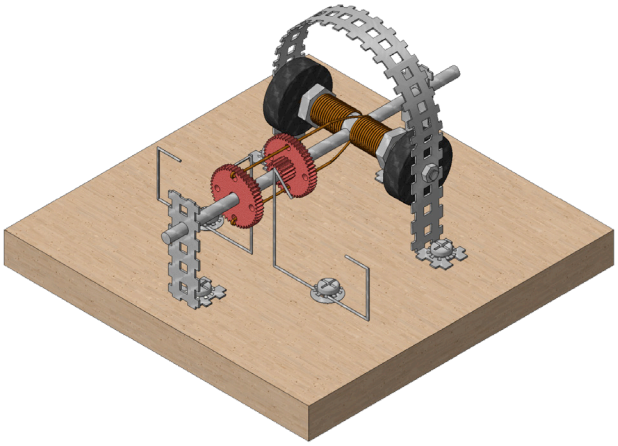
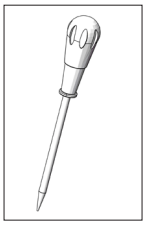
116.301

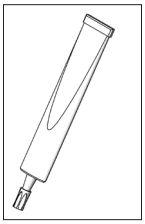
Electric Motor Easy

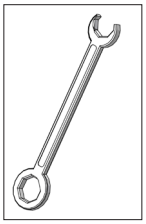
Attention, copper wire changed, correct wire is temporarily enclosed in the shipping carton! (247.191)

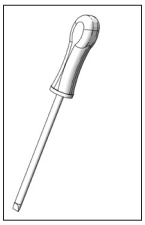


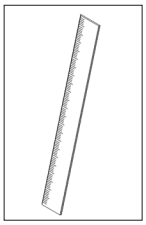
Tools required:

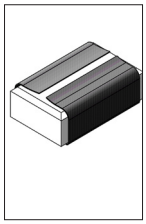

Pricking awl

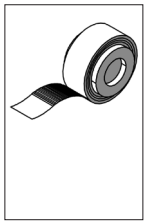

superglue

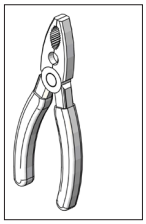

wrench

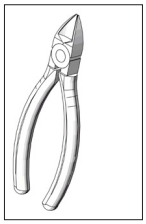

slotted screwdriver

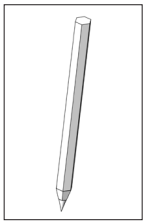

ruler

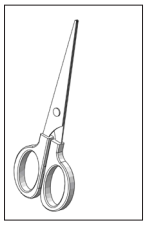

grinding paper

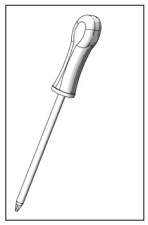

cellotape

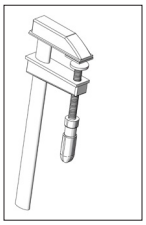

comb pliers


side cutter


pencil


scissors


Philips screwdriver

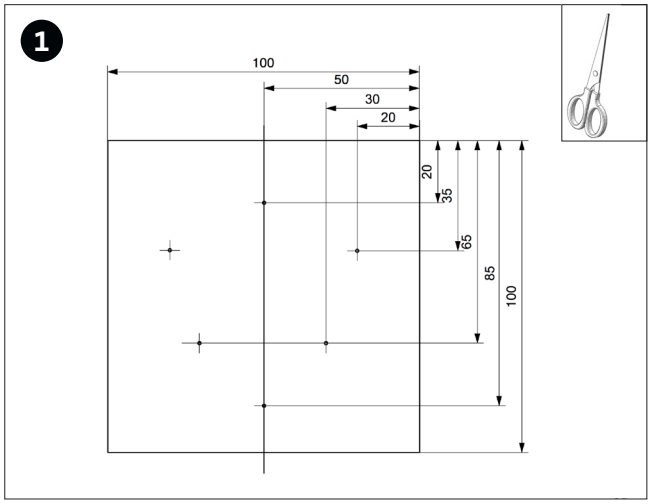

clamp

drill bit

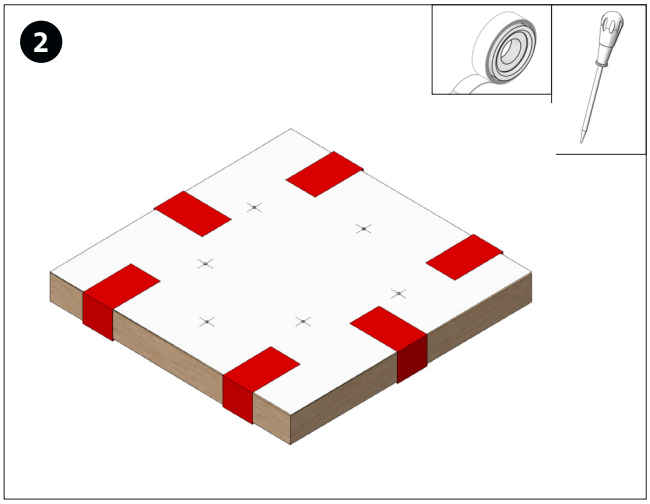
Please note:
The OPITEC handicraft packs are not toys in a typical off-the-shelf sense, but rather additional teaching and learning material for educational purposes. This craft pack may only be constructed by children and adolescents under the guidance and supervision of experienced adults.
Not suitable for children under 36 months. Choking hazard!

Stocklist	Qty	Size (mm)	Description	Part-Nr.
MDF-Board	1	100x100x10	Baseplate	1
Square Hole Sheet	2	150x10x0,5	Storage	2
Double Gearwheel	2	30/10 - ø2,9	Gear	3
Metal Axis	1	95x3	Axis	4
Ring Magnet	2	ø18xø5,5	Magnet	5
Hexagonal Screw with bore	1		Screw	6
String Wire	1	0,25	Contact	7
~~Copper Coated Wire~~	~~1~~	~~240x0,6~~	~~Coil~~	~~8~~
Serrated Washer	6	M4	Mounting	9
Washer	2	9/4,3	Mounting	10
Nut	2	M3	Mounting	11
Thread Screw	2	16x3	Mounting	12
Tapping Screw	6		Mounting	13
Beech Wood Wheel	1	40/10	Bending Aid	14
Copper Coated Wire	1	400 x 0,5	Coil	8

