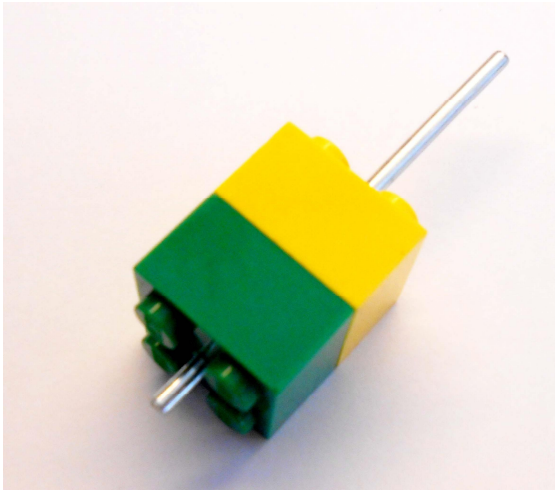
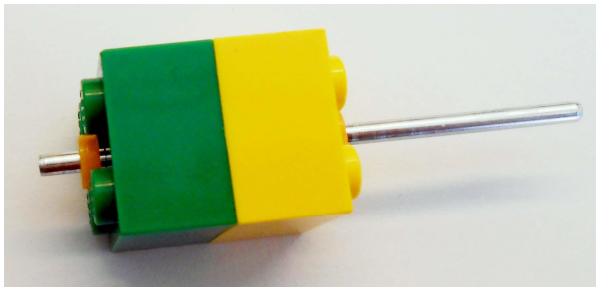
Assembly Instructions: Kit #14
Rapid Assembly Advanced QuikLock Reed Switch Motor

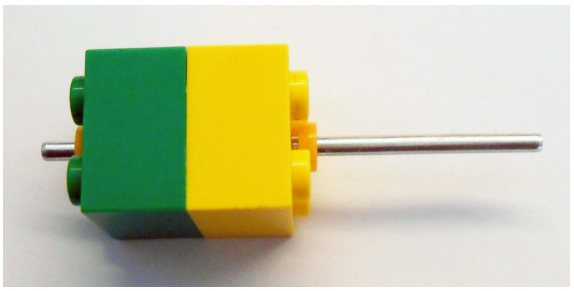


1. Insert the motor shaft through the holes in two 2x2 rotor pieces as shown*. Short end of the shaft should stick out about 1/8” (3 mm) above the surface of the knobs.

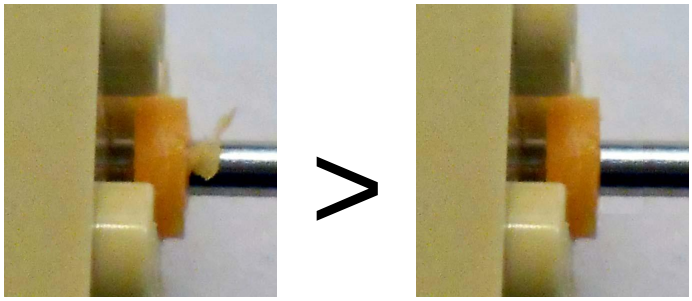


2. Add plastic sleeves (washers) to both ends of the shaft. They fit tightly and require some effort. You may put the sleeve on the table and push the shaft in with the negative end of the battery. Leave a small gap so the sleeves are slightly above the surface of the knobs.





If you notice the burrs on the plastic sleeves remove them with a sharp knife.

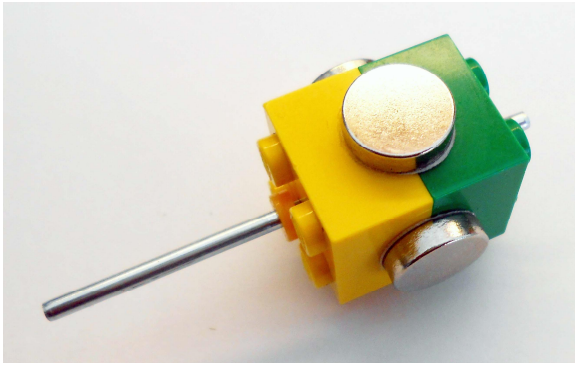


3. Attach double sided sticky pads to the magnets. It does not matter to which side you attach them as long as you use the same pole for all magnets. This is very important! If you do not use the same pole for all magnets your motor will not work.

   The easiest way to achieve it is to attach the pad to the top of the stack and then move top magnet to the bottom; after you attach all seven pads your stack should look as shown. Do not remove the second liner from the pads yet.

Neodymium magnets used in this motor are very strong! Be very careful – if they are allowed to fly to each other they may shatter.

