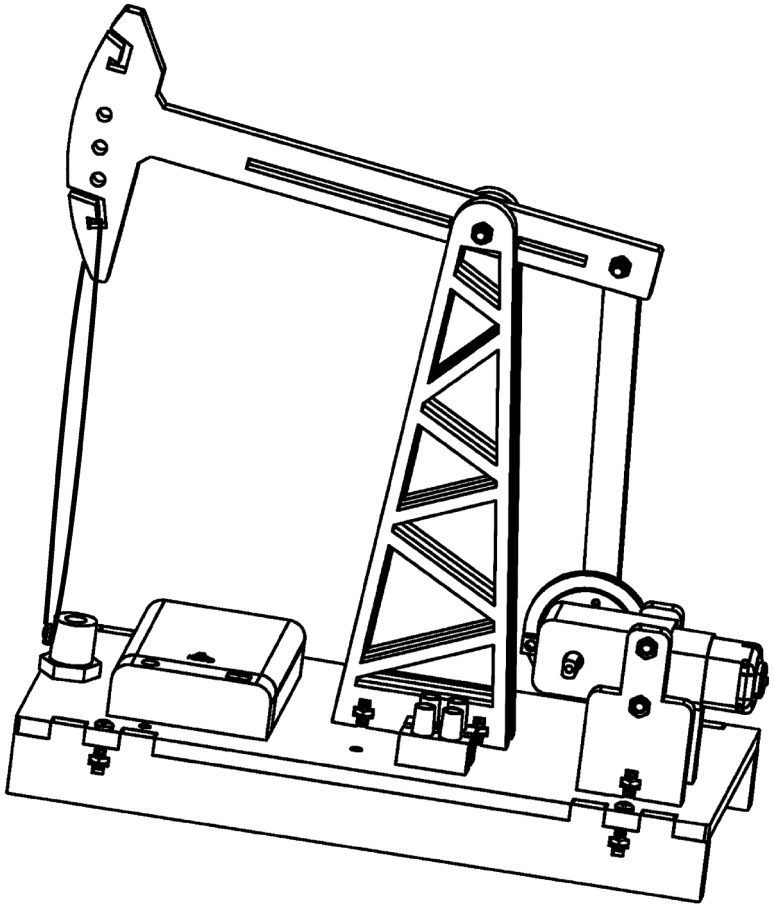
AREXX Engineering

WTR-AOE

PISTON OIL PUMP KIT

PUMPJACK



A pumpjack is the overground drive for a reciprocating piston pump in an oil well.

Pumpjacks could be observed at travels in various countries. In the UK Netherlands and Germany they were common in the northern provinces.

In The UK The Kimmeridge Bay oilfield and Wytch Farm, Dorset are important oilfields where you still can find some of the old pumpjacks in use.

Nowadays you will not be able to find much operational pumpjacks in the European landscape. These pumps may only be found in an open-air museum and in some old oil fields.

Abroad many pumpjacks are still being used.

Precautions

- When you open the bag with the parts, you cannot return the product anymore
- Before you start assembly, read all instructions in this manual first.
- Be careful using tools, they can hurt you.
- Do not assemble this product in the company of little children, they can swallow the small parts or hurt themselves with the tools.
- Never shortcut the batteries.
- When the product gets wet, disconnect the batteries and dry all parts of the product.
- Remove the batteries when you are not using the robot for a longer period
- Children under the age of 14 years should only build this item under supervision of an adult person.

Normal use

This product was designed as a school lab kit for anybody who is interested in technology. The primary goal for this kit is the assembly and operation of a pumpjack (a piston pump for oil wells) with 3 fully charged AAA batteries. Additionally you may customize this kit and modify its functions to create creatures such as a Jumping Jack.

This simple kit demonstrates the operational function how a rotation may be transformed into up and downward movements. This product is no toy and not suited for children under 8 years of age. Any use other than that described above can lead to damage to the product and may involve additional risks such as short circuits, fire, electrical shock etc.

Manufacturer and Dealer are not responsible for the consequences of improper use, assembly mistakes and or operation of this product as a result of ignorance of this manual. If necessary, the contents of this manual can be changed any time without prior notice. New manual versions will be available on: **http://www.arexx.com**

Important
Read before you start the precautions

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SCHOOL LAB

WTR-AOE

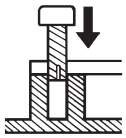
PISTON OIL PUMP KIT

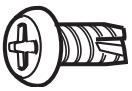
We strongly suggest to read this chapter first before assembling the product!

Assemble the robot in the exact order as described in this manual. This way you will avoid assembly mistakes. If you assemble in the correct order and study the picture on the packaging so now and then, you will build a perfectly functioning robot in no time.

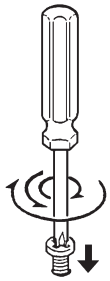
All parts fit perfectly, so there is absolutely no need to use force. Work calmly and read the complete manual before you start to assemble this robot.

Self-tapping screws (Parker)





A self-tapping screw looks similar to a wood screw. When you screw it in a hole, it can cut the threads at the same time. Never try to screw it down all the way for a first time, because it may easily become stuck or you will damage its head.

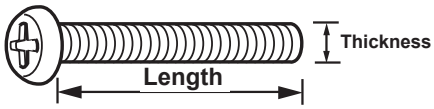


Tapping screws always have a sharp point sometimes with a small carve. The best way is to screw it in and out a bit.