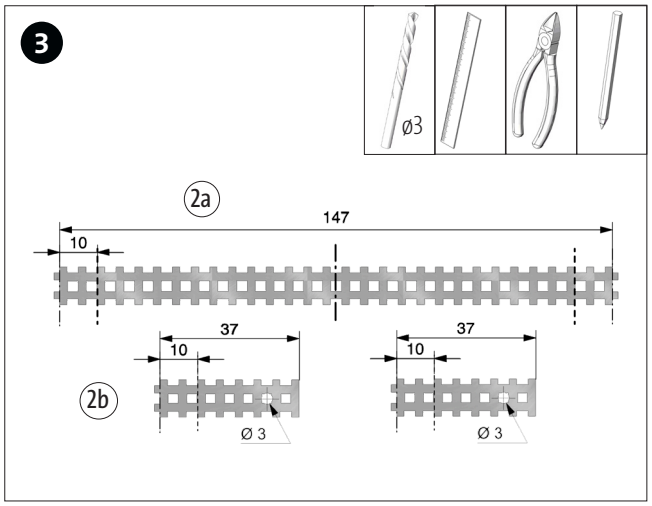
OPITEC



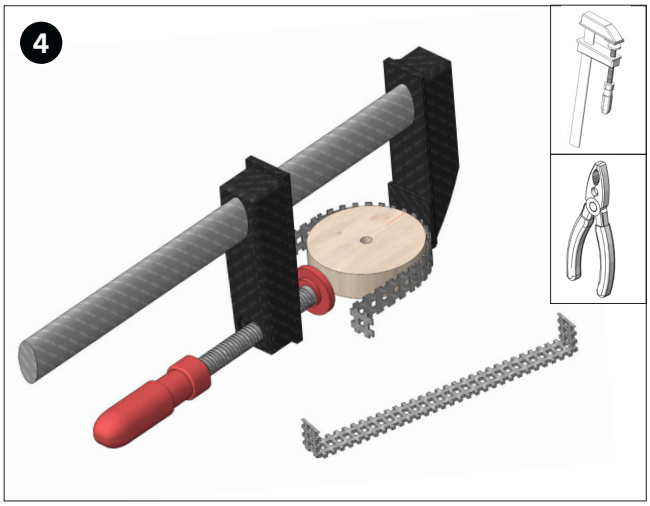
Cut out the template (page 3) for the baseplate.



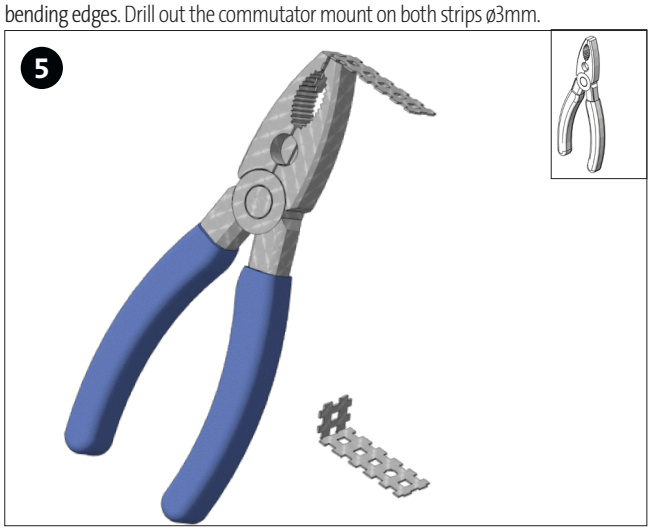
Affix the template onto the baseplate and mark the screw locations with the pricking awl.



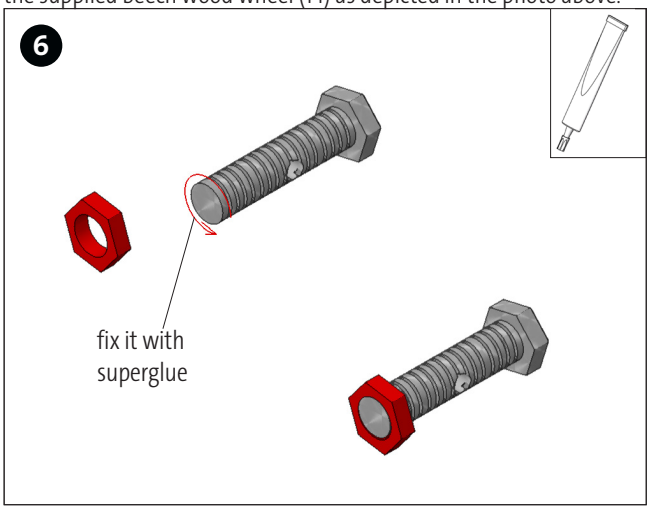
Cut one perforated metal strip (2a) to 147 mm of length and mark the bending edge at either end. Cut off two 37 mm pieces from the second strip (2b) and mark the bending edges. Drill out the commutator mount on both strips ø3mm.



