

TOY „TRACTOR” BUILDING MANUAL

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Instructions for building a toy tractor from 3mm and 6mm plywood.

In the manual, I describe how to build the toy 'Ursus 385 Tractor', which I made for my grandson. This project and others I made, with SVG files, are available on the website <https://github.com/ZET-System/ZET-Toy-Tractor>.

I placed the instructional video on the website <https://www.youtube.com/channel/UCpifb5z4qqLqFVbfuf9QIlg>.

Other projects I have made (a trailer for the tractor, a remote-controlled fire ladder, a remote-controlled crane, and many others) will be placed in the same place on GitHub.

I am happy to help people who have doubts about how to build this or that toy. Please send your questions to the email address: zbigniew.wlodarczyk@hotmail.com.

I have a request to be careful while playing in your workshops and to read the whole manual before assembly. The toy is called Ursus 385, but because of many simplifications, it is not a model, only inspired by it.

Introduction

Before we start playing with the toy assembly, some general notes.

The parts needed to build the toy are in the SVG folder, divided by the thickness of the plywood.

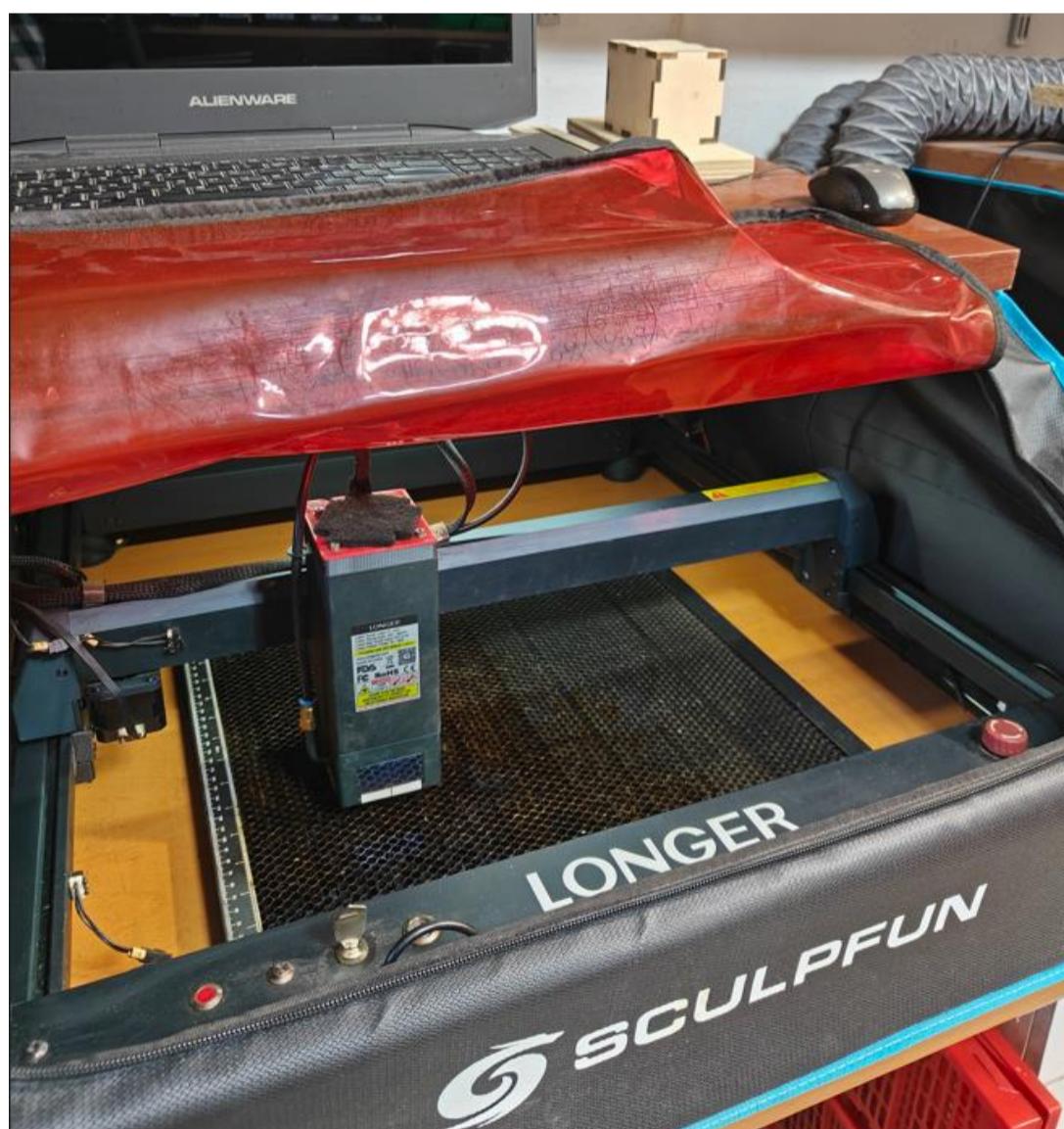
The parts should be cut on a laser cutter, placed on the available sheets of plywood. My models are made on A4 plywood sheets.

I provide ready projects for cutting with the LightBurn program. You can also use another program, for example, LaserGRBL.

To optimally arrange the pieces on the plywood sheet (nesting), I use a program integrated with LightBurn (<https://svgnest.com/>).

The presented toy is intended for small children, so the construction was supposed to be impact resistant, and for this reason I used mainly 6 mm plywood. If cutting 6 mm plywood on your equipment is difficult, you should set multiple passes or instead of one 6 mm format, use two 3 mm formats.

Cutting parameters depend on the equipment you have. I mainly use the Longer 40W laser, on which for 3 mm thickness I set the speed to 600 mm per minute and for 6 mm plywood I set the speed to 300 mm per minute (Rysunek 1).



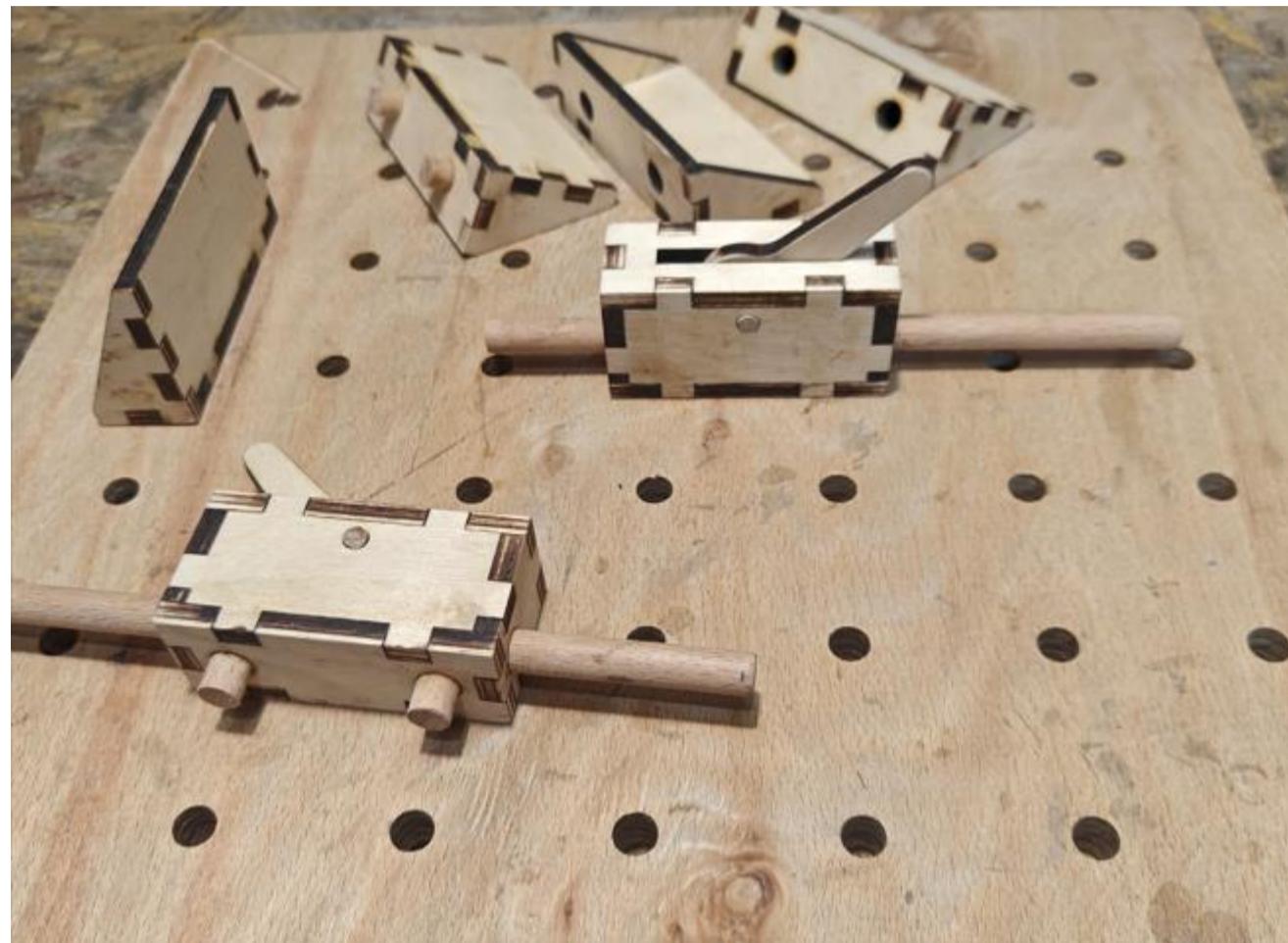
Rysunek 1 Station for cutting out plywood elements.

Due to the large amounts of smoke emitted during cutting, I use a Sculpfun tent connected to a ventilation channel supported by an axial fan. There are two fans in the system. The first at the tent outlet and the second at the outlet to the chimney.

I cut the elements on a 400 x 400 mm honeycomb table. Since burning plywood involves the release of tar substances created by burning the glue used to produce plywood, I regularly wash the table and base in an engine cleaner (K2 Akra). As a tub I use a plastic container measuring 55x50x11 cm, originally intended for bathing pigeons (😊). I use the detergent multiple times, storing it in a plastic container between baths.

I have observed that too much deposits ignite from the hot laser, even causing micro-explosions that can move the table. This means that the table and base need to be washed quite often.

When gluing, I use a special table with holes in which I attach supports. The table makes it easier to glue elements at right angles (Rysunek 2).



Rysunek 2 Assembly table

After cutting out all the elements, I sand them on both sides with fine sandpaper (I usually use 60-grit sandpaper for sanding large allowances and 180 and 240 for rough and final sanding).

I sand the slanted surfaces on a sander with adjustable speed and adjustable table angle. Using a sander is not required, of course, but it makes the work easier. (Rysunek 3).



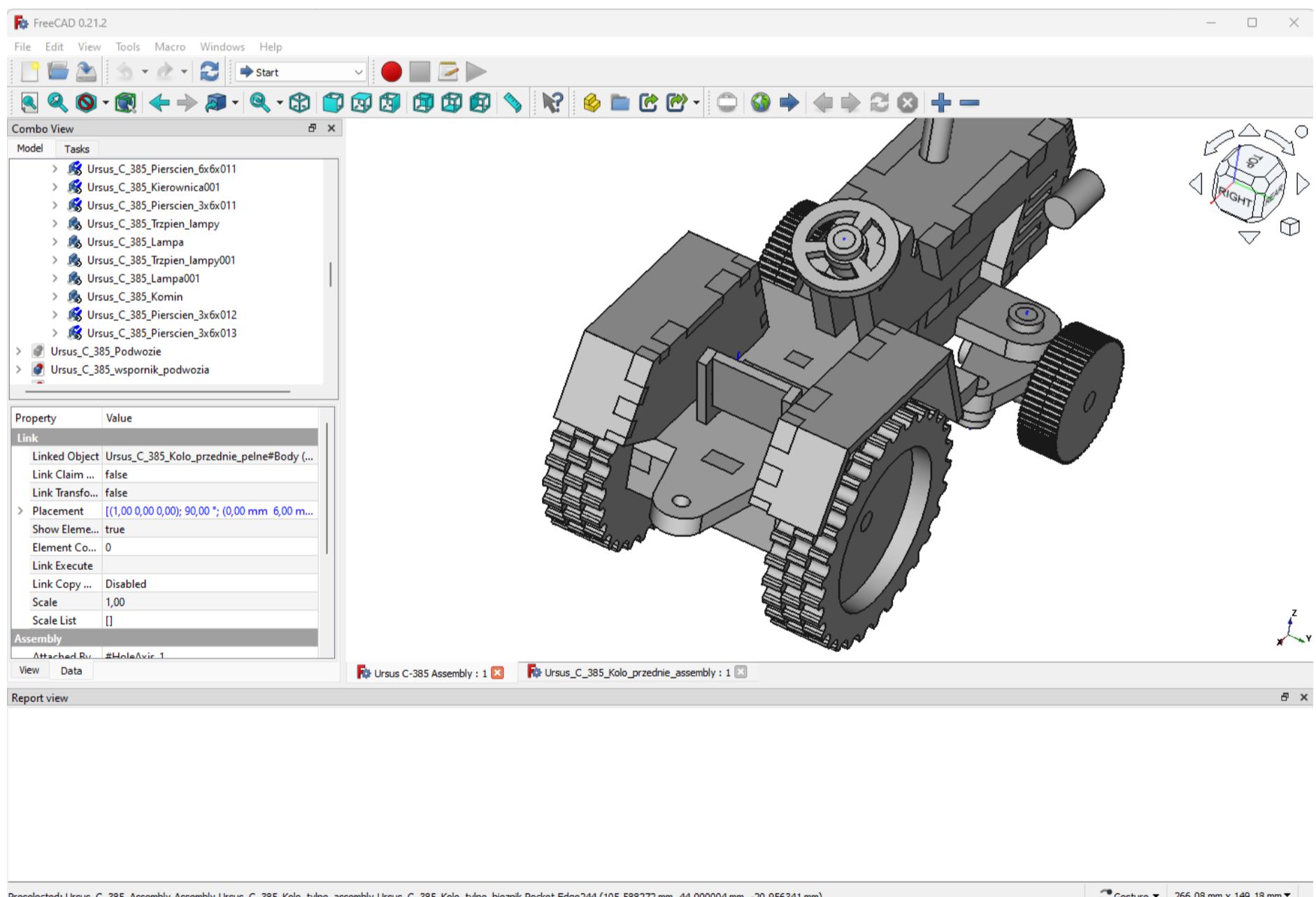
Rysunek 3 Grinder with adjustable table

In addition to the cut-out elements, you will also need wood glue (preferably quick-drying), sheets of fine sandpaper (e.g. 180), a paper towel, sticks or a brush for applying the glue, a lot of willingness and patience (Rysunek 4).