1. Screw in
2 Screw out a bit
3 Screw in further and
continue step 1 and 2

Do not screw a tapping screw in and out to often because the screw hole may become enlarged and the screw will loose all grip and proper function.

Screws and nuts



Nut

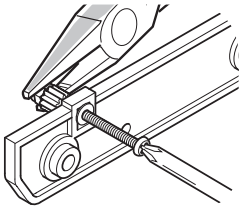
Lock nut

In a moving environment, screws and nuts must be tightened properly. A lock nut is a special nut with nylon inside which will lock itself automatically.

Another easy way to lock a screw is to use ordinary fingernail polish. A big advantage of nail polish is that you always can loosen it quite easily again. A professional way to lock a screw is to use for example locktite a sort of glue especially made for screws, but it is very difficult to unlock such a screw afterwards.

The size of a screw is expressed by thickness and length. A screw with the marking M2 x 10 means 2mm thick. The length of the thread is 10mm. A M2 nut means it is used for a M2 screw so the nut always corresponds with the screw thickness.

Lock nut fixation



To lock the lock nut in a proper way, use a plier or the spanner which is supplied in this kit. See drawing on the left!

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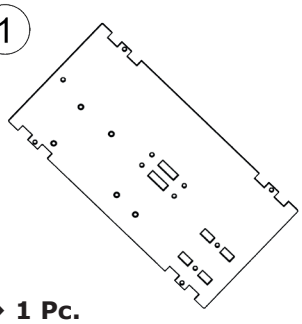
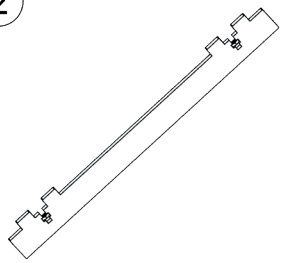
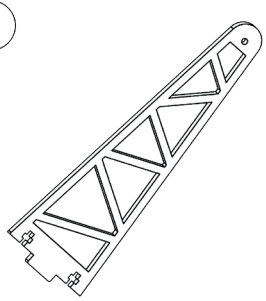
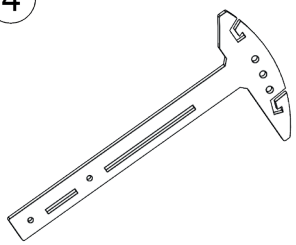
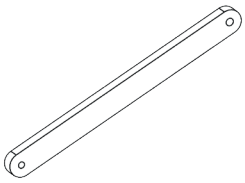
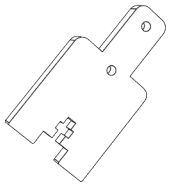
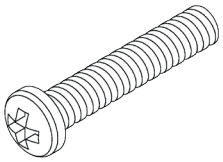
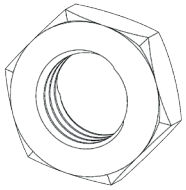
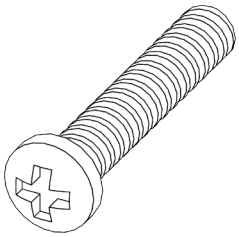
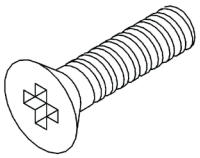
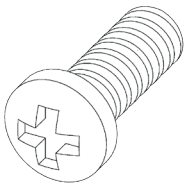
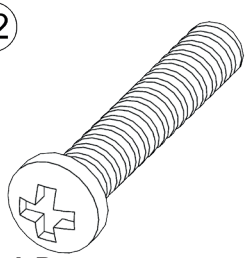
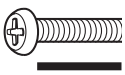
pumpjack

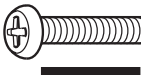
PARTLIST

1  ◇ 1 Pc. Base board	2  ◇ 2 Pcs. Side board	3  ◇ 2 Pcs. Carrier panel	4  ◇ 1 Pc. Walking beam (lever)
5  ◇ 1 Pc. Connecting rod	6  ◇ 2 Pcs. Motor holder	7  ◇ 10 Pcs. Bolt M3x12	8  ◇ 18 Pcs. Nut M3
9  ◇ 2 Pcs. Bolt M3x20	10  ◇ 2 Pcs. Bolt M3x10	11  ◇ 2 Pcs. Bolt M4x8	12  ◇ 1 Pc. Bolt M3x16

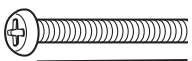
SCALE FOR SCREWS

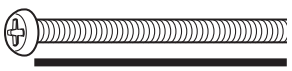

M4x8


M3x10 Flat head!