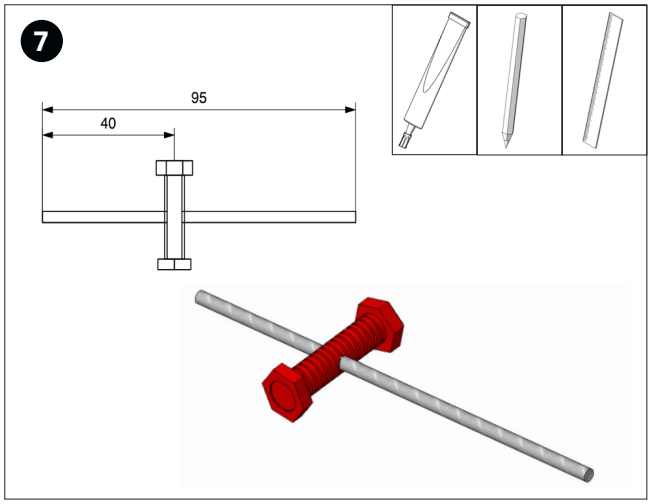
Use the comb pliers to bend the ends of the perforated metal strips (2a) in a 90 degrees angle. Afterwards bend the strip evenly around the supplied beech wood wheel (14) as depicted in the photo above.



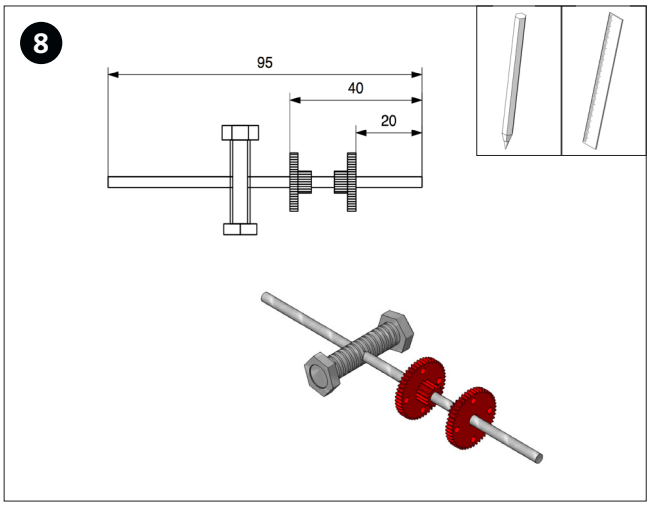
Bend both perforated metal strips (2b), to a 90 degree angle with the comb pliers as depicted.



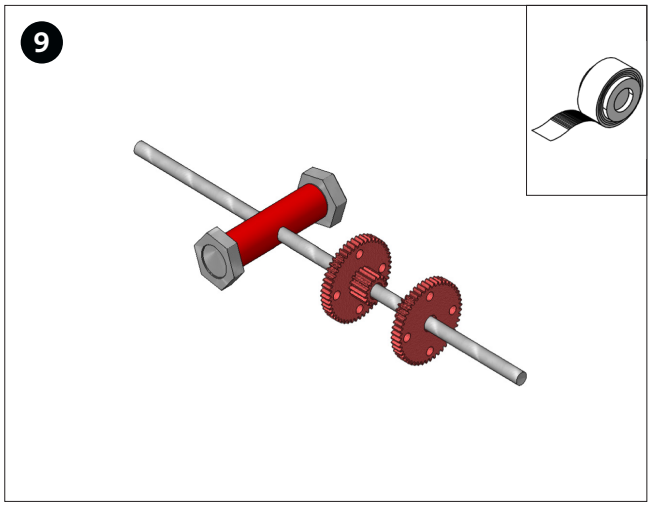
Screw the nut on to the threaded screw und fix it with superglue.