Rysunek 4 Materials needed to assemble the toy

I prepare my construction designs in FreeCAD (I use Assembly 4 to assemble the elements). The pictures in the manual also come from FreeCAD (Rysunek 5).

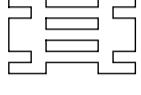
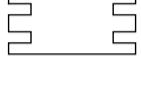
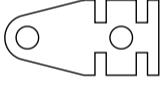


Rysunek 5 Program FreeCAD

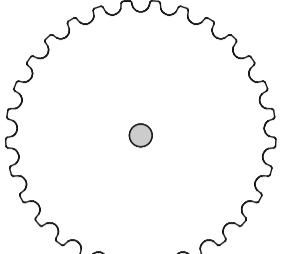
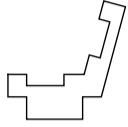
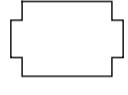
List of items

In the table I present all the elements from which the toy will be glued. I have included a sample drawing, the name of the SVG file and a description, information about the number of elements needed, the thickness of the plywood from which I cut the elements and the number that I use in the rest of the instructions.

Drawing	File name/Part name	Quantity	Plywood thickness	Number
	Ursus_C_385_Podwozie.svg	1	6	1
	Chassis			
	Ursus_C_385_Wspornik_podwozia-x2.svg	2	6	2
	Chassis support			
	Ursus_C_385_Silnik_bok-x2.svg	2	6	3
	Engine side			
	Ursus_C_385_Silnik_gora.svg	1	6	4
	Top of the engine			
	Ursus_C_385_Pulpit_kierownicy.svg	1	6	5
	Steering wheel panel			
	Ursus_C_385_Pokrywa_silnika_bok-x2.svg	2	6	6
	Engine cover side			
	Ursus_C_385_Pokrywa_silnika_gora.svg	1	6	7

	Top of engine cover			
	Ursus_C_385_Pokrywa_sinika_przod_dol.svg	1	3	8
	Lower part of the front part of the engine cover			
	Ursus_C_385_Pokrywa_sinika_przod_gora.svg	1	3	9
	Upper part of the front part of the engine cover			
	Ursus_C_385_Mechanizm_przednich_kol_wspornik.svg	1	6	10
	Front wheel system support beam			
	Ursus_C_385_Mechanizm_przednich_kol_prowadnica-x2.svg	2	6	11
	Front wheel tilt guide			
	Ursus_C_385_Mechanizm_przednich_kol_podpora_walka-x4.svg	4	6	12
	Front wheel axle support			
	Ursus_C_385_Mechanizm_przednich_kol_lacznik.svg	1	3	13
	Front wheel swing guide connector			
	Ursus_C_385_Blotnik_tyl-x2.svg	2	6	14

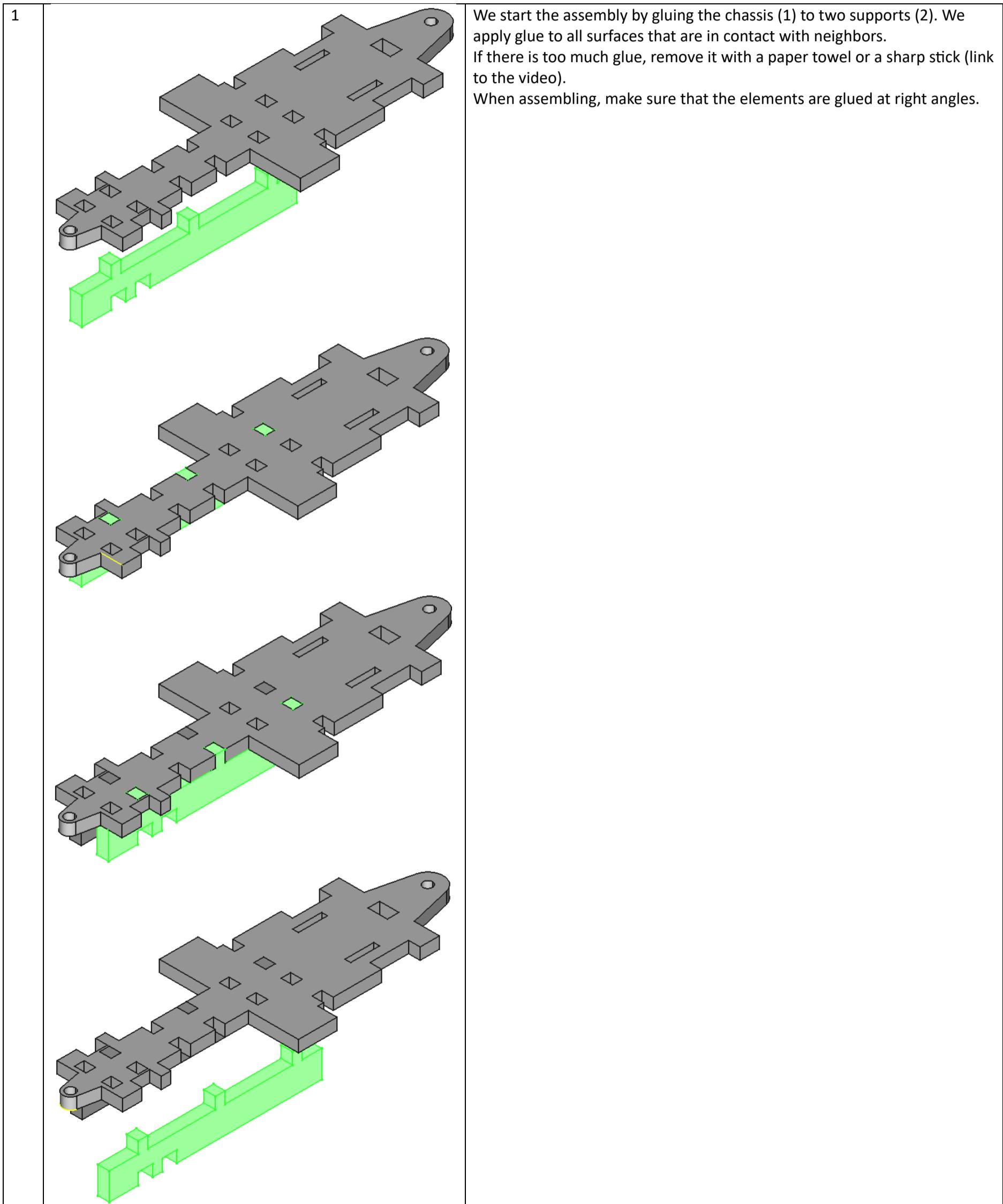
	Rear fender support frame			
	Ursus_C_385_Podwozie_tyl.svg	1	6	15
	Rear underbody cover			
	Ursus_C_385_Blotnik_tylny_LG-x2.svg	2	3	16
	The top of the fender			
	Ursus_C_385_Blotnik_tylny_LP-x2.svg	2	3	17
	Front part of the fender			
	Ursus_C_385_Blotnik_tylny_LT-x2.svg	2	3	18
	Rear part of the fender			
	Ursus_C_385_Kolo_przednie_pelne-x4.svg	4	6	19
	Front wheel			
	Ursus_C_385_Kolo_tylne_bieznik-x2.svg	2	6	20
	Outer part of rear wheel			
	Ursus_C_385_Kolo_tylne-x4.svg	4	6	21

	Wewnętrzna część koła tylnego			
	Ursus_C_385_Krzeselko_bok-x2.svg	2	3	22
	Driver's seat side			
	Ursus_C_385_Krzeselko_oparcie-x2.svg	2	3	23
	Seat and backrest of the chair			
	Ursus_C_385_Kierownica.svg	1	3	24
	Steering wheel			
	Ursus_C_385_Pierscien_3x6x9-x5.svg	5	3	25
	Locking ring - thin			
	Ursus_C_385_Pierscien_6x6x9-x3.svg	3	6	26
	Locking ring - thick			
	Steering wheel shaft: $\phi 6 \times 18$	1	$\phi 6$	27
	Shaft for front wheel: $\phi 6 \times 39$	2	$\phi 6$	28
	Shaft of rotation to the front wheel: $\phi 6 \times 15$	2	$\phi 6$	29
	Wheel Connector Shaft: $\phi 6 \times 12$	2	$\phi 6$	30
	Rear wheel shaft: $\phi 6 \times 76$	1	$\phi 6$	31
	Lamp: $\phi 10 \times 16$	2	$\phi 10$	32
	Chimney: $\phi 8 \times 45$	1	$\phi 8$	33

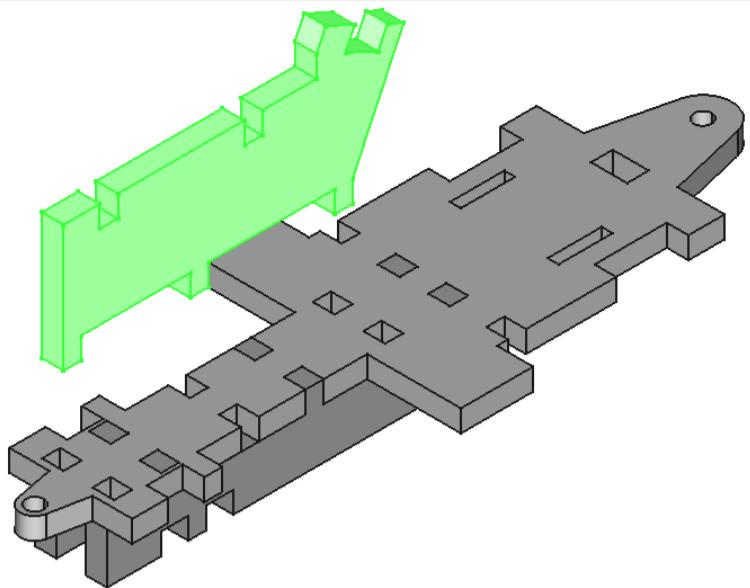
	Lamp holder: $\phi 3 \times 11$	2	$\phi 3$	34

You can use a $\phi 6$ diameter shaft to make all the shafts. However, this requires changing the diameter of the holes in the engine cover (the default is a $\phi 8$ shaft). Changing the lamp diameter does not require changing the design. It is enough to use a $\phi 6$ shaft instead of a $\phi 10$ shaft.