M3x12


M3x16

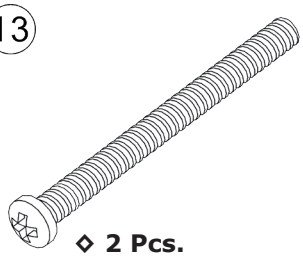
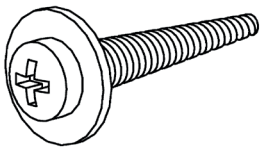
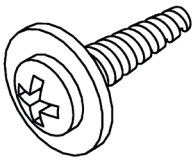
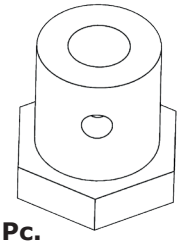
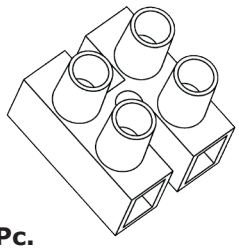
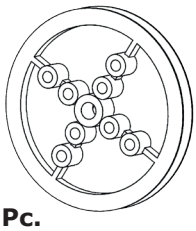
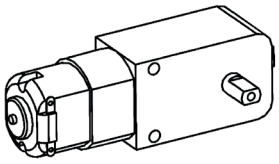
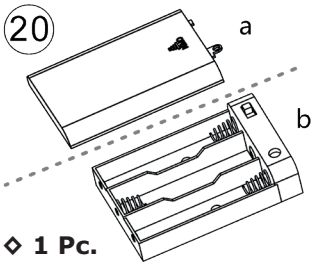
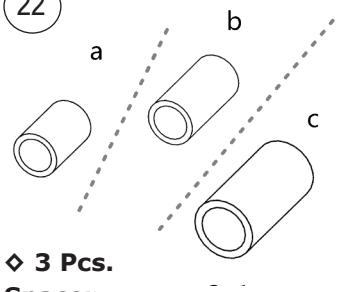

M3x20


M3x20

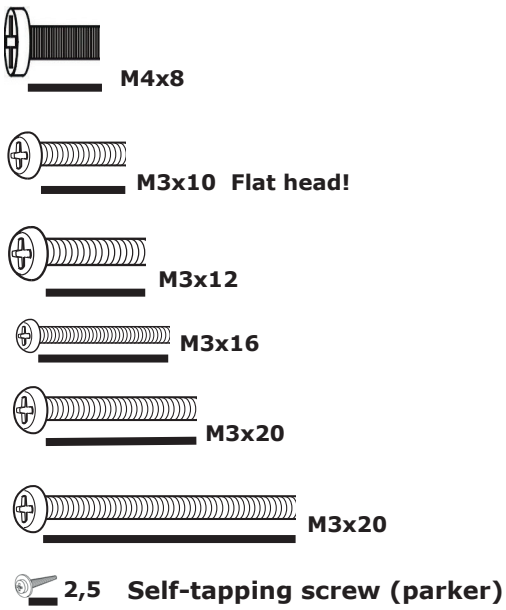

2,5 Self-tapping screw (parker)

pumpjack

PARTLIST II

13  ◇ 2 Pcs. **Bolt M3x30**	14  ◇ 1 Pc. **Bolt M2.6x12**	15  ◇ 1 Pc. **Bolt M2.3x10**	16  ◇ 1Pc. **Axis with nut**
17  ◇ 1 Pc. **Terminal block**	18  ◇ 1 Pc. **Traction wheel**	19  ◇ 1 Pc. **Motor**	20  ◇ 1 Pc. **Battery Compartment**
21  ◇ 1 Pc. **Rubber band**	22  ◇ 3 Pcs. **Spacer**	**a = Shortest length** **b = Middle length** **c = Longest Length**	

SCHAAL VOOR SCHROEVEN



M4x8

M3x10 Flat head!

M3x12

M3x16

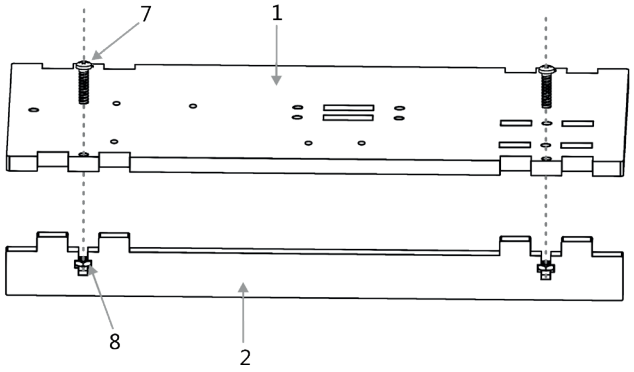
M3x20

M3x20

2,5 Self-tapping screw (parker)

ASSEMBLY INSTRUCTIONS

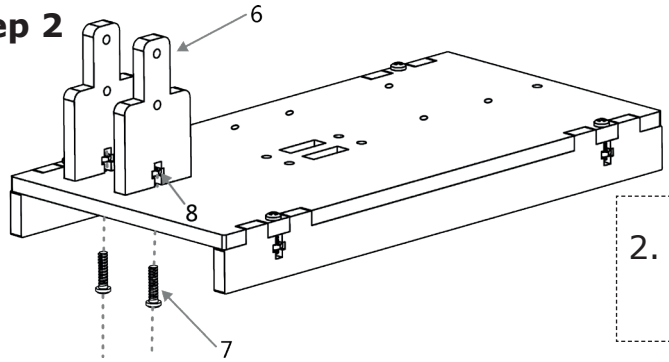
Step 1



1. We will begin the assembly phase by mounting the side panels at the bottom of the base board. Plug the nut's tip into the gap and keep the nut in position by pressing your finger to the opposite backside. Select the correct bolt and screw in into the nut.