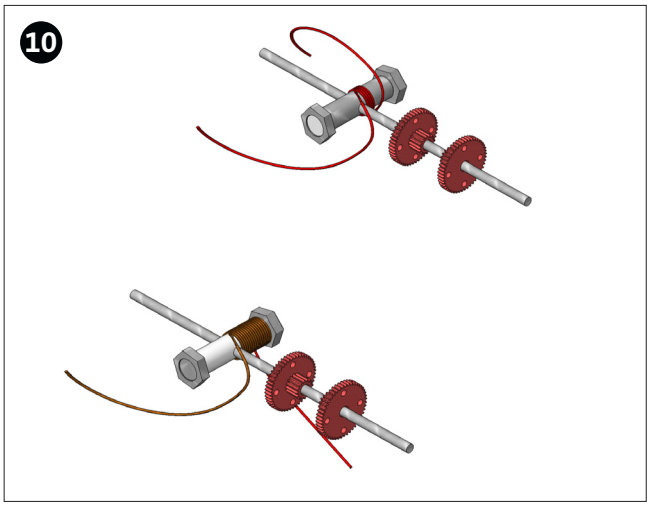
Measure and mark 40 mm off the metal axis. Fix the threaded screw with superglue at that position.



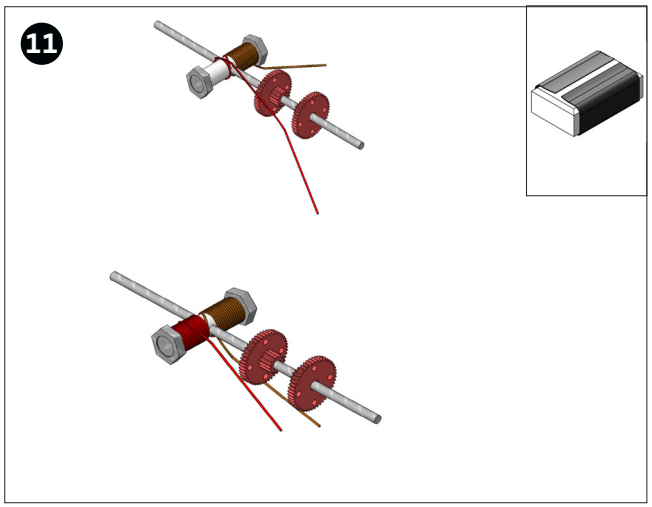
Transfer the measures onto the axis (4) and position the cogwheels (3) at the marks.



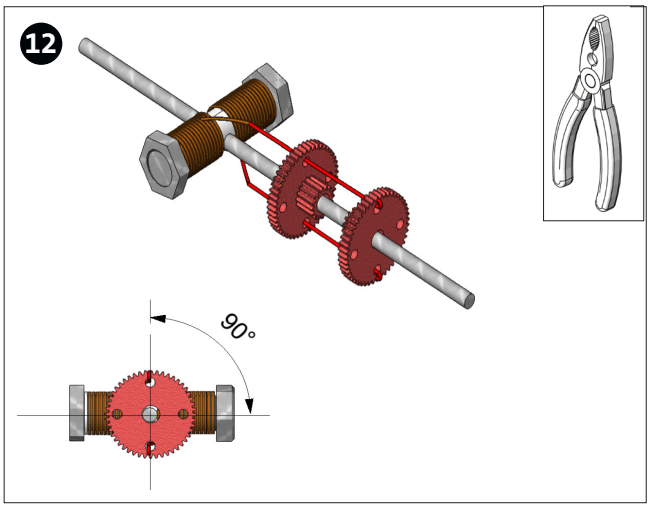
Mask off the screw thread with cello or electrical tape



Wind the cooper coated wire (8) around the taped screw thread. Start with the middle of the wire in the middle of the screw thread and wind it around one side first until about 40 mm are still protruding. (corresponds to approx. 75 windings on each side)



Now do the second side in the same manner. Finally, isolate both protruding wire ends with sand paper.



Thread the wire ends as depicted through the cogwheel's bores. Bend the ends in order to fasten the construction. Pay attention to the 90 degree alignment of the coil and the collector.