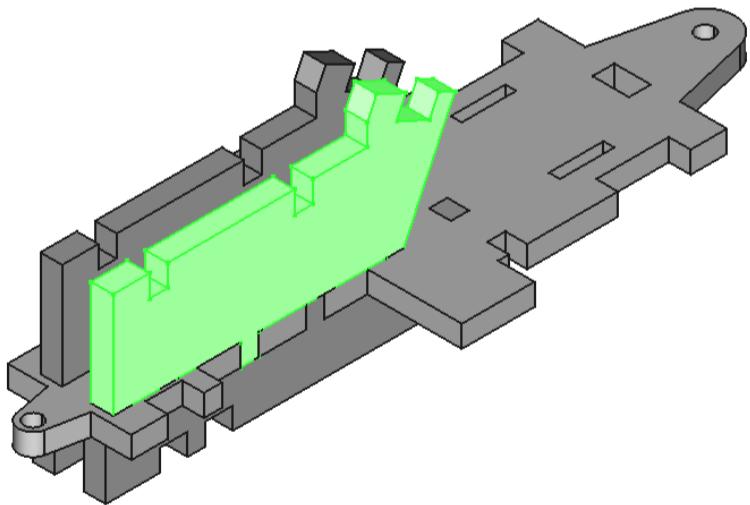
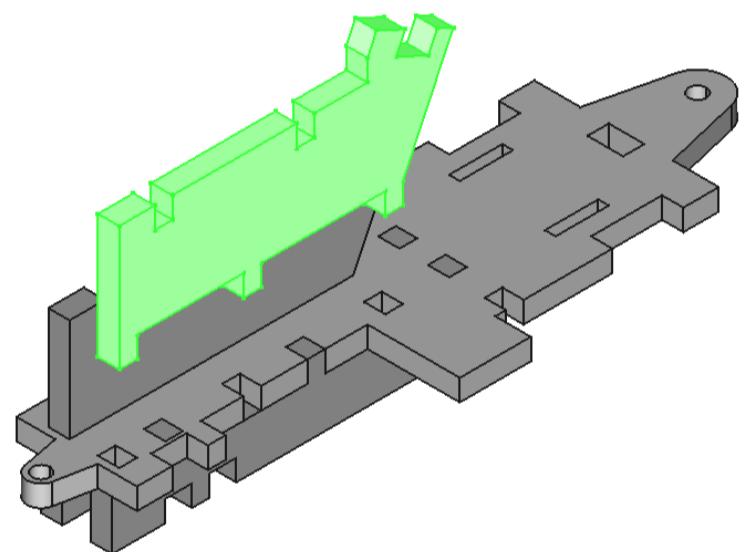
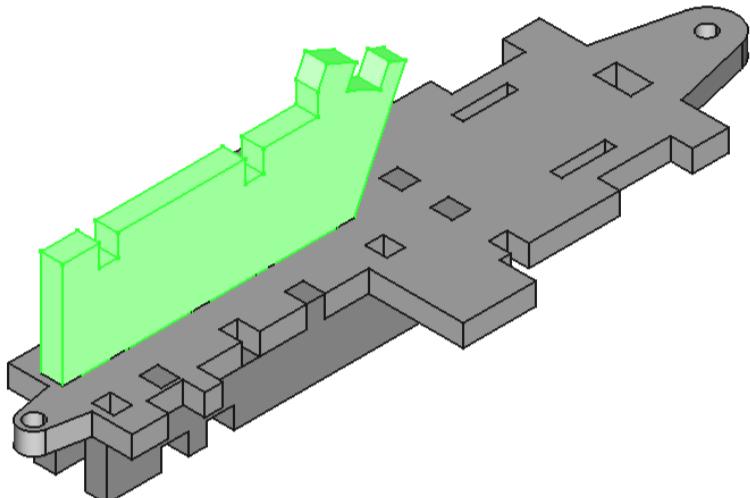
To make the lamp holder I used a $\phi 3$ diameter shaft, for which I used skewer sticks.

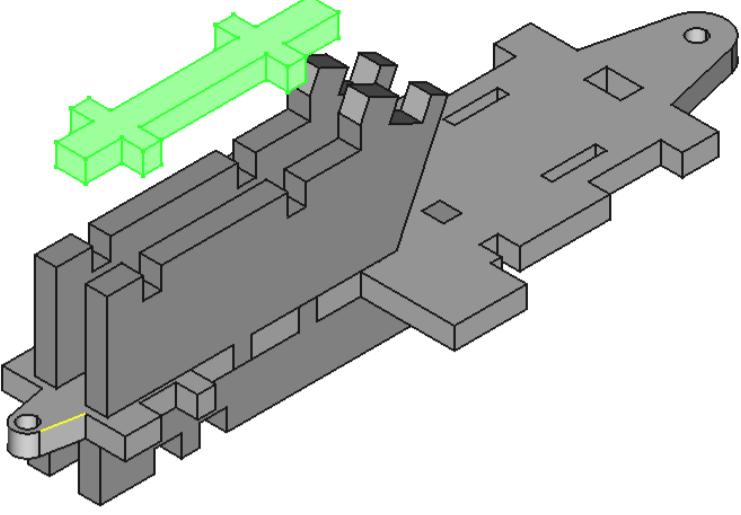
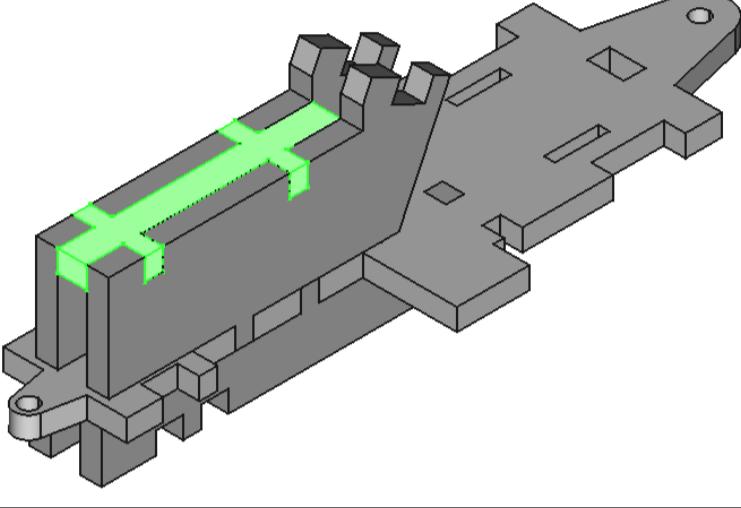
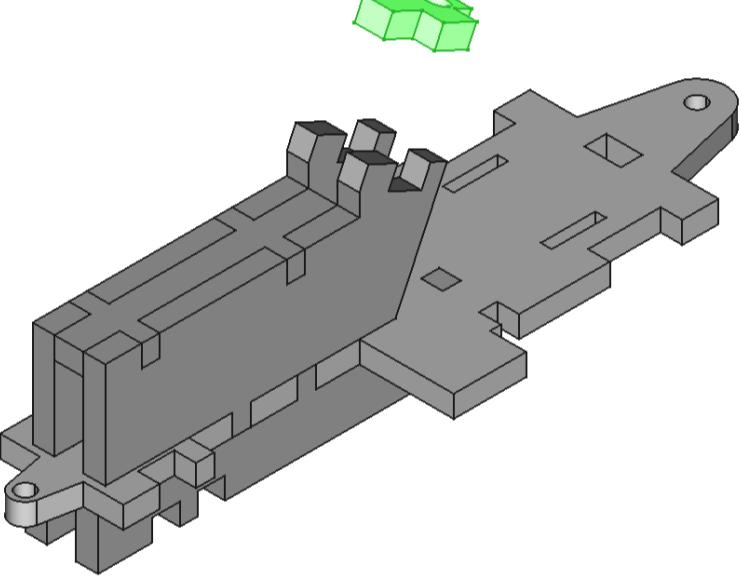
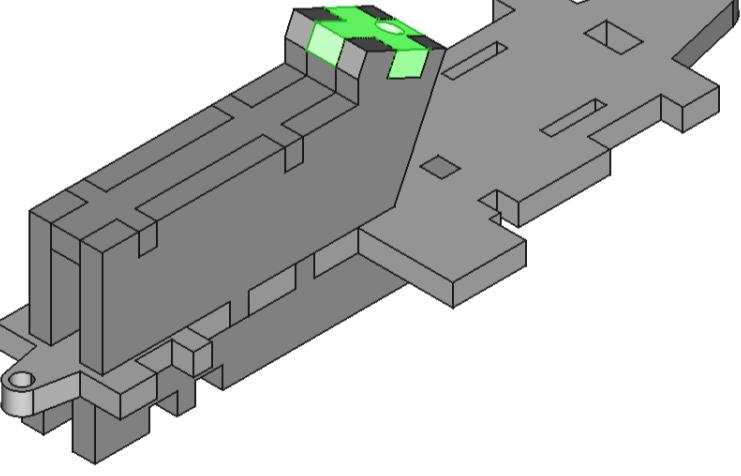


2

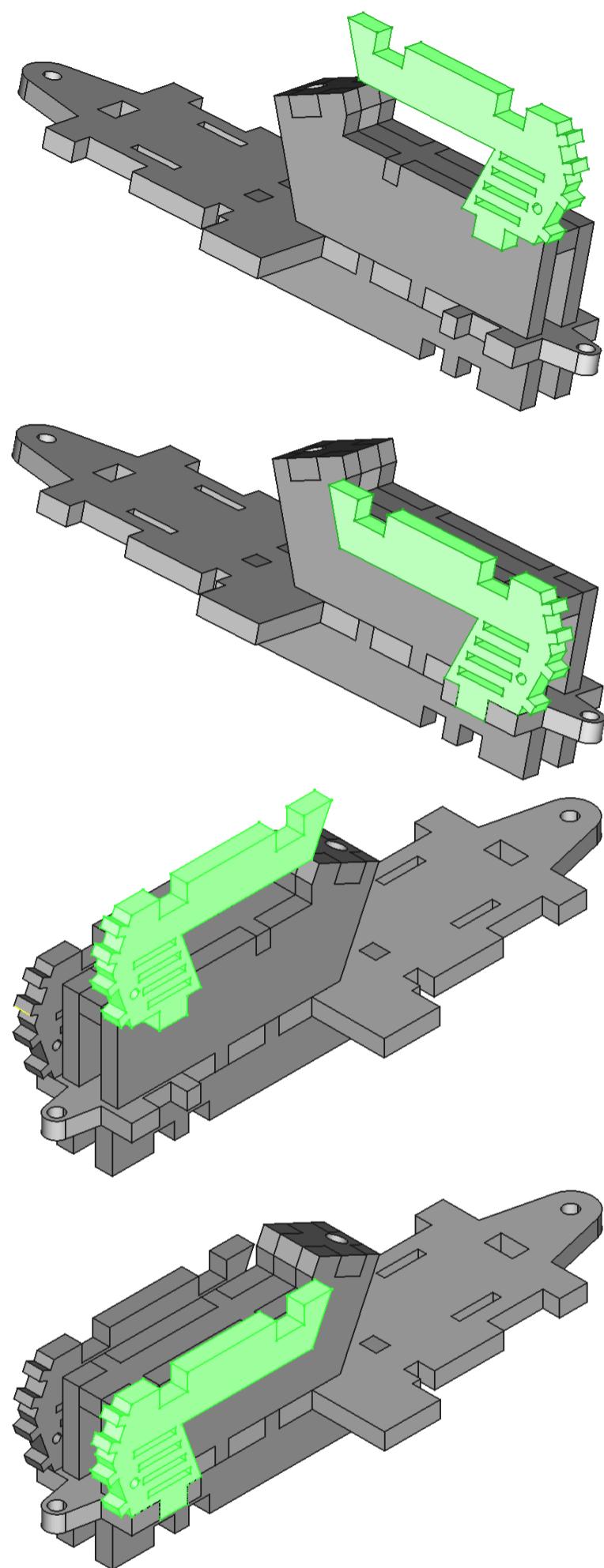


In the next step, we mount the engine sides (3) to the chassis (1). As in the previous step, care must be taken to maintain the correct angles and to ensure that the elements fit tightly together.



3	 	<p>The sides of the engine (3) are stiffened with a cross member (4).</p>
4	 	<p>The last element of the engine is the steering panel (5). It is important to remember that the panel can be decorated with engraved drawings of clocks. Icons should be added to the project when cutting the element from plywood.</p>

5

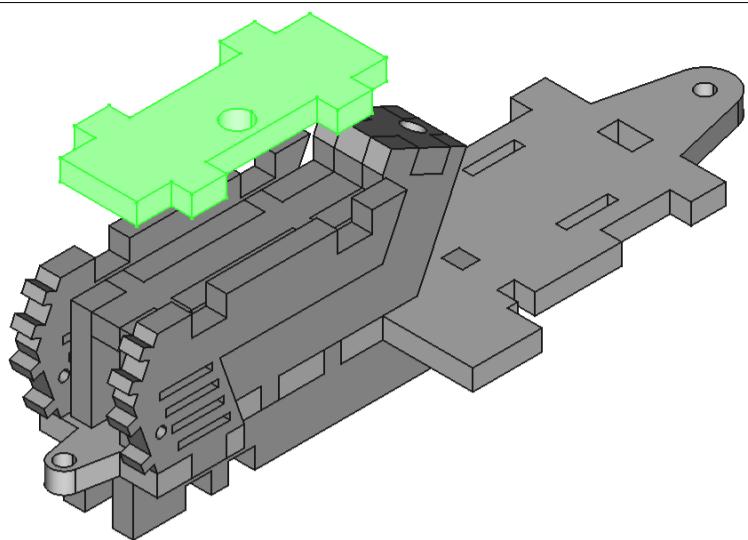


We start the outer casing of the engine by gluing the sides (6). It should be noted that there is a small gap between the cover and the engine itself. To avoid warping, it is worth putting a 1 mm thick piece of cardboard in while the glue dries.