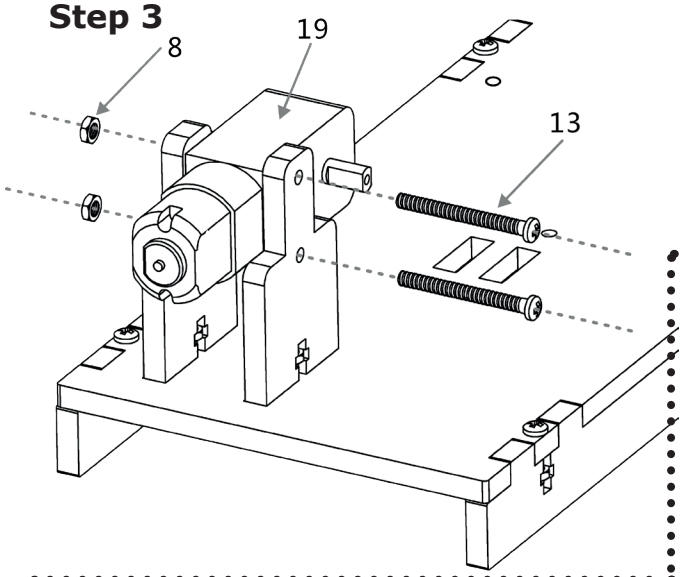
TIP
Cover the backside with some adhesive tape in order to fix the nut's position and keep both hands free to screw the bolt into the nut.

Step 2



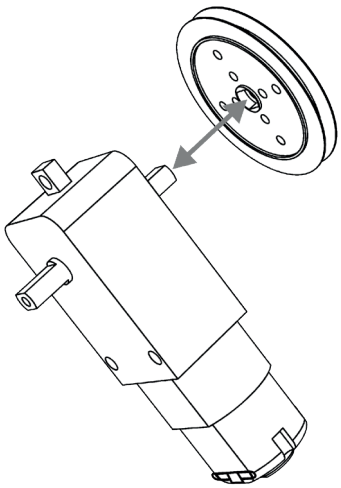
2. Mount the motor brackets to the base board. Use the mounting procedure as described in assembly step 1

Step 3

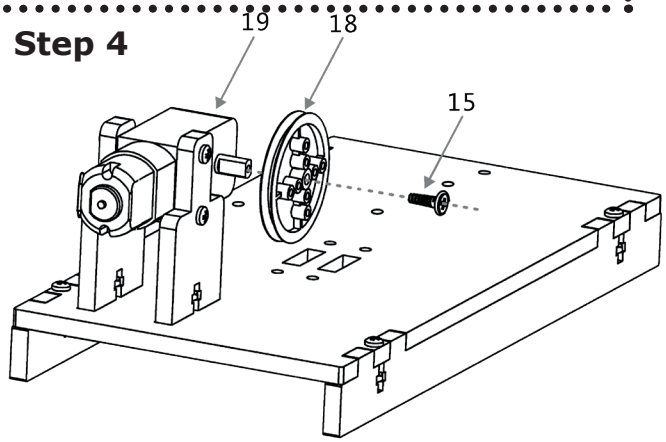


3. Mount the motor case to the motor brackets. Please use the longest bolts to attach the motor.

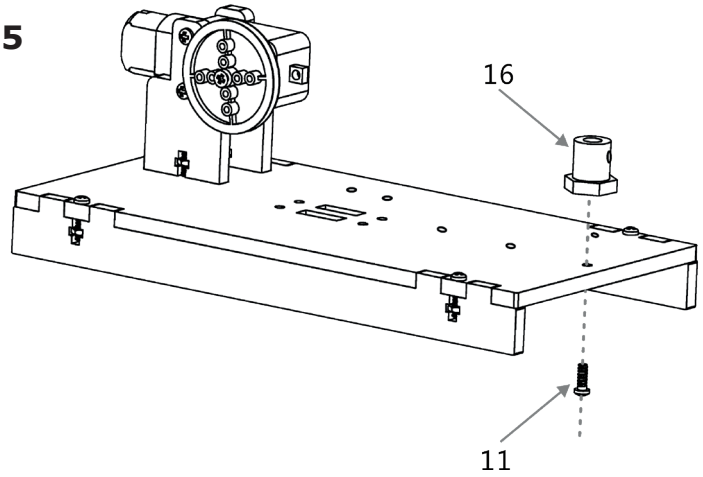
4. Attach the traction wheel to the motor axis.