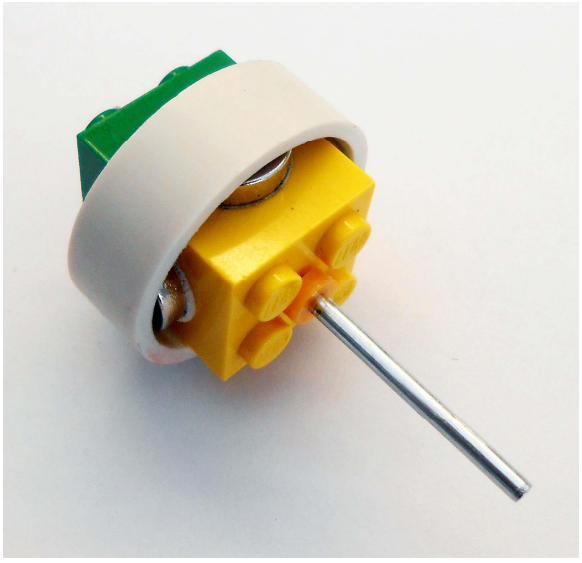
4. Attach four magnets to the rotor. Try to be accurate and center them on each side. Make sure there is no gap between the plastic halves.



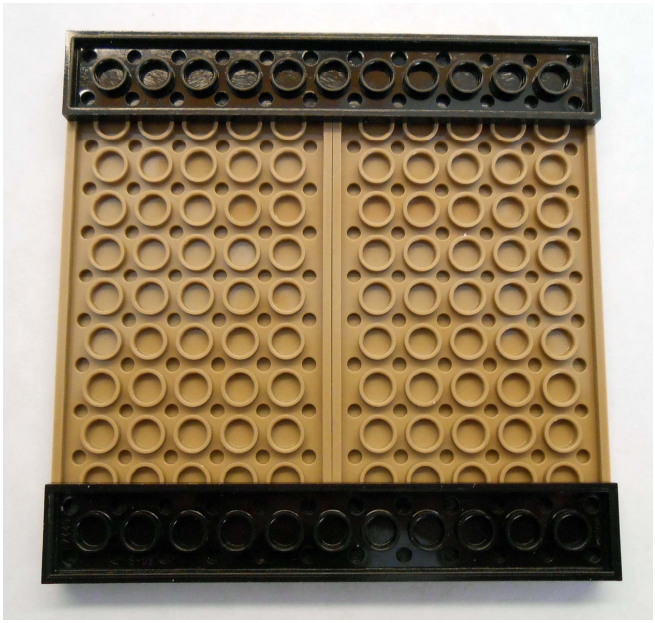
Make the second rotor with two magnets if you plan to compare them during your experiments. Attach the magnets to the opposite sides. This step is optional and may be done later.

5. If you assembled the motor properly and lubricated the axle this motor on 6 Volts may rotate with the speed exceeding 6000 RPM (with the speed control knob). In some of our experiments we achieved more than 7000 RPM! This is really fast and due to centrifugal force the magnets may lose the adhesion and break the reed switch or fly off the rotor.

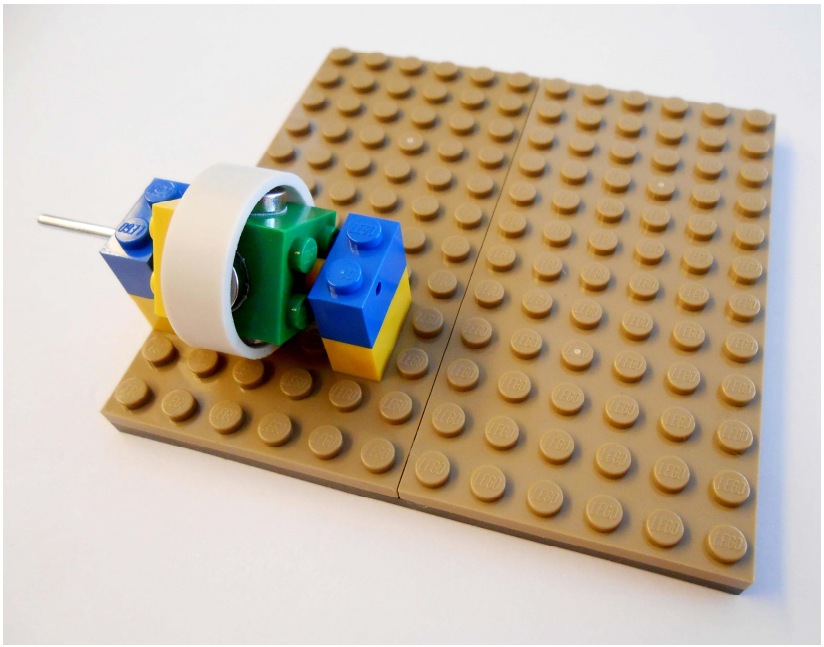
   Add the safety ring that completely eliminates this possibility. It fits tightly and requires some effort. Center the ring to cover the magnets. Squeeze the rotor halves together to make sure that there is no gap between them.