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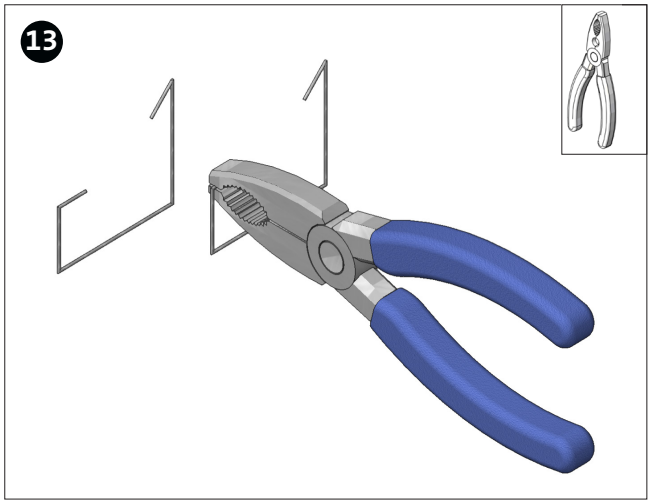
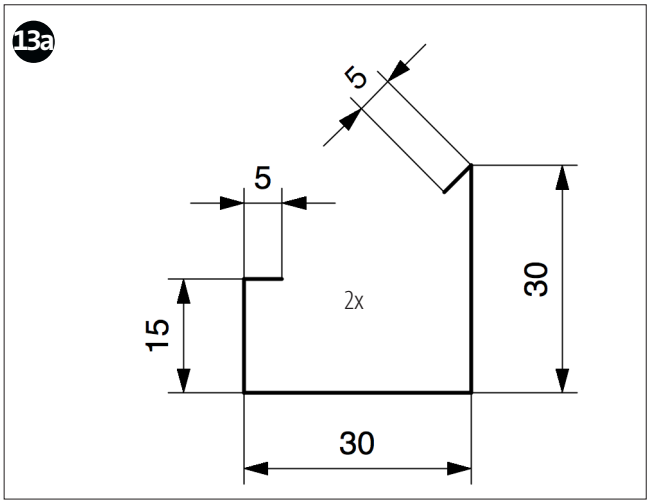
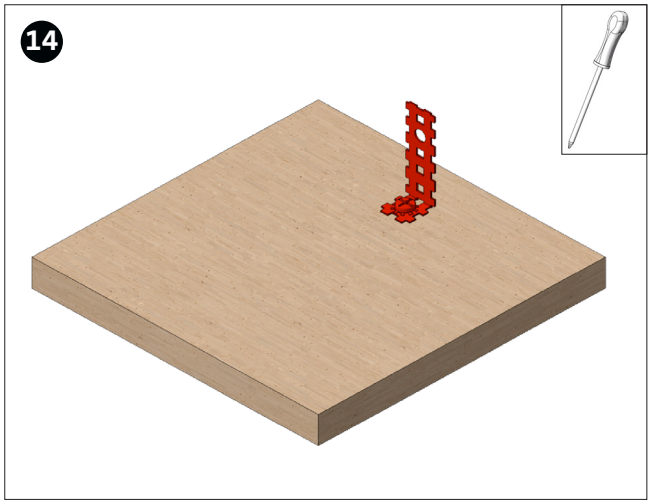


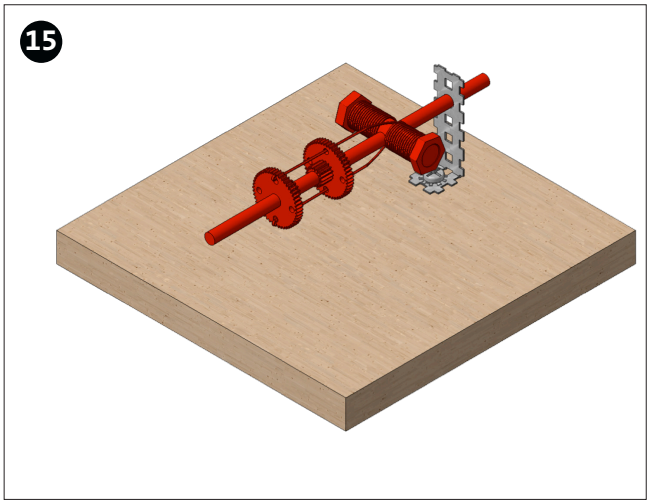
Bend the spring steel wire with the comb pliers according to the template (figure 13a). Establish both sliding contacts.