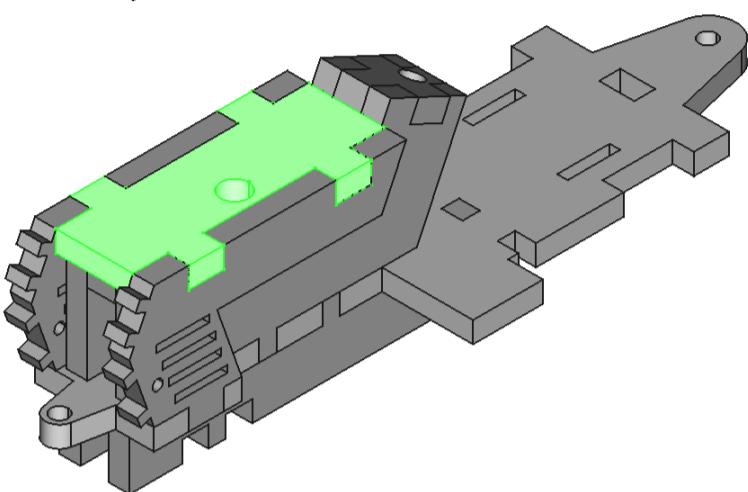
Note! The glue should only be applied to the lower part connecting the casing to the chassis.

The structure will be stabilized after gluing the upper part of the casing (7) with the hole for the chimney.

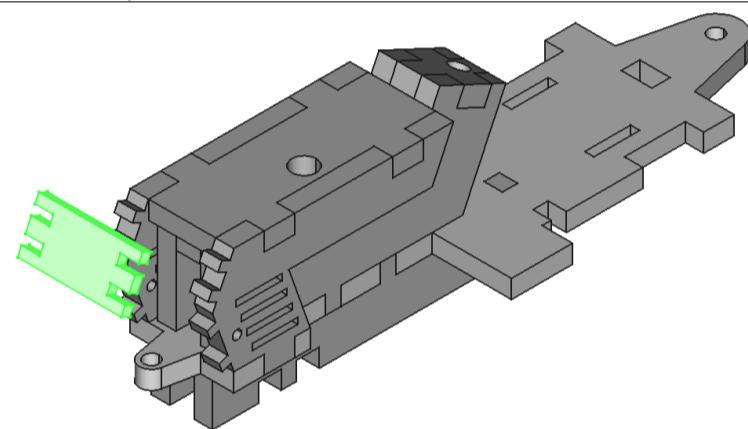
6



The upper part of the engine casing (7) stabilizes the entire casing by providing the correct distances from the engine.
Pay attention to the place where the chimney will be glued. It is intended to be on the left side of the cover when viewed from the driver's seat.



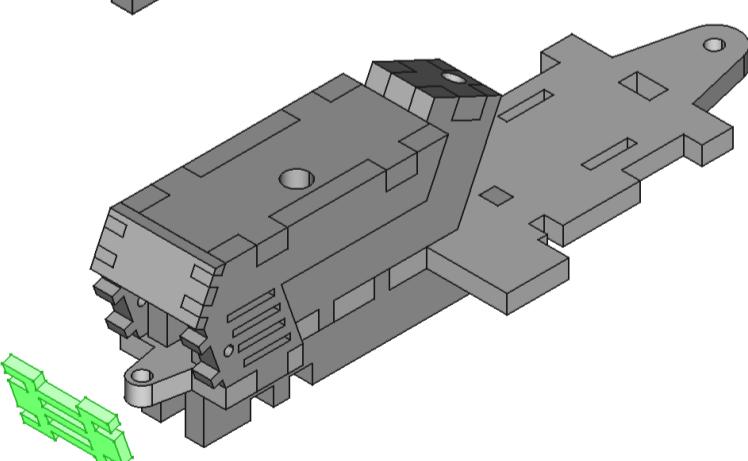
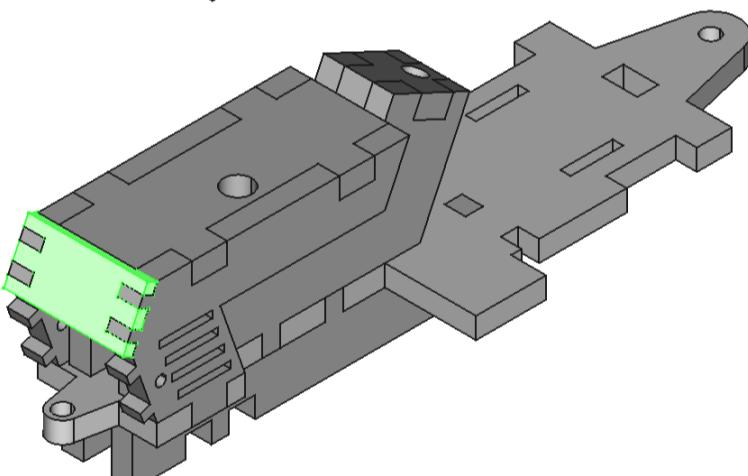
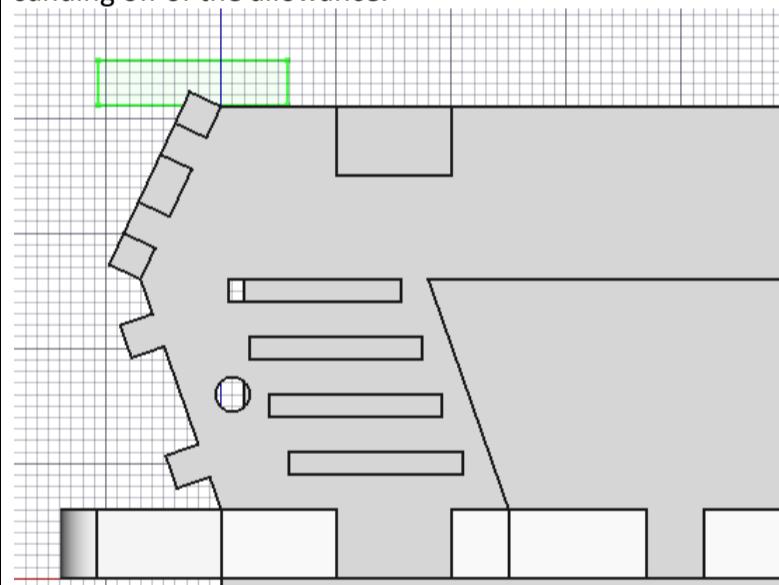
7

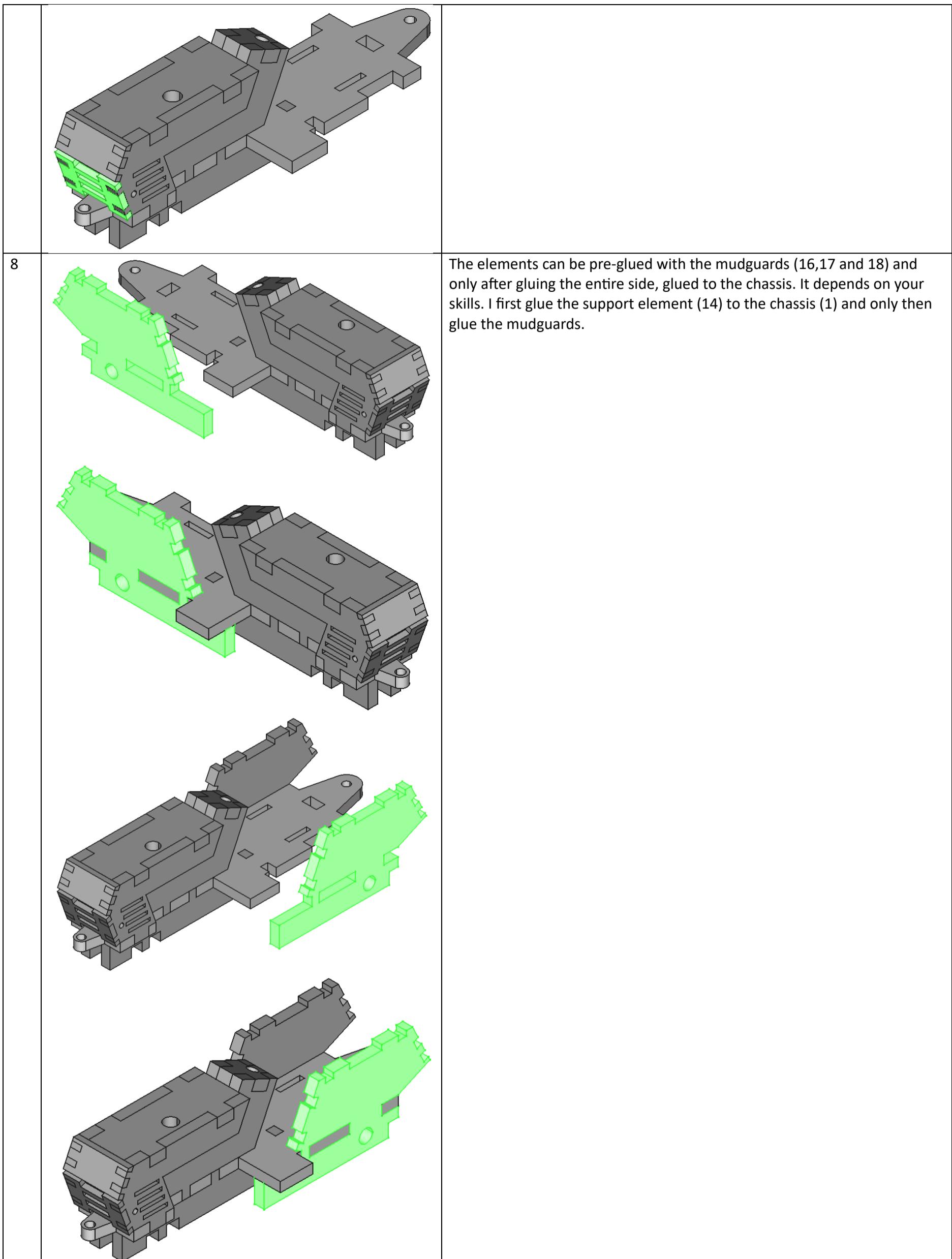


The last elements of the cover are the radiator covers (8 and 9) located in the front part.

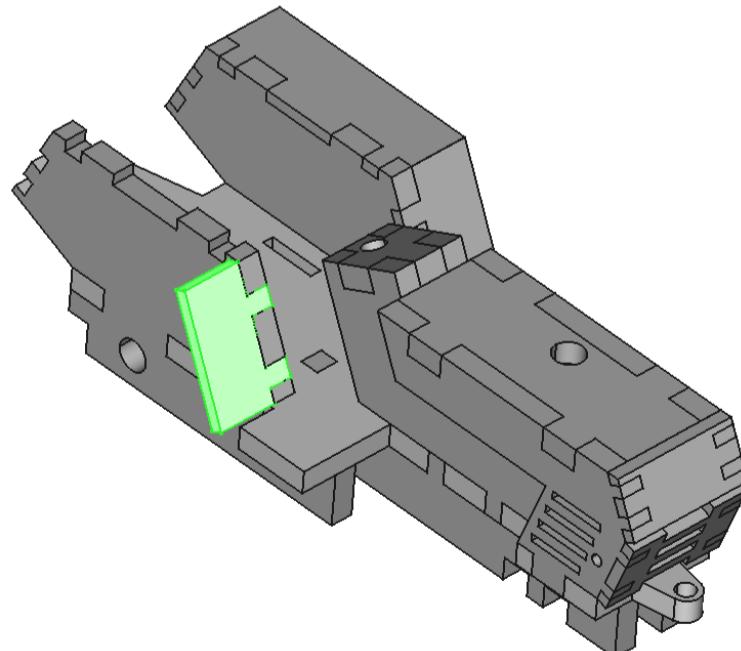
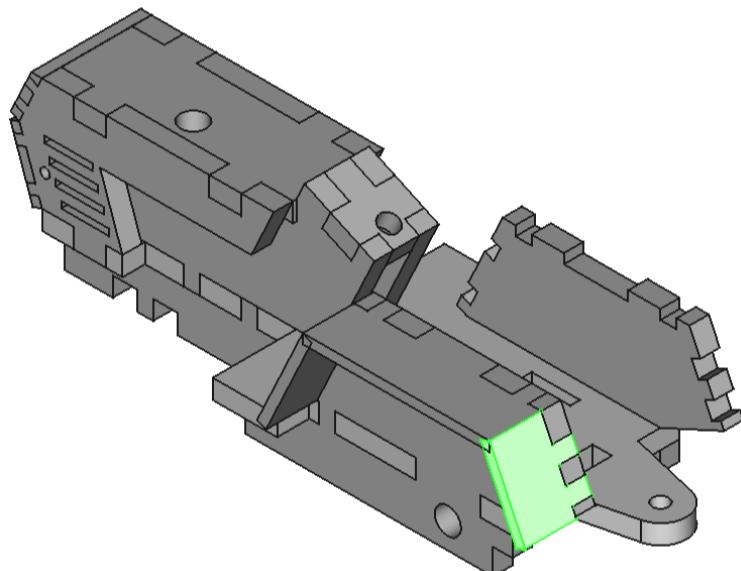
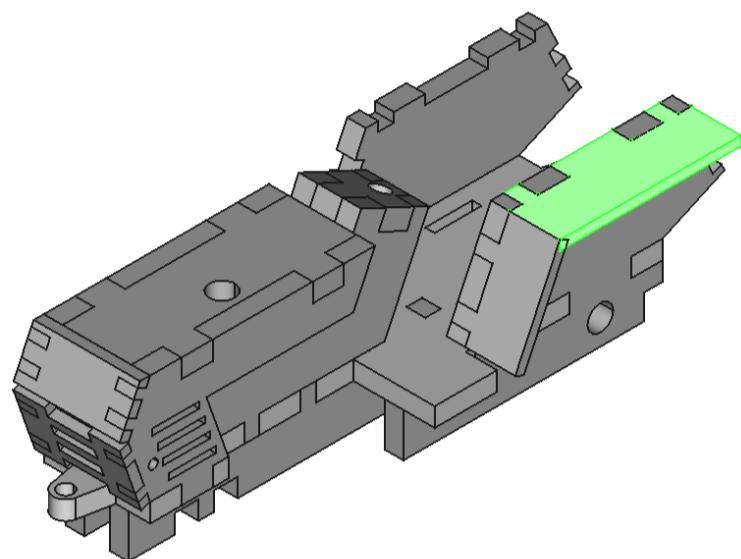
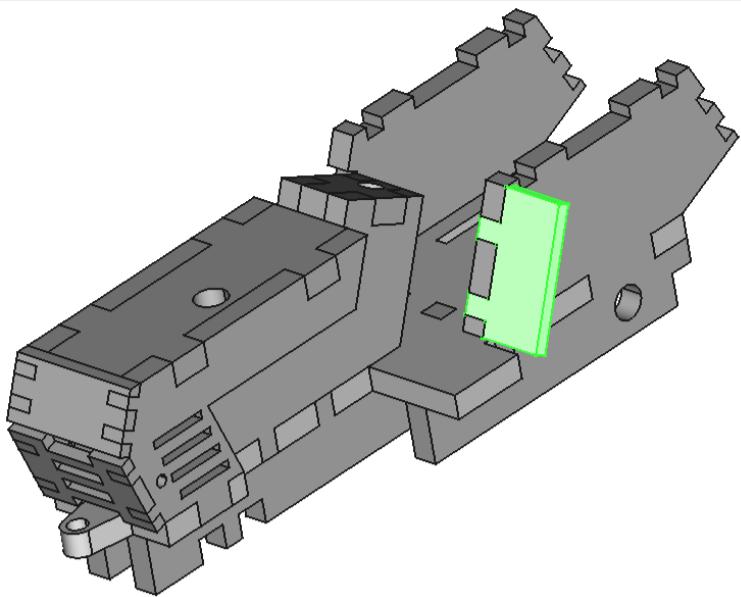
Important information concerns the upper part (9), which due to a certain gluing angle will protrude above the upper cover. The allowance (marked with a green rectangle in the drawing below) can be sanded off after gluing, taking care not to damage the upper surface.