6. Assemble the motor base plate.

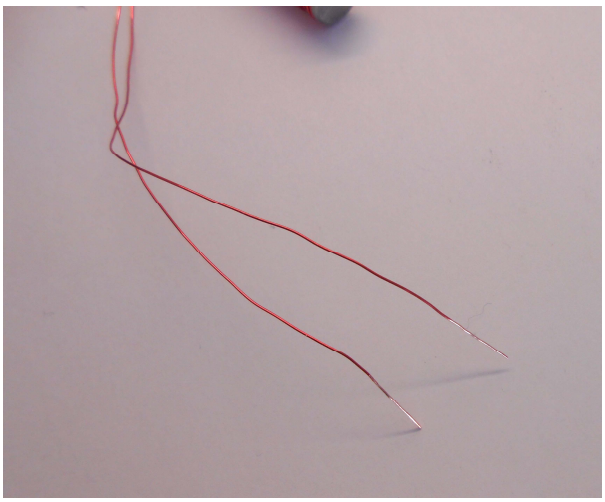


7. Assemble rotor on the base plate. Try to spin it by hand. If it does not spin freely you might need to squeeze blue bricks slightly together to push plastic shaft sleeves in. There should be a tiny gap between sleeves and inner sides of the bricks with holes.

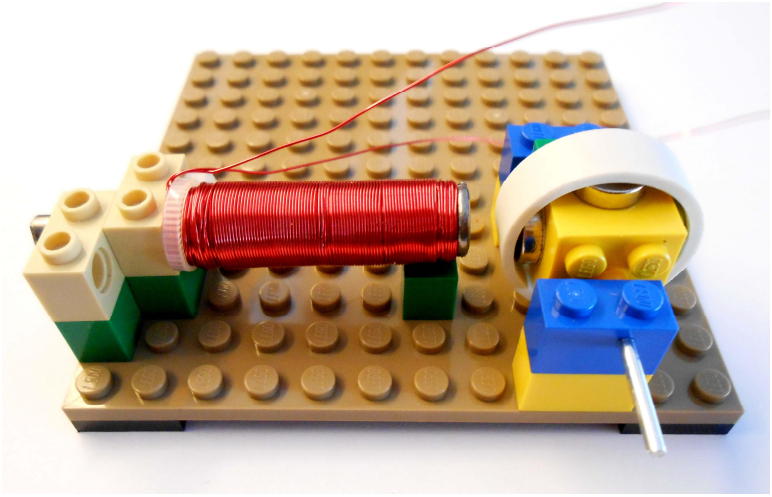


We strongly recommend lubricating the shaft ends where they contact blue bricks. It allows the motor to run smoother and faster. You may use a drop of oil from your car dipstick, WD-40, or even vegetable oil.

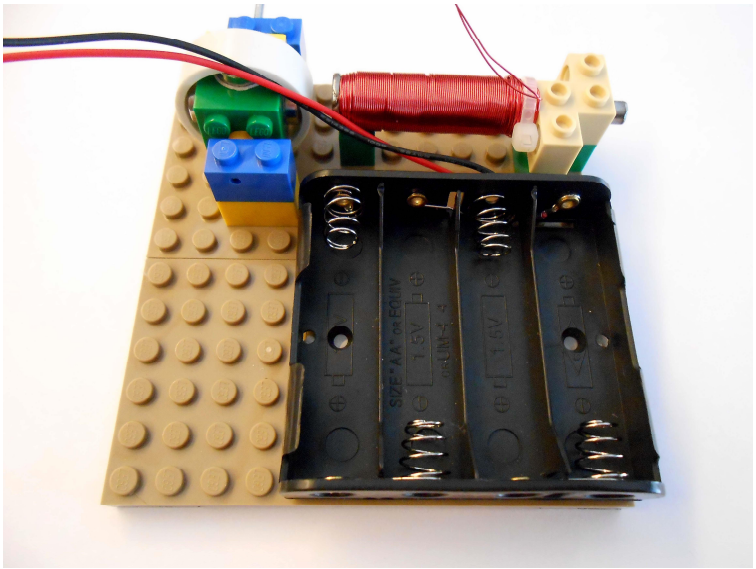
8. Remove the insulation from the wire tips with fine sandpaper (included) or a sharp knife.



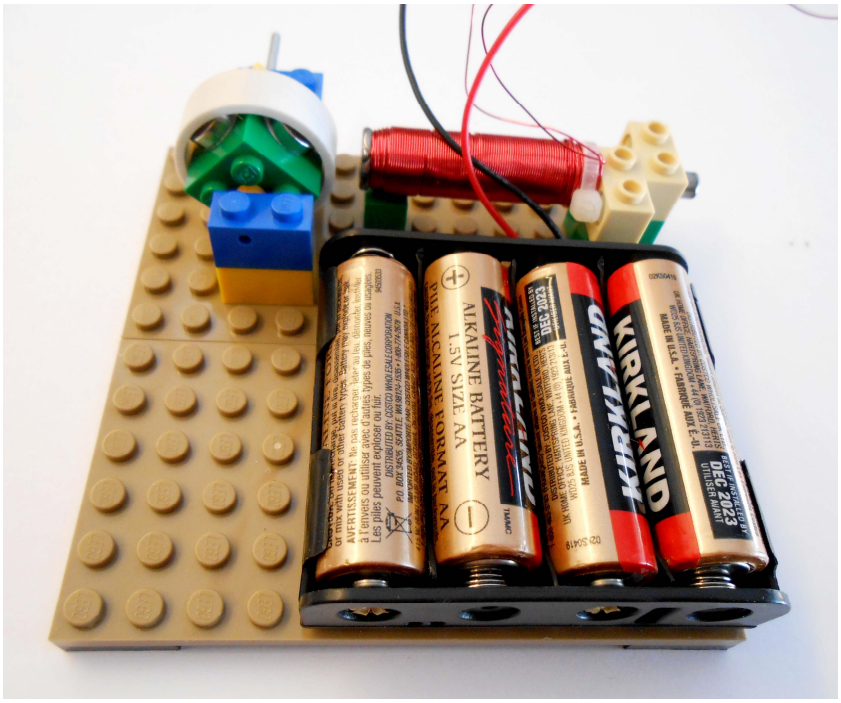
9. Assemble electromagnet on the base plate.