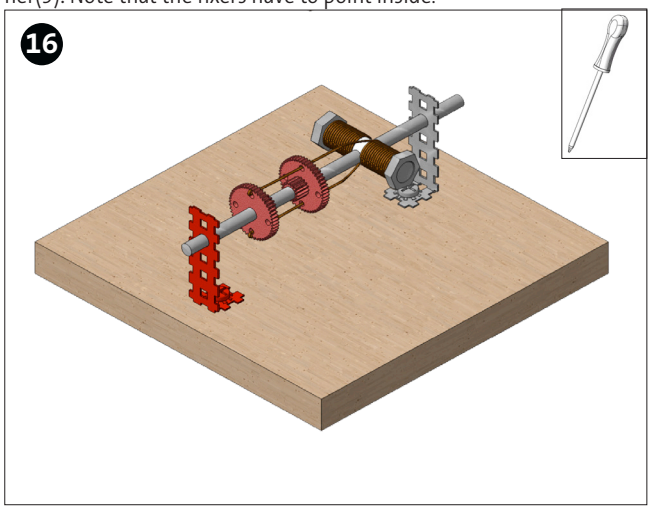
Bending template for spring steel wire M 1:1



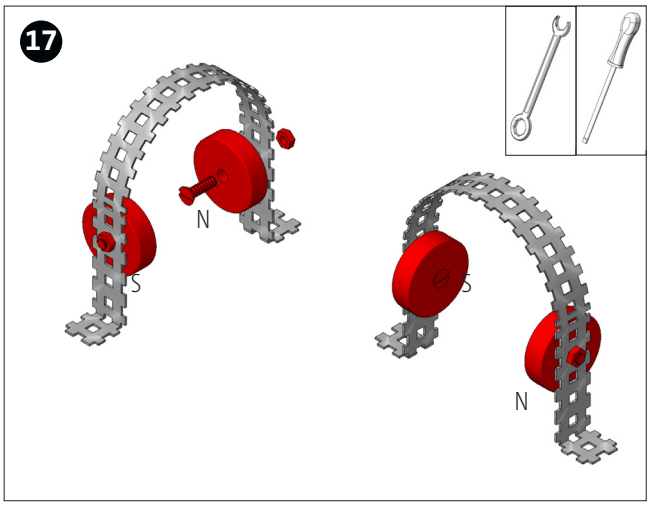
Mount the first perforated strip (2b) as depicted on to the marked bore of the bearing block (cf. step 2) using a screw (13) and a washer(9). Note that the fixers have to point inside.



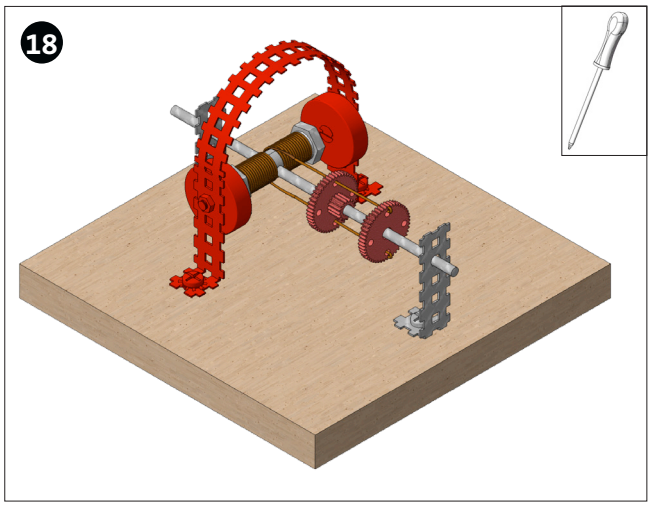
Stick the commutator to the bearing block (2b) as depicted.