Step 4

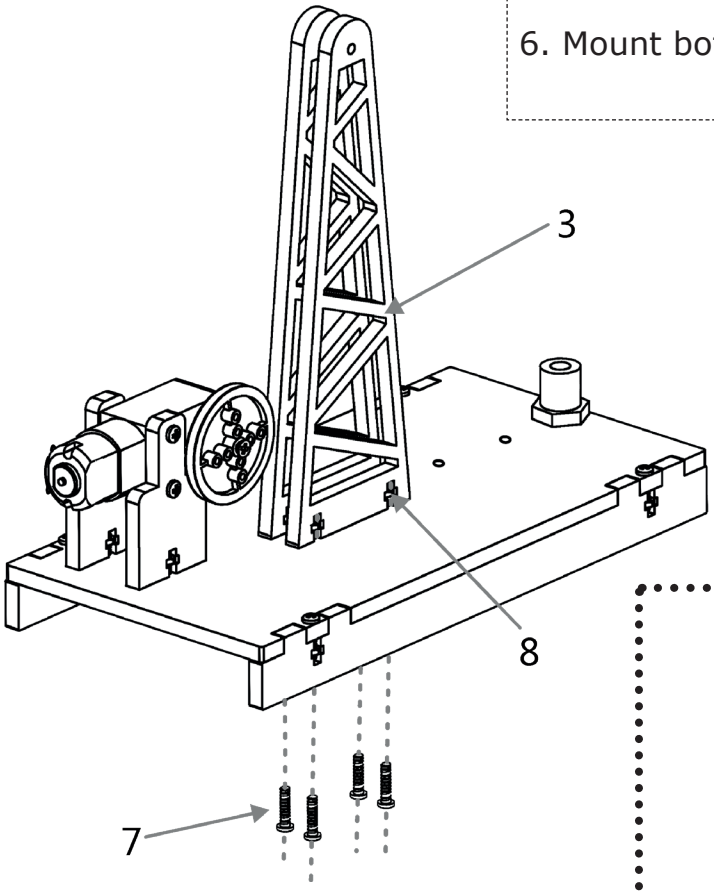


Step 5



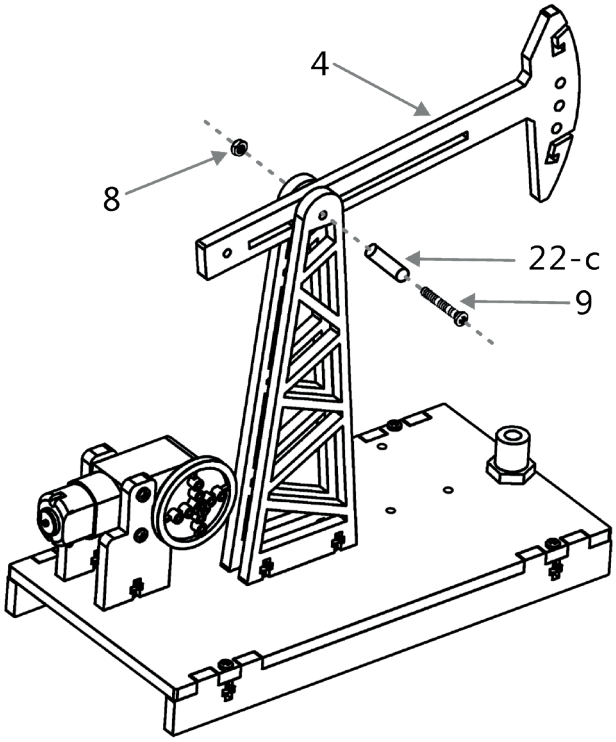
5. Install the axis with the nut to the base board.

Step 6



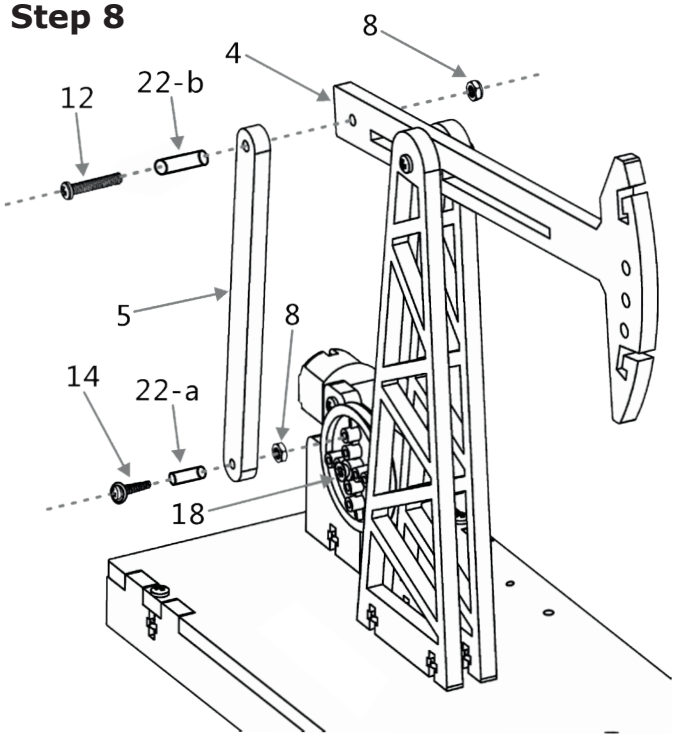
6. Mount both carrier panels to the base board.