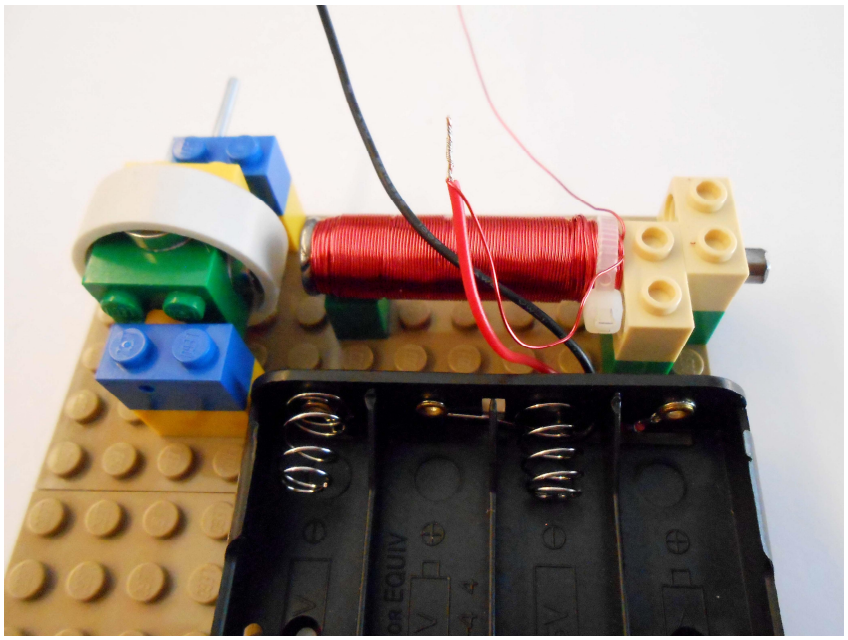
10. Attach the battery holder to the base plate.



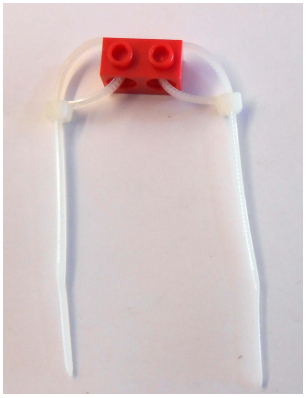
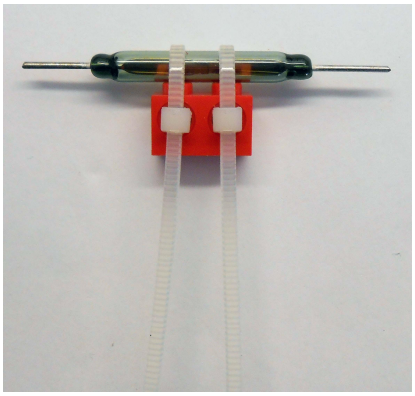
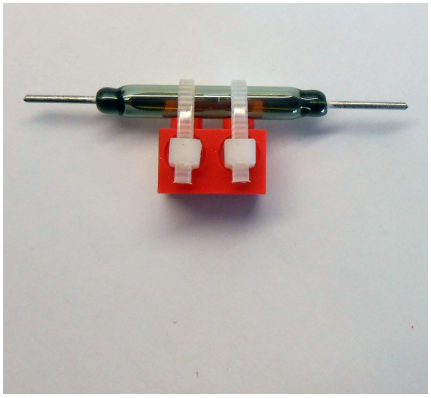
11. Insert the batteries and briefly connect electromagnet wires to the battery holder wires. If nothing happens switch the wires. With the correct connection electromagnet repels the permanent magnets and the rotor stops in the position below. This is a perfect test for the electromagnet and the magnets orientation: rotate rotor quarter turn four times – if all permanent magnets are oriented properly rotor should always stay in the position shown.