To ensure an even sanded surface, I recommend covering a wooden block or a specialist cork block with sandpaper. This will prevent excessive sanding off of the allowance.

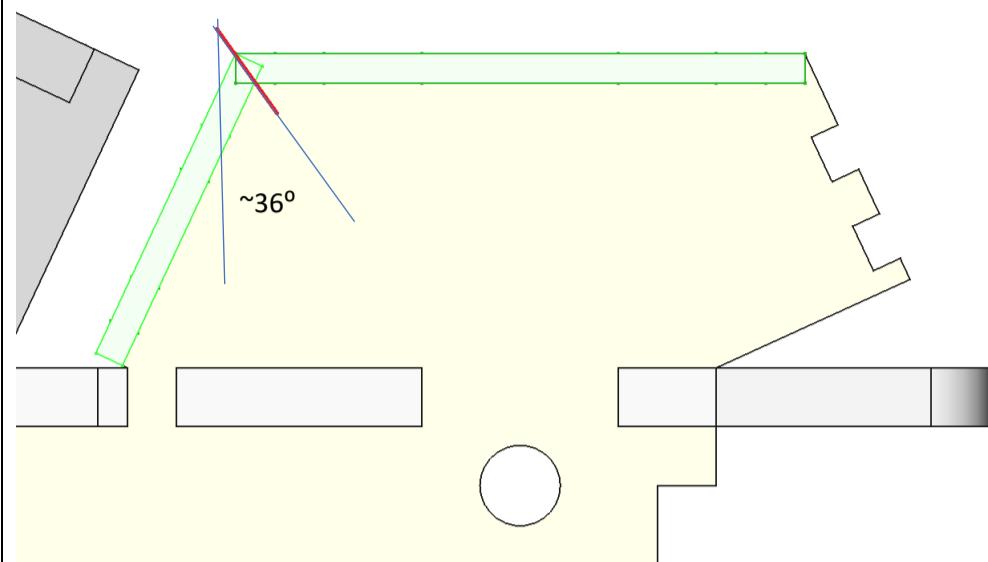




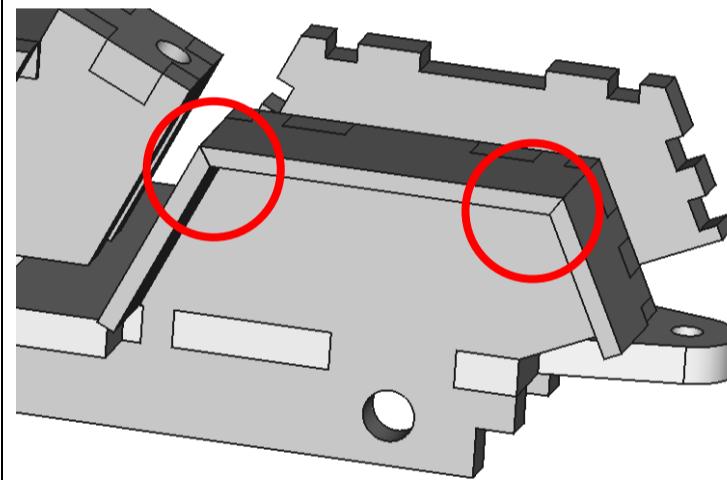
9



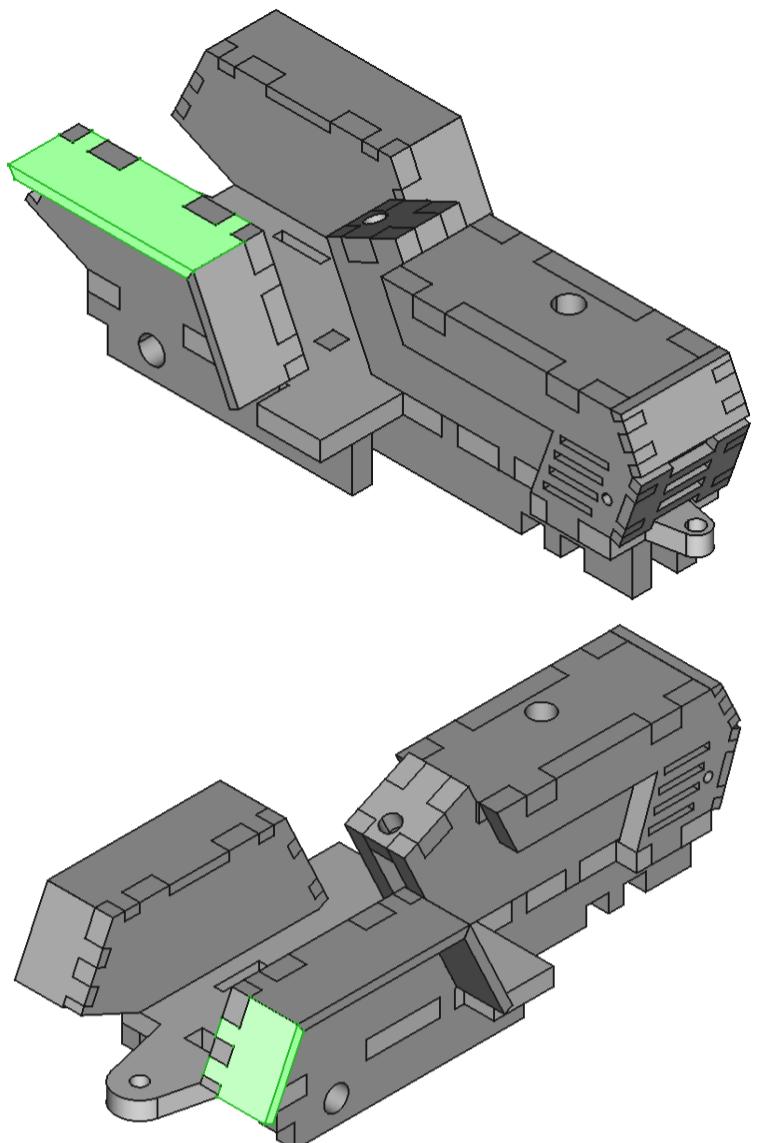
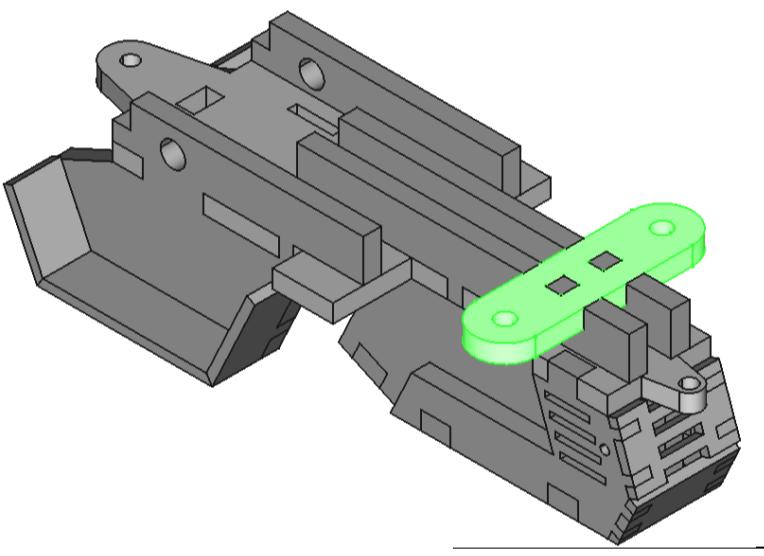
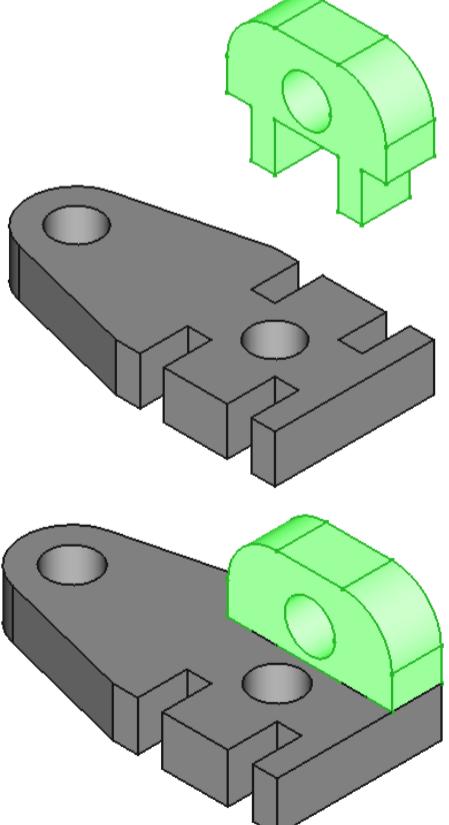
Before you start gluing the fender segments (16, 17 and 18), make sure that the individual elements do not touch at right angles, which means that it is necessary to grind the point where the fender segments meet before gluing them to the supporting part (14).