Step 7

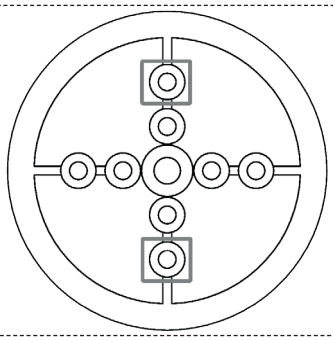


7. Install the walking beam to the carrier panels. Don’t forget to install spacer C.

Step 8

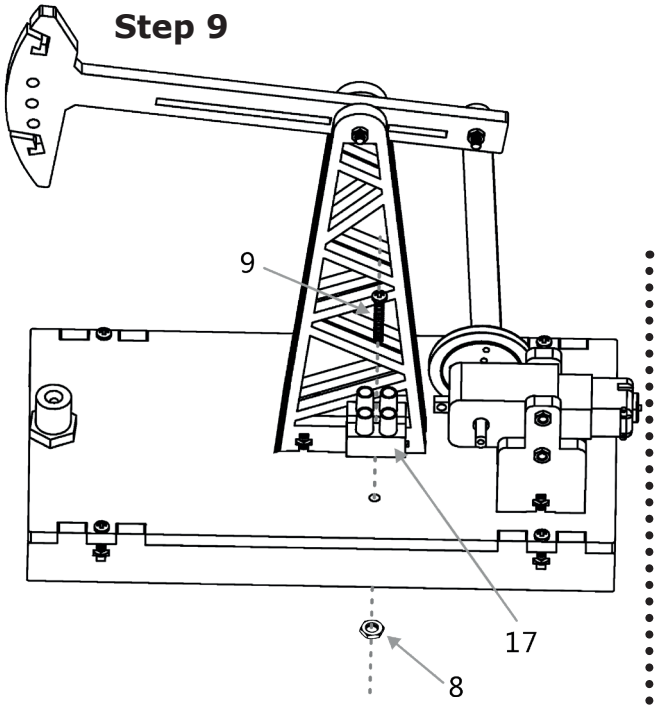


8. Mount the connecting rod between the walking beam and the traction wheel. Don't forget to install both spacers



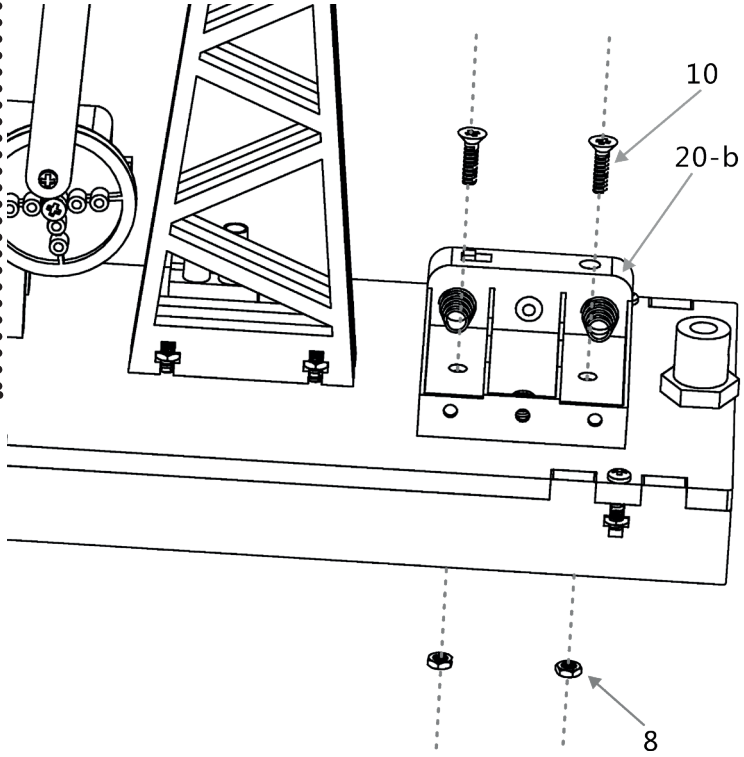
8.1. ***Attention!***
The screw must be attached into the quadratic marked holes at the wheel. This attachment will cause the traction wheel to be used as a crank shaft.

Step 9



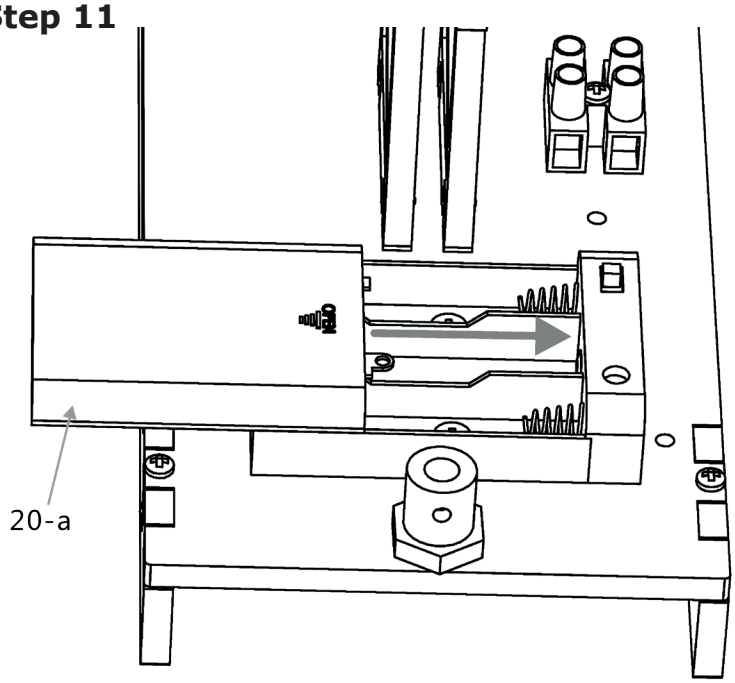
9. Install the battery compartment to the base board.