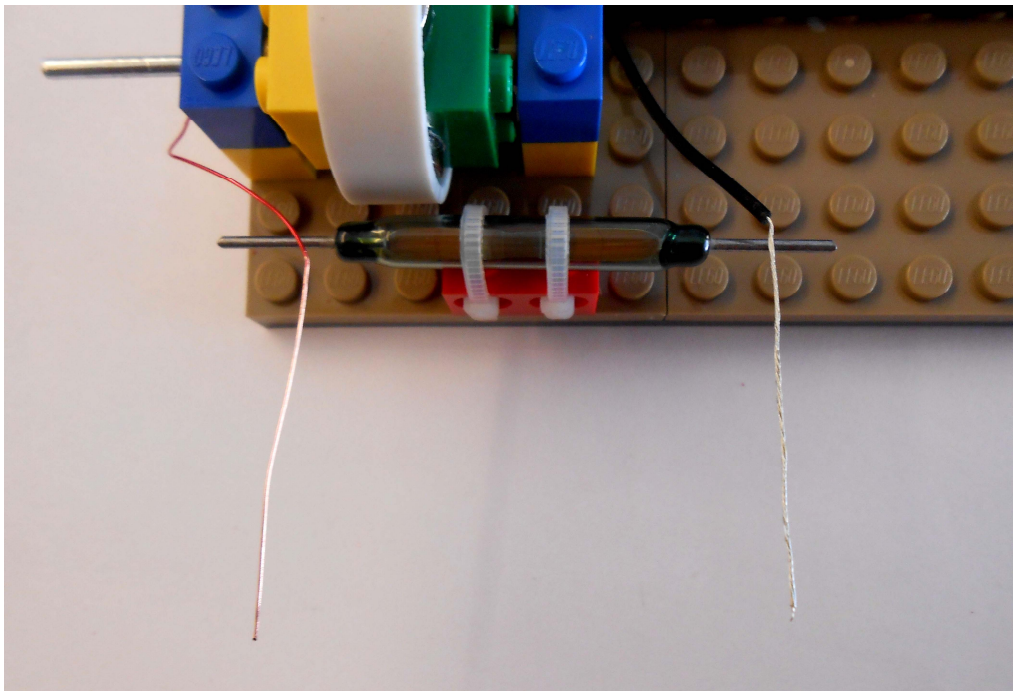
12. After you found the correct connection trim red (positive) wire from the battery holder and corresponding electromagnet wire. Remove the insulation from the wire tips and twist them together. You may tack this connection under the battery holder.



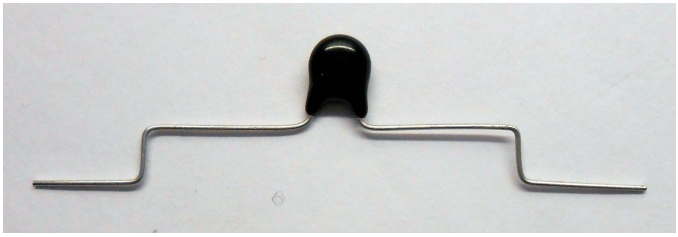
13. Fasten the reed switch to 1x2 brick with side holes using cable ties. Trim them with scissors.

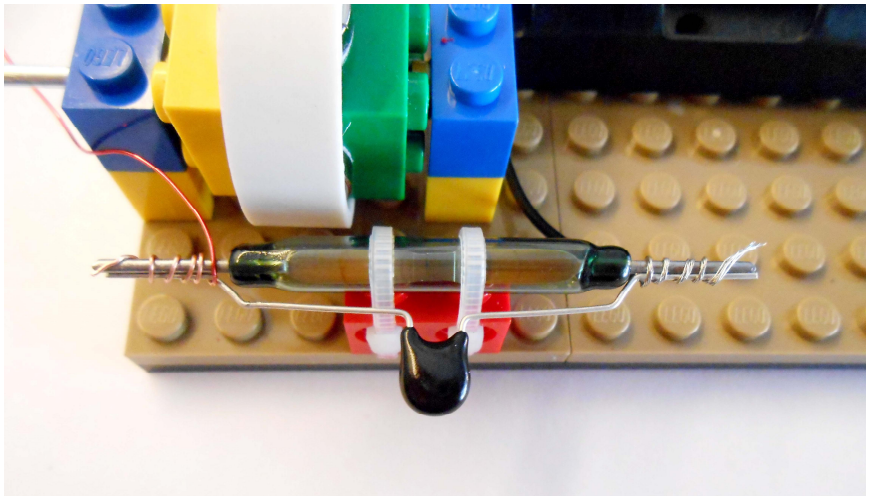
14. Assemble the reed switch on the base plate. Trim the wires as necessary and remove at least 1” (2.5 cm) of insulation.



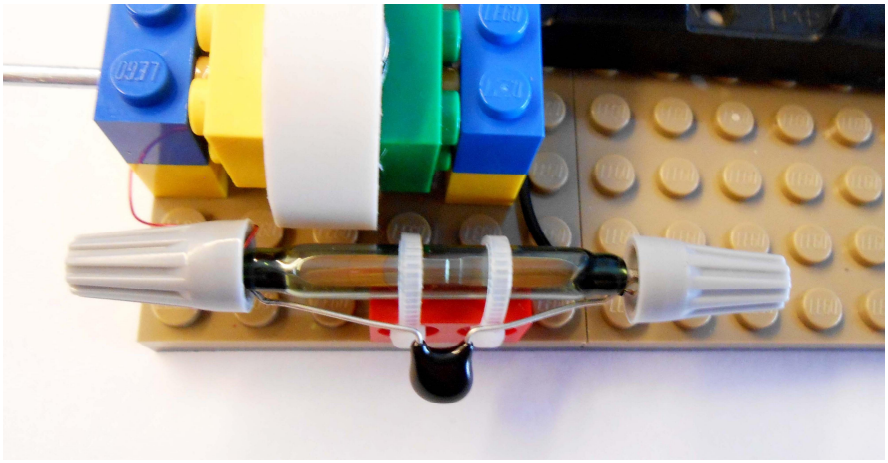
15. Form ZNR contacts as shown.