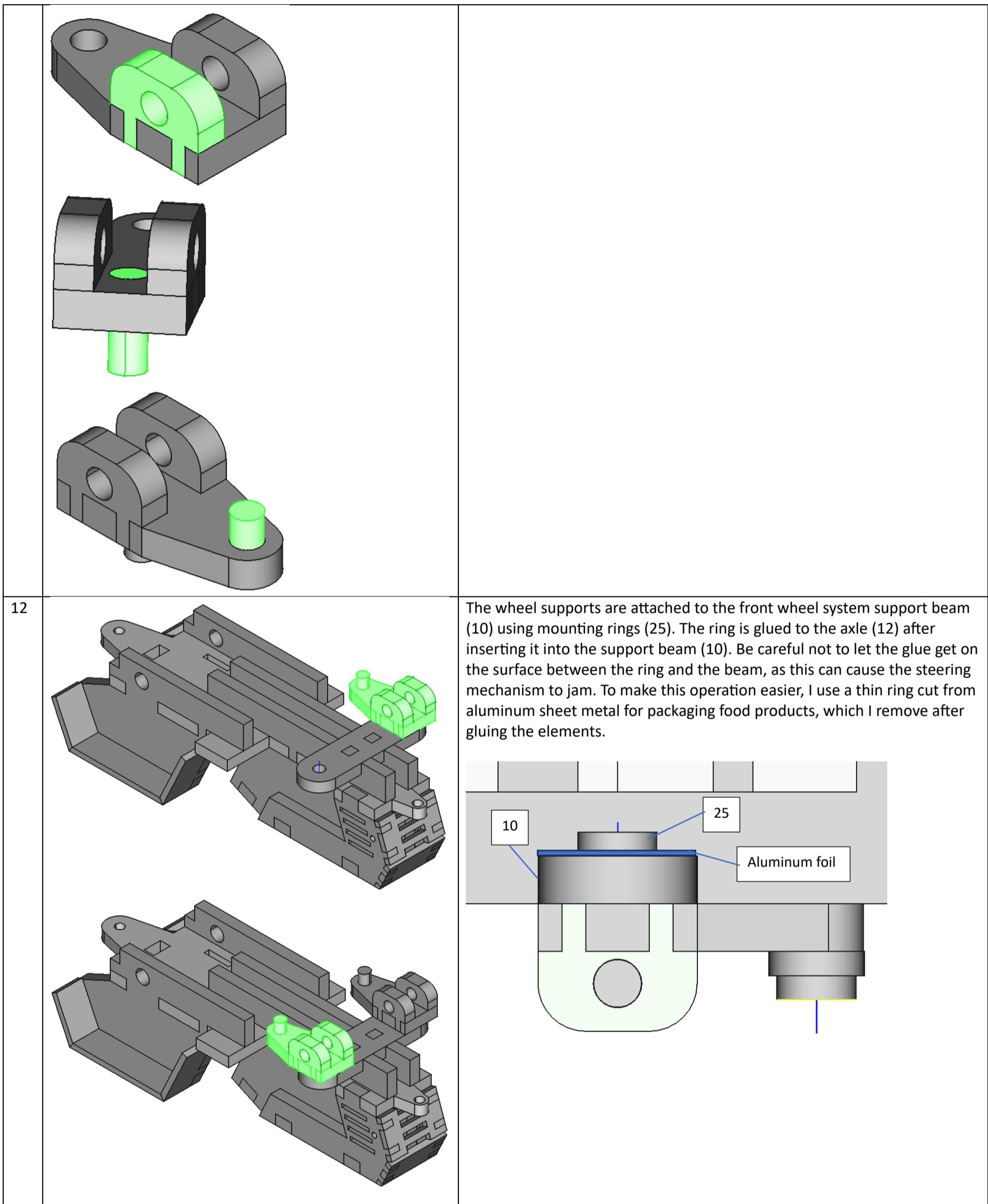


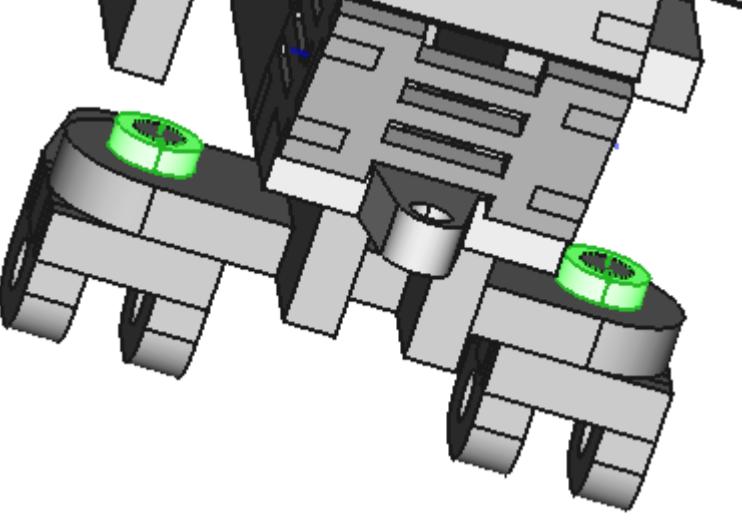
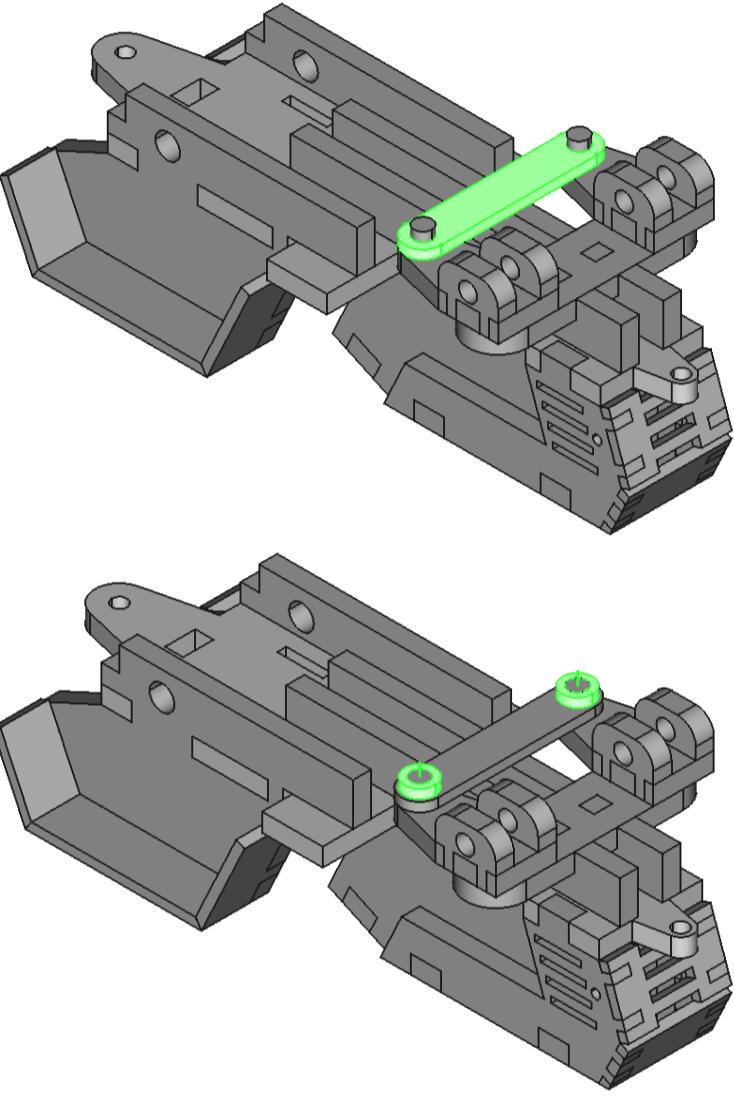
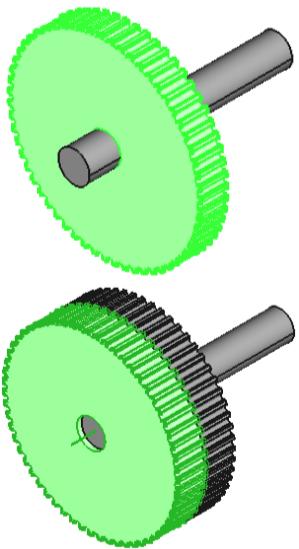
Both edges should be sanded at an angle of about 36° . To make it easier, print out the attached image and sand the edges step by step by applying the elements to the printout. You can also make a template using a protractor. I would like to point out that small inaccuracies can be corrected with a little more glue.



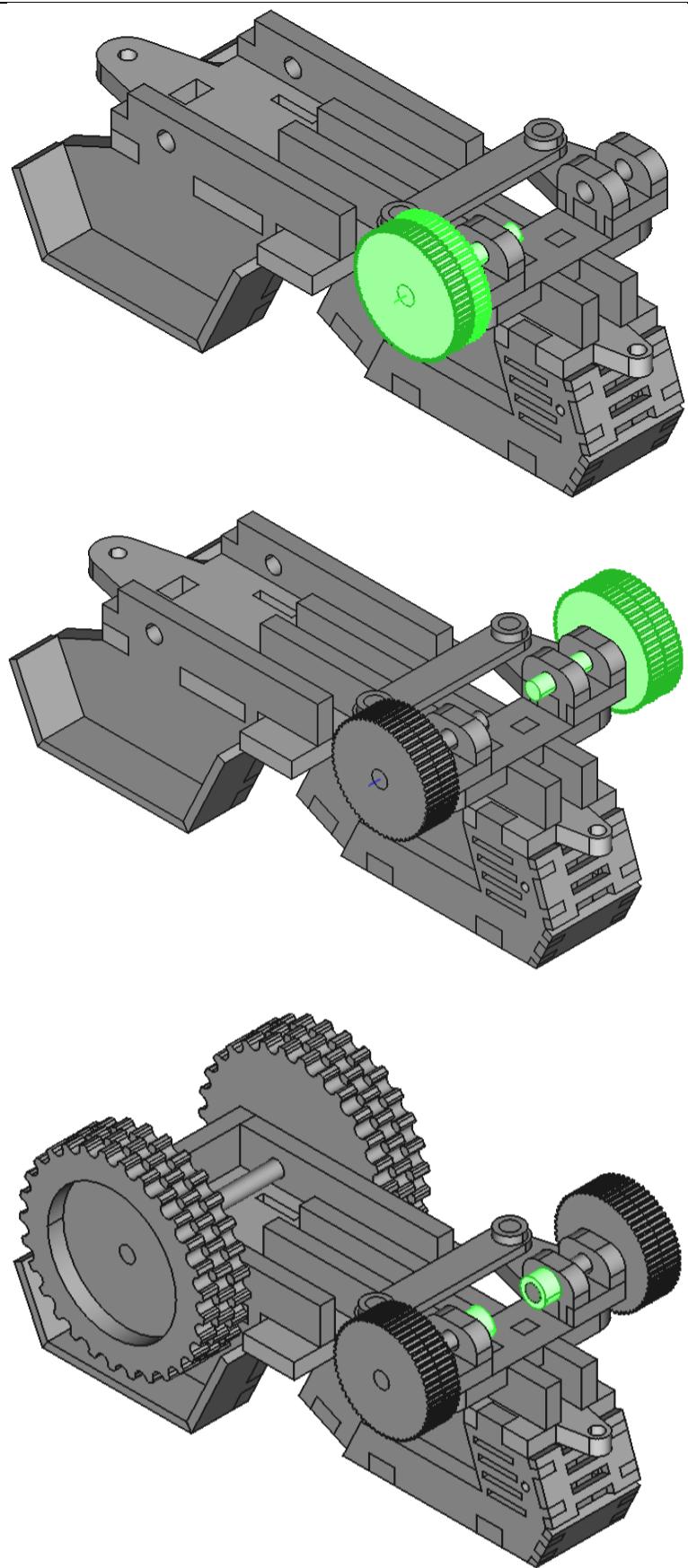
We repeat the operation for the left and right sides, remembering that the elements are not identical on both sides and the grinding of the segments of each side must be done independently.

		
10		<p>After assembling the body, we move on to assembling the chassis. We start by gluing the front wheel assembly support beam (10).</p>
11		<p>In the next step, we glue two sets of swivel wheel supports. The support consists of a guide (11), two axle supports (12), a rotational axis (29) and a rotational axis of the wheel connector (30). Since the wheel axle will rotate in the supports, the coaxiality of the holes and right angles between elements 11 and 12 must be maintained.</p>

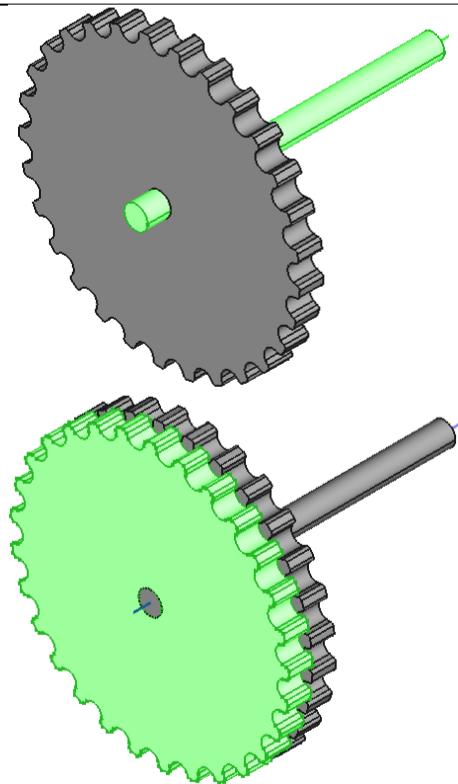


		
13		<p>We connect both supports with each other using connector 13 and two rings 25.</p> <p>We glue the rings to the axle (30), remembering not to apply glue from the connector side (you can use aluminum washers described in step 12).</p>
14		<p>The front wheels are 12 mm thick. They are made by gluing the elements (19).</p> <p>The wheels can be cut out of 3 mm or 6 mm plywood. Since there are indentations on the circumference of the wheels, gluing the wheels from 3 mm plywood allows you to shift the subsequent layers to create a herringbone pattern resembling the classic tread of tractor tires. In the case of 6 mm plywood, there are only two layers and when using an offset, it should be done symmetrically for both wheels, so that the wheel on the left is a mirror image of the wheel on the right. In the example I made, I did not use an offset for the front wheels. The wheels are mounted on the axle (29).</p>