Step 10



10. Install the battery compartment to the base board.

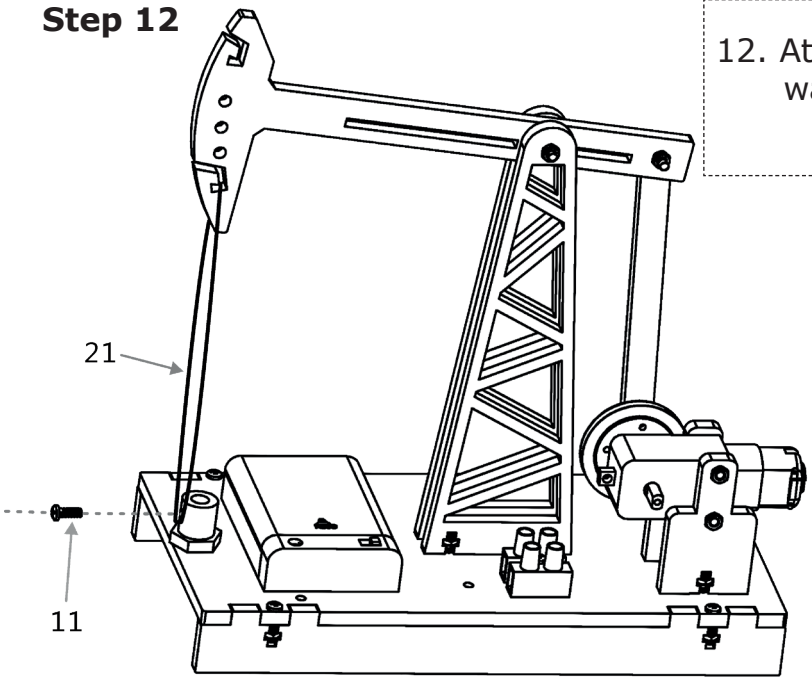
Step 11



11. Attach the terminal block to the base board.

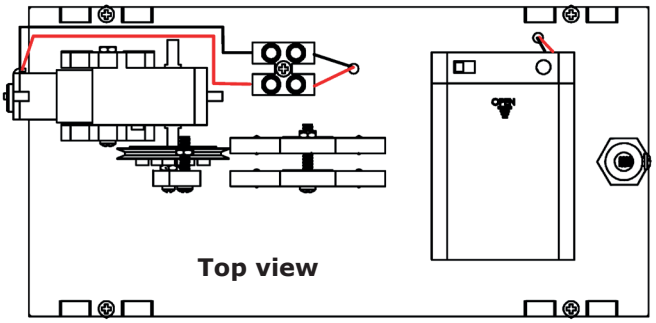
11a. Attach the battery cover to the battery compartment.