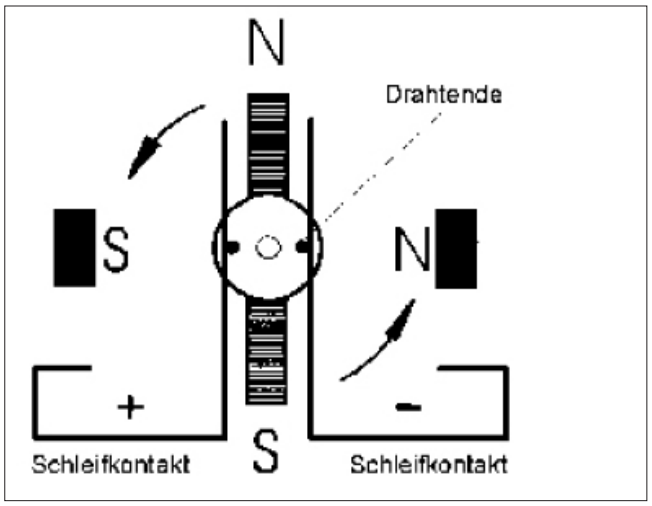
Now mount the second perforated wire (cf. 14). Check the rotor for ease of movement, otherwise carefully drill out the openings with a drill bit 3mm.

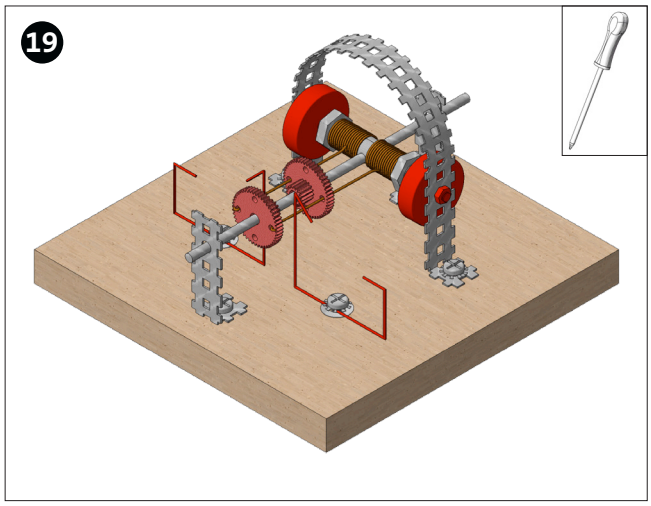


Fix the magnets with nuts (11) and bolts (12) to the bow. Pay attention to the correct polarity while fixing.



Screw the bow with the attached magnets as depicted on to the pre-punched bore (cf. step 2) using two screws (13) and two washers.





Affix the hoop as depicted by using the washers (10), serrated washers (9) and screws (13). It is important that the hoops have only light contact with the chopper wire.

How does an electric motor actually work?
Please take notice of the drawing beneath.

Keep in mind:
Like poles repel each other while unlike poles attract one another! While the two permanent magnets are constantly magnetic, electromagnets can be disconnected. If the polarity of the minus and plus pole is exachanged, the electromotor even changes its poles in other words, a north pole becomes a south pole and vice versa. An iron core can amplify the magnetic force of a coil.

Thus, if current flows through the coil, the core turns magnetic. His poles are attracted by the poles of the permanent magnet. Since the collector is turning around as well, each wire end of the coil gets in contact with the sliding contacts. As the current is now flowing reversely through the coil, the poles inside the coil also reverse The iron core is now repelled by the permanent magnets. The repelling and attracting of the iron core leads to a permanent rotation.

Positioning the collector
A schematic figure of the cross between the coil and the imagined line between the wire's ends/ 1mm bore.

Template Base
M 1:1