15

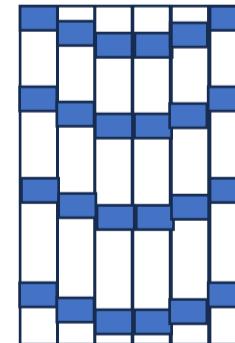


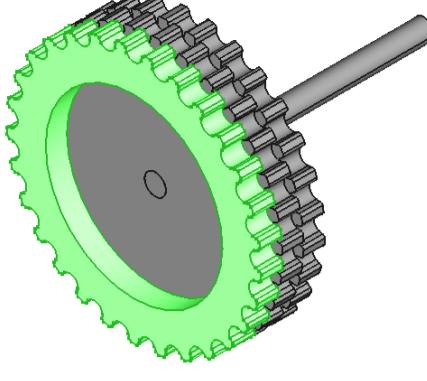
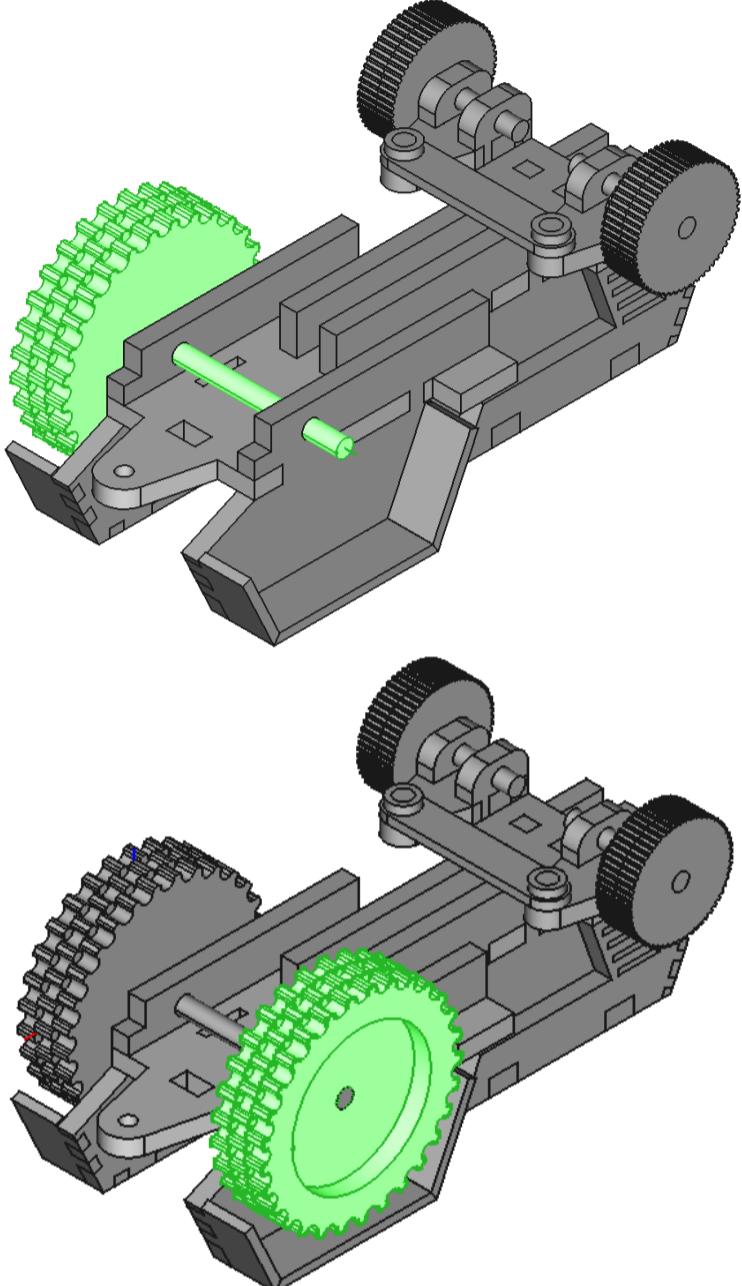
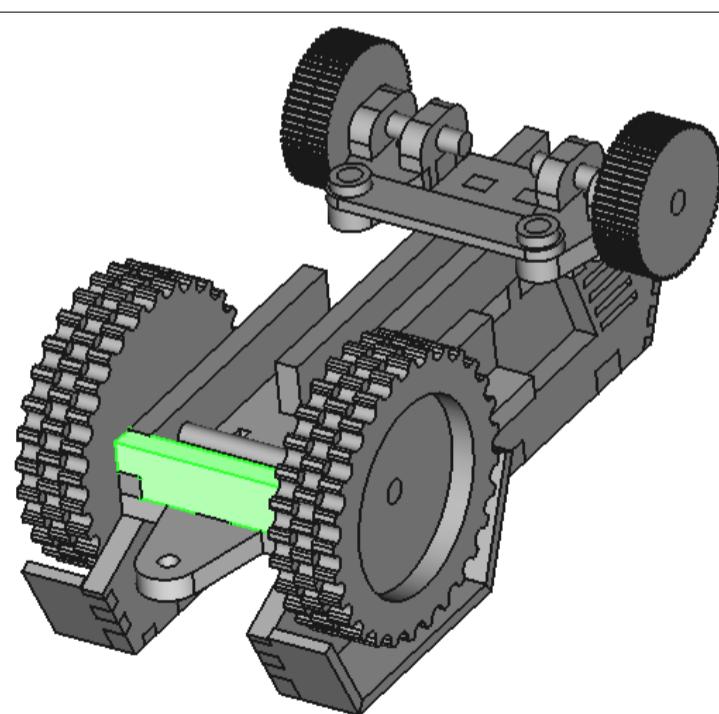
16

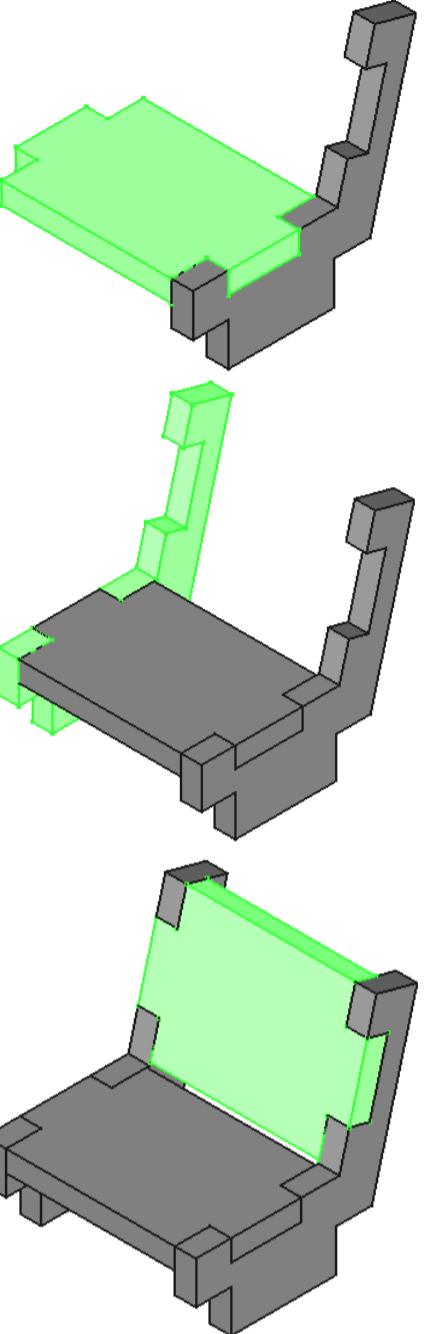
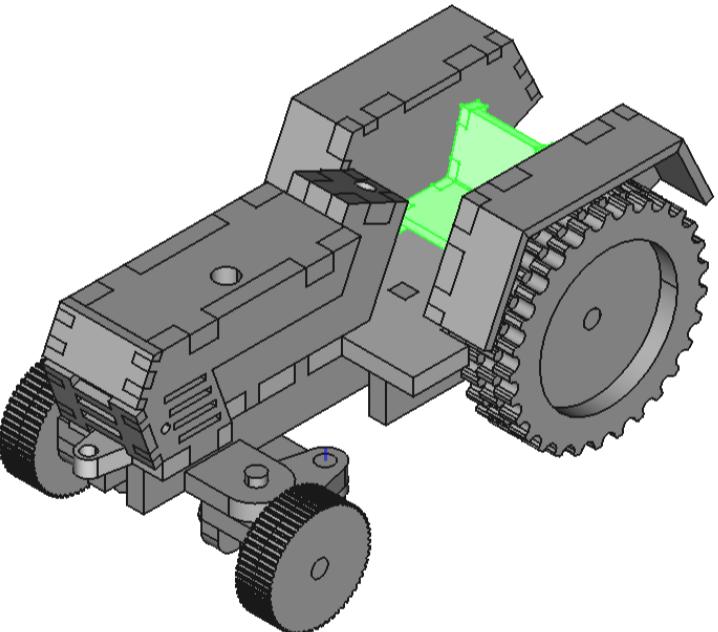
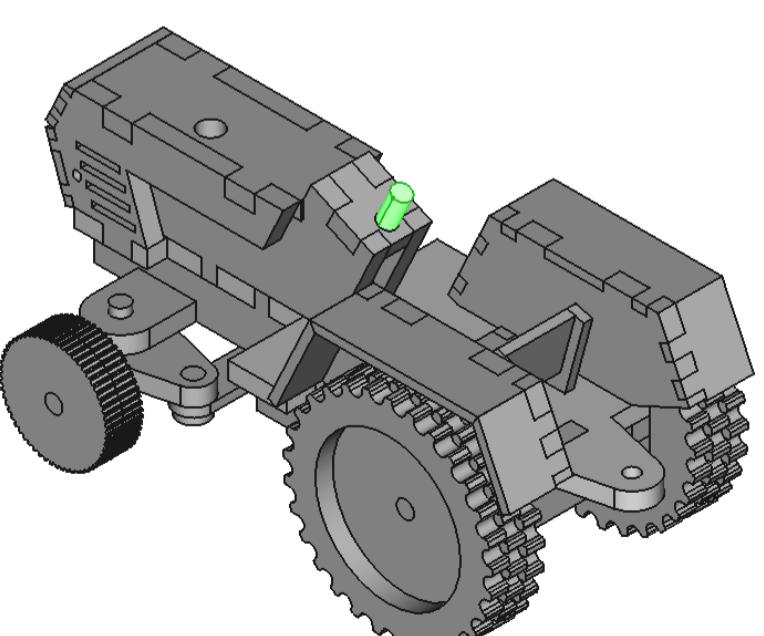


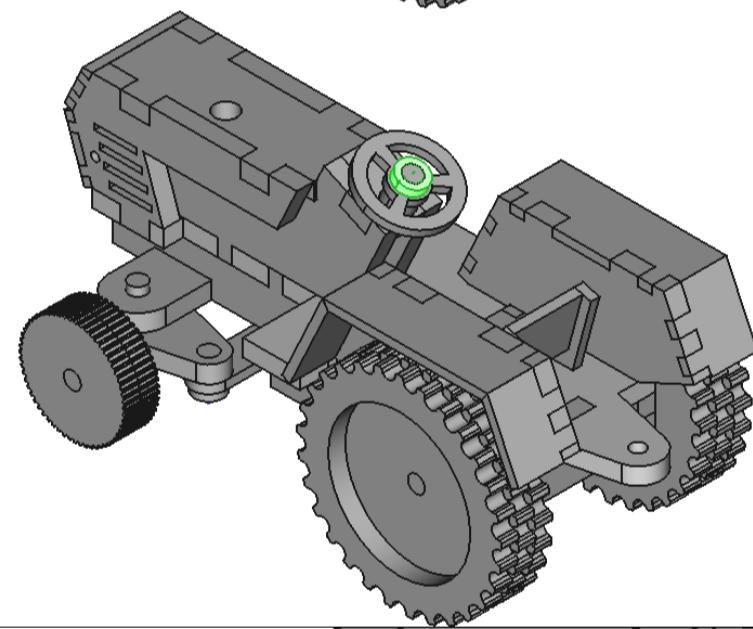
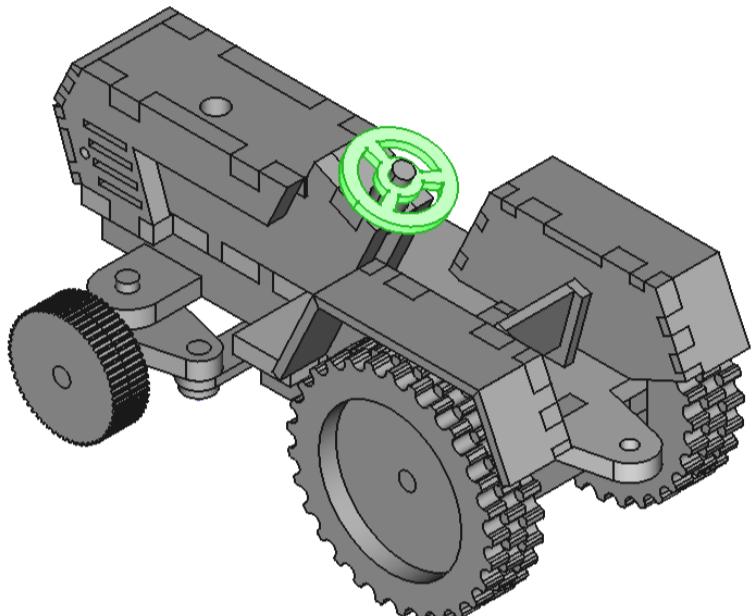
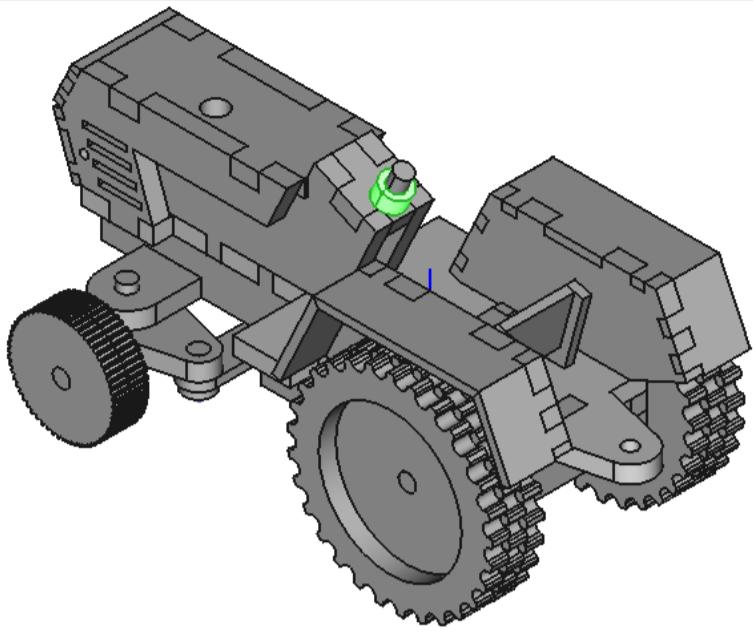
The wheels (20 and 21) are glued to the axle (31).
 The rear wheels are 18 mm thick and, like the front wheels, can be cut from 3 mm or 6 mm plywood. To make the wheels resemble classic elements used in tractors, only the inner rings are solid (21). The outer part is a ring (20) resembling the shape of a tractor tire.