16. Wind bare wire ends tightly around the reed switch / ZNR contacts.

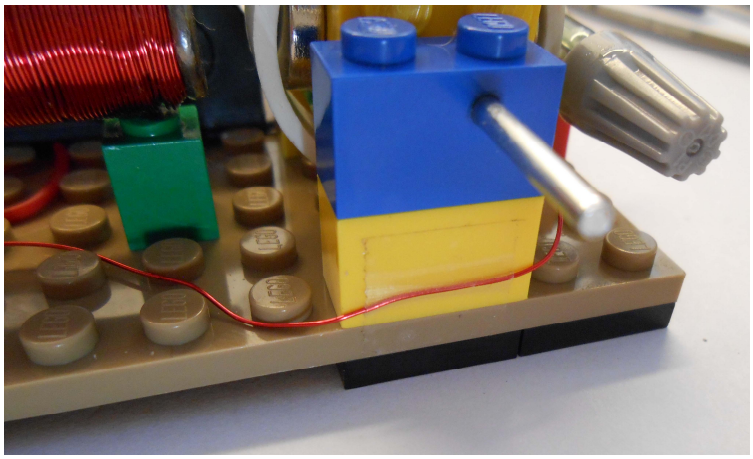


17. Screw twist-on connectors. Do not over tighten as you may break the reed switch!



18. You may tape the electromagnet wire that is connected to the reed switch to the side of the rotor stand (clear tape is shown). Make sure the tape is below the axle hole.

    If you plan to add a generator from the generator kit to your motor you also need to add 1x2 plate under the motor shaft.



Spin the rotor by hand. Make sure it does not hit the electromagnet, reed switch or wires. You should hear the click every time the magnet passes the reed switch.

Your motor is ready to check. It should work on 1, 2, 3, or 4 batteries. On one battery it may require a slight push if your electromagnet is not aligned with the motor axle or the permanent magnets are not perfectly centered on the rotor.

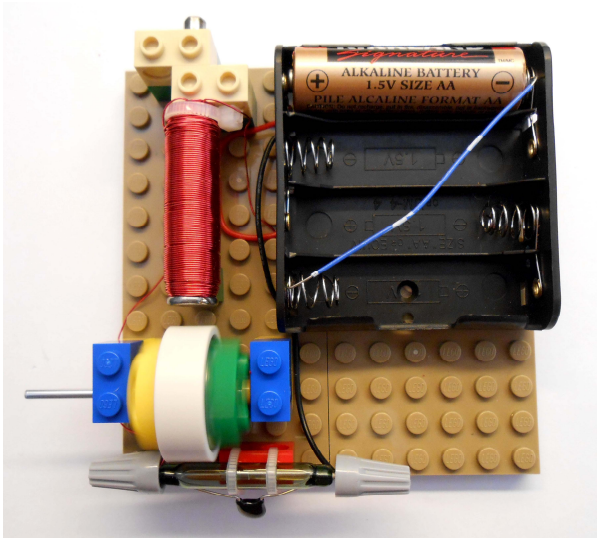
19. The included jumper wire allows you to experiment with 4 different voltage settings (1.5, 3, 4.5, and 6 V DC). You will need 4 AA size batteries.

    Insert bare ends of the jumper wire between the spring and plastic case to make a good contact and hold them in place.

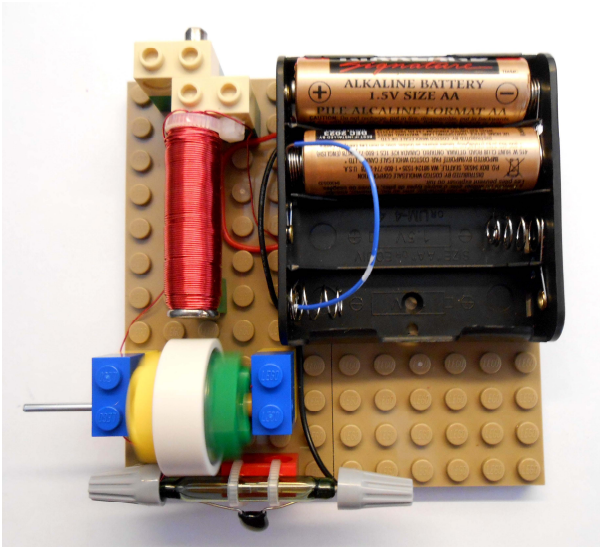
    The following pictures show typical usage of the jumper wire for 1, 2, or 3 batteries.

    Please note that some battery holders may have different connections inside. If your battery holder design is different you can still use the jumper wire in the same manner to get all 4 voltages, but you need to find appropriate connection points for each voltage setting.