To improve the visual effect, it is advisable to move the subsequent elements relative to each other to obtain a herringbone effect.

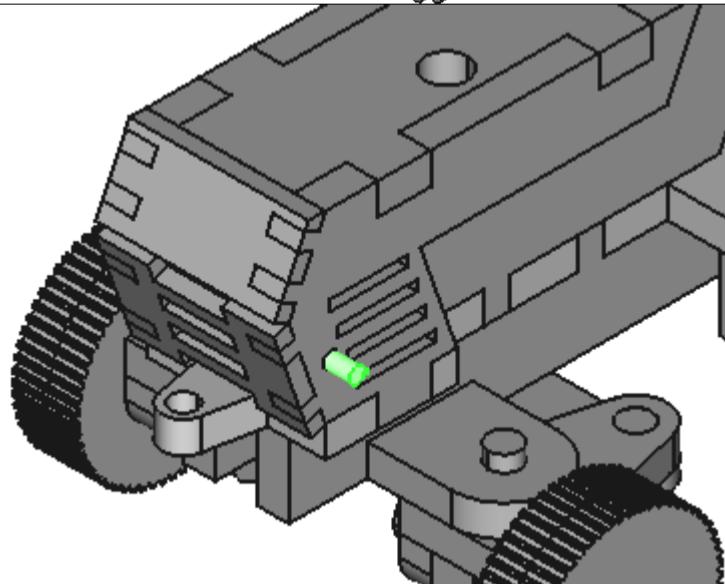


		
17		The rear wheels are glued into the toy with a small amount of play, so that the wheels turn freely. Additionally, it is worth remembering to use paraffin.
18		After assembling the wheels, we glue in the rear chassis cover (15). It can be glued in earlier, but if the wheels are glued in too stiffly, the clearance can be corrected by gently grinding the sides of the glued element.

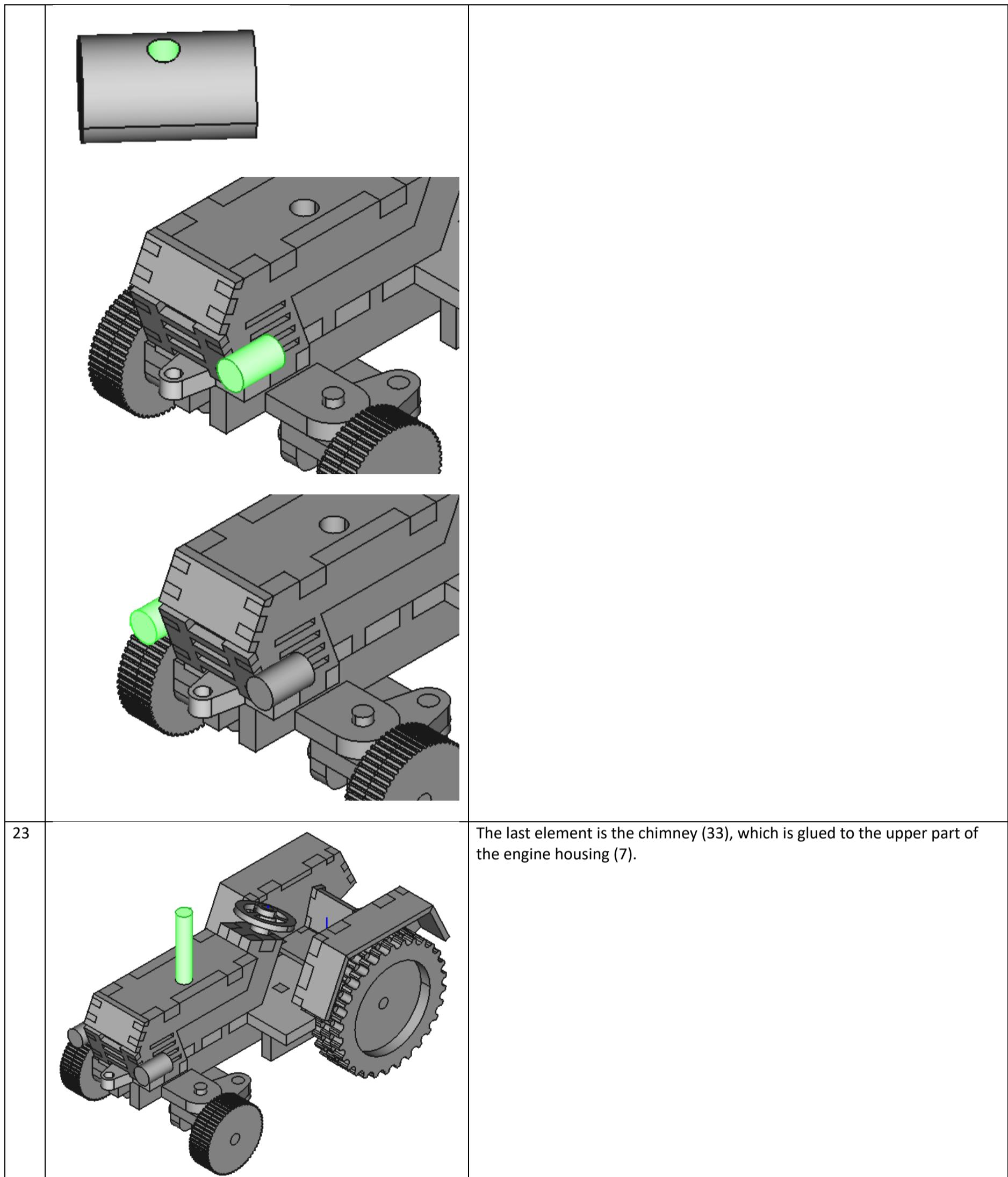
19		<p>The driver's seat consists of two sides (22) and an element (23) glued in place of the seat and backrest.</p>
20		<p>The finished chair is glued into the holes in the chassis (1).</p>
21		<p>The steering wheel (24) is attached to the dashboard (5) on the glued steering wheel axle (27). A thick ring (26) is placed between the dashboard (5) and the steering wheel. It does not have to be glued to the dashboard or axle. The steering wheel rotates freely on the axle. The lock is a thin ring (25), which should be glued to the steering wheel axle. It is important to move the steering wheel after gluing the ring so that it rotates easily during play.</p>



22



The front lights (32) are attached to the cover (6) using thin shafts (34). In the design, the hole has a diameter of 3 mm, but you can redesign the system to adapt it to the materials you have. The lamp can also be made from a shaft of a different diameter. I drill a $\phi 3$ hole in the shaft that imitates the lamp to a depth of about 5 mm and additionally use a small amount of glue between the lamp and the housing.

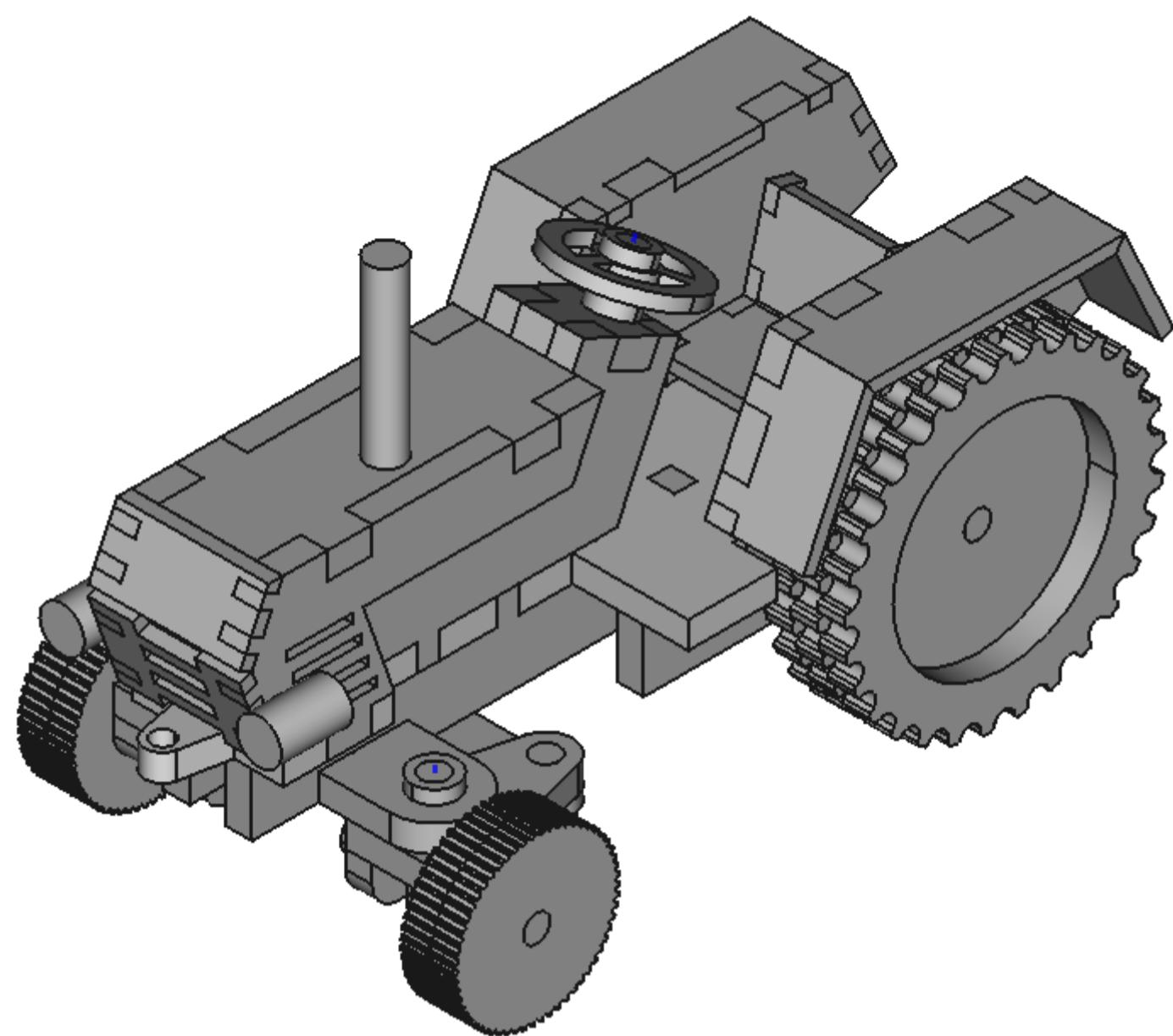


The whole thing should be sanded with fine sandpaper.

The elements can be covered with clear varnish, but it is not necessary.

It is worth decorating the toy by engraving various graphics in place of the engine, on the steering panel or on the back of the chair. I leave this to your imagination.

The elements can be adapted to your own needs and, in case of difficulties, simplify, e.g. the shape of the wheels by cutting out a smooth surface. (Rysunek 7)



Rysunek 6 Complete toy project.



Rysunek 7 Ready-made toy without tread