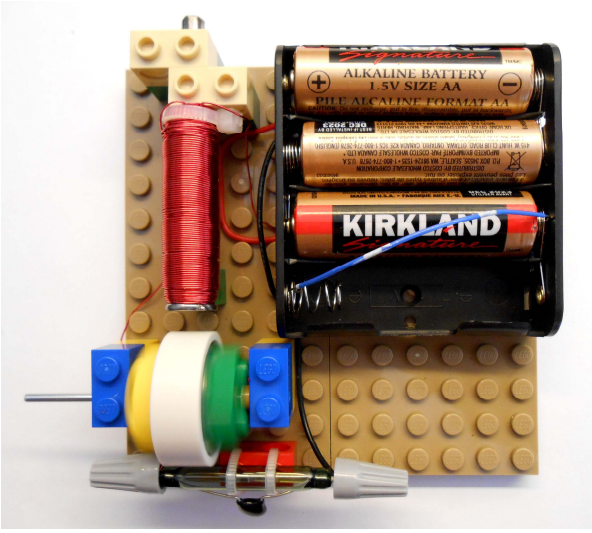
    1.5 Volts:



    3 Volts:

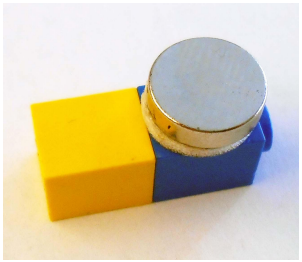


4.5 Volts:



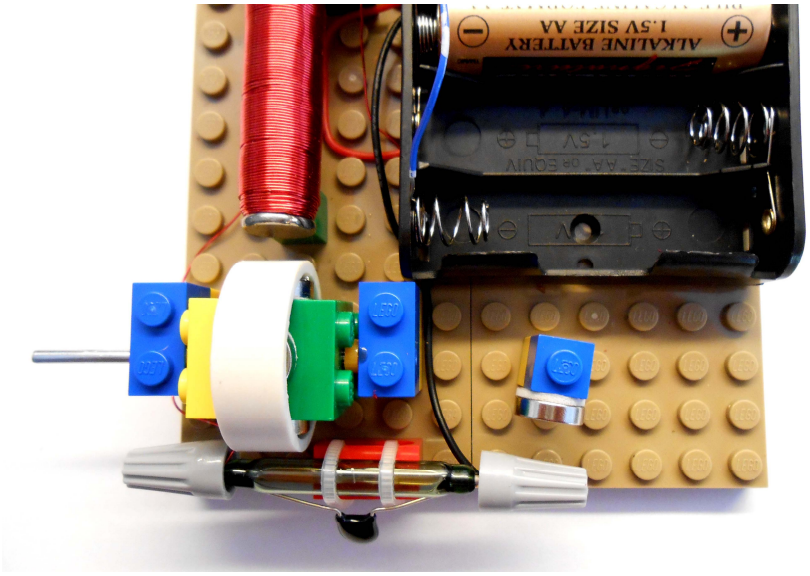
20. You may add speed control knob that allows changing the speed of the motor from maximum to full stop. It may also significantly increase the rotational speed.

    Attach the magnet as shown. Make sure the pole facing outwards is the same as on the rotor magnets.

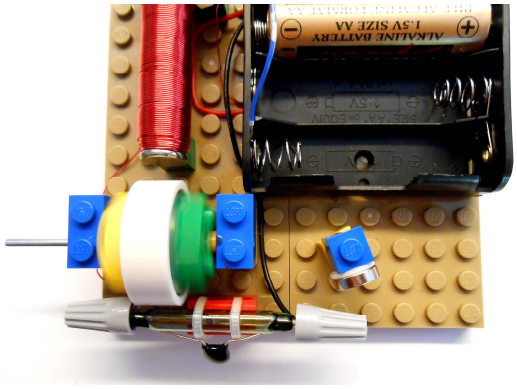


21. Speed control knob should be located as shown below and it provides the following speed changes (positions are approximate, experiment with it yourself).

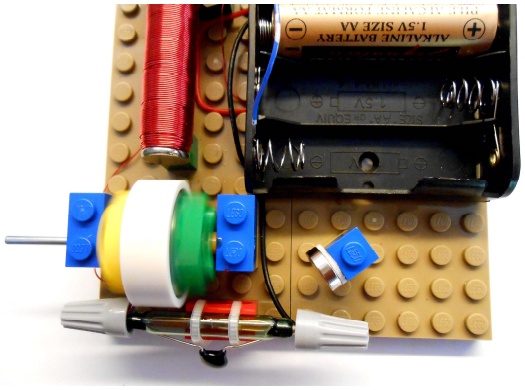
    Full stop:



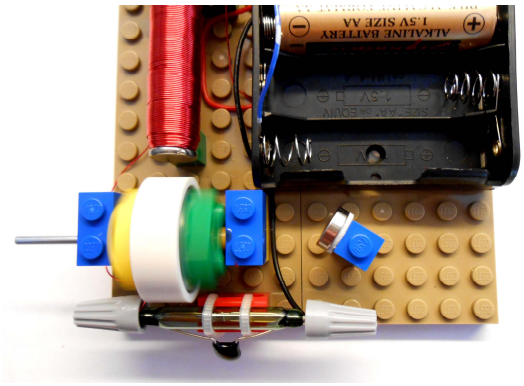
Slow speed:



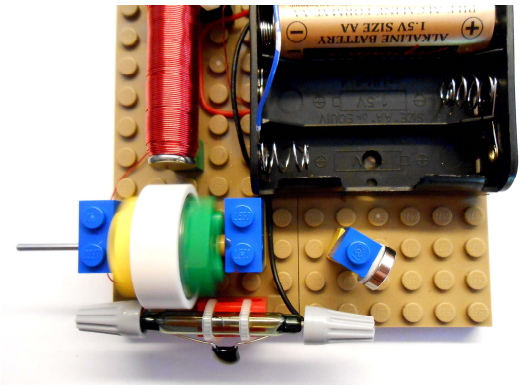
or



Maximum speed (may be even faster than without speed control knob):



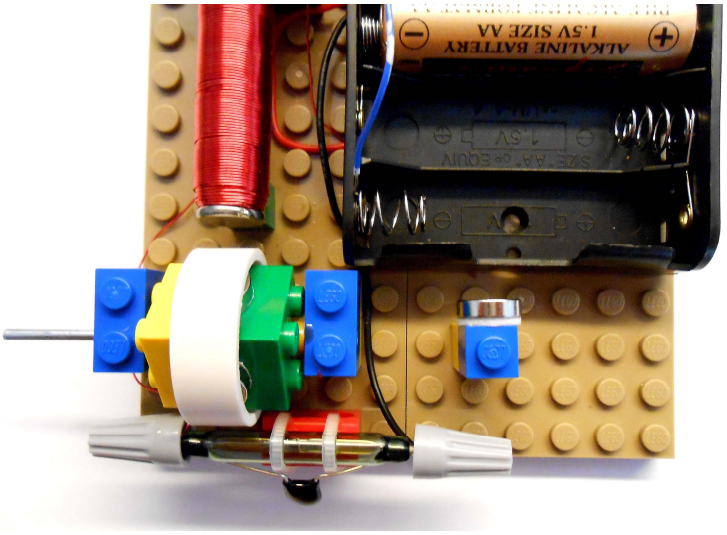
or



Speed control magnet counteracts with the magnets on the rotor (that is why it is important to have the same pole to face a reed switch). It changes the gap between the reed switch contacts.

The phenomenon of increasing the speed is based on making the gap smaller allowing the reed switch to work faster.

Warning! The motor may also stop when the speed control knob is in this position:



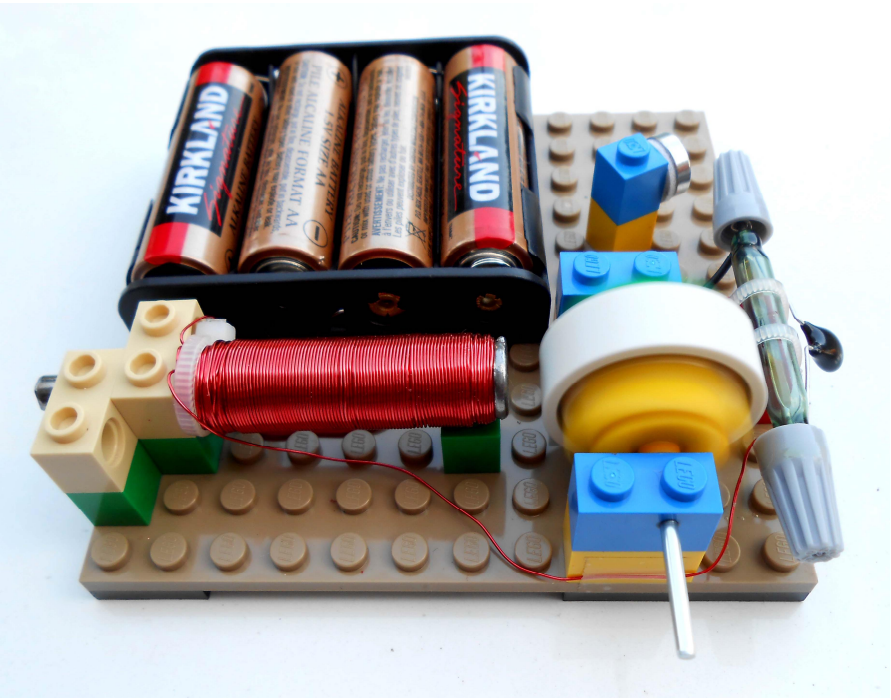
Under no circumstances leave the motor in this position, even for a short time! The motor looks like it is in a complete stop but in reality there is a big current going through the circuit (it may exceed 1 A on 4 batteries). This current will quickly deplete the batteries and can overheat and destroy the electromagnet and the reed switch.

In other words using the speed control knob as a switch is possible only if you stop the motor as shown in the first picture. Removing one of the batteries might be a better option.

You may glue bricks together and to the base plate if you do not plan to disassemble it. Do not glue the speed control knob!

Visit our site at www.simplemotor.com for principles of this motor operation, troubleshooting, speed measurement and other experiments.

Enjoy your motor! We hope you had fun building it.



---

* Colors of the parts may vary.