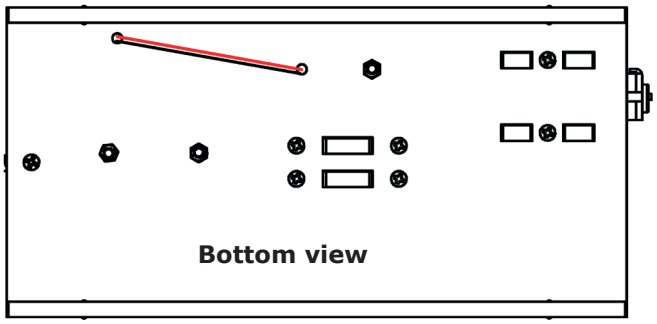
Step 12



12. Attach the rubber band between the walking beam and the axis with nut.

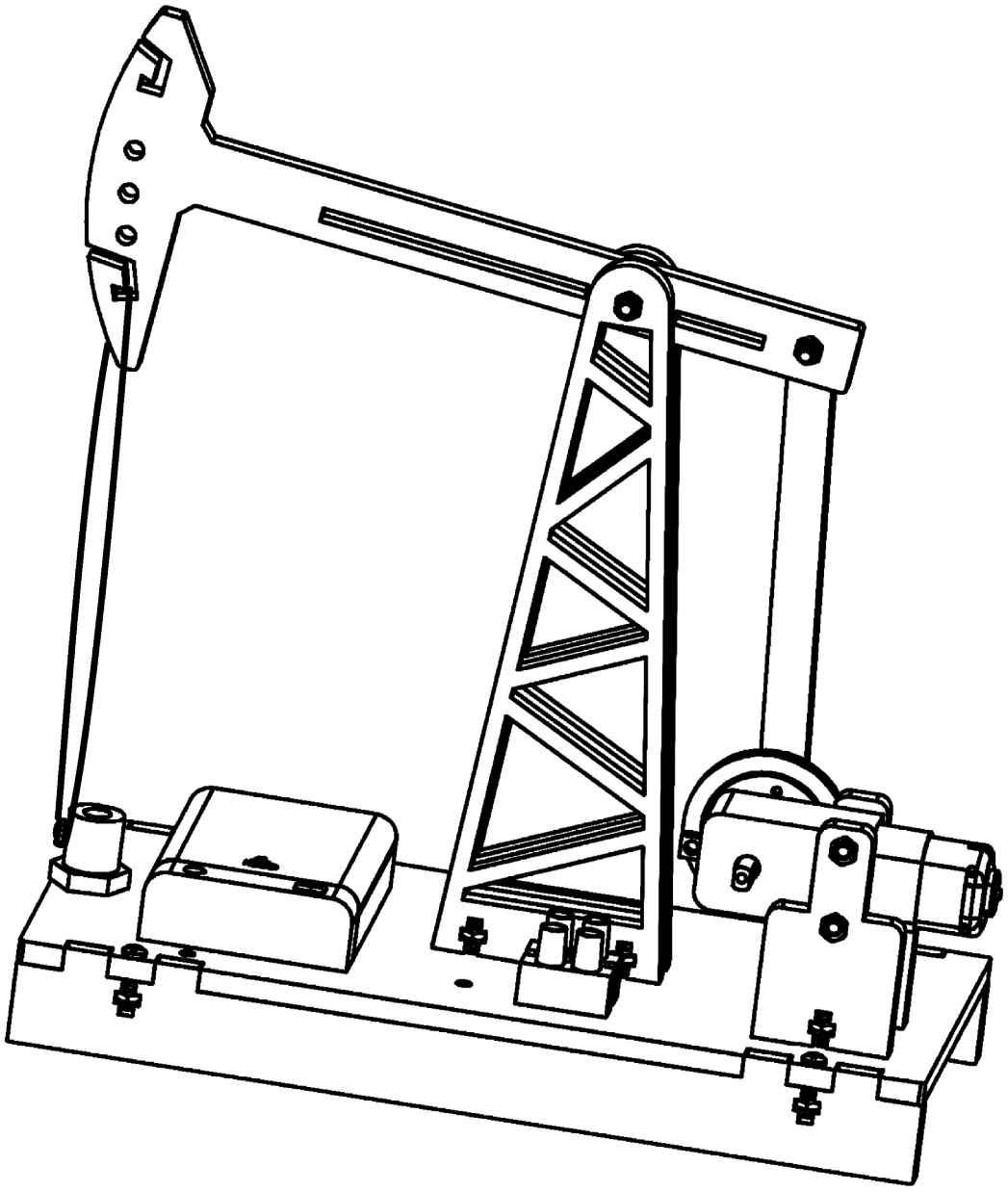
Step 13





13. Connect the cables to the terminal block. The cable routing between battery compartment and terminal block is to be located at the bottom side of the base board.

CONNECT
Red to Red
Black to Black



TESTING THE PUMPJACK

Insert 3 pcs. AA batteries into the battery compartment and switch the device "on". If the motor does not rotate immediately you might have to kick-start the engine.

Debugging procedure

If your PUMPJACK does not perform properly, try the following debugging procedure:

1. Check the batteries, the Switch and the electric wiring.
2. Remove the connecting rod between the motor and walking beam. Now check if the motor is running.
3. Connect the motor's cables directly to the batteries. Now check if the motor is running.

English

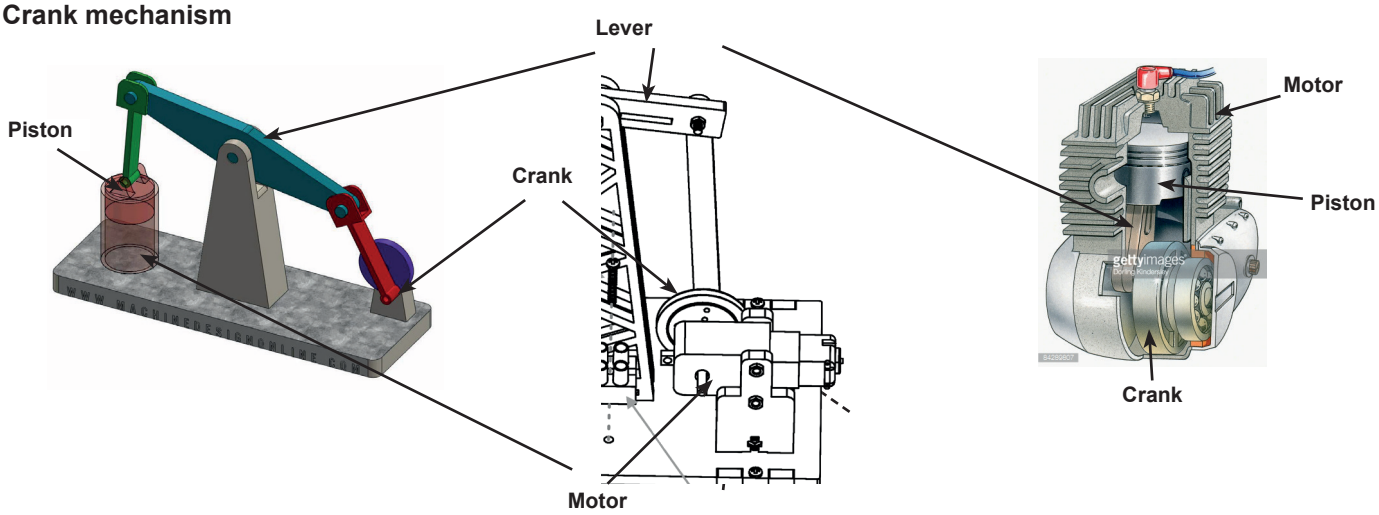
HOW DOES A PUMPJACK WORK?

In this chapter we describe detailed information about gear drive systems. We also explain what makes the PUMPJACK's design so extraordinary. The PUMPJACK's mechanics consist of several devices. The primary device is the motor, which delivers rotational energy at its fast spinning axis.

The cogwheels in the gear box are needed to couple the fast rotating motor axis to the slowly rotating, but more powerful traction wheel. In our design the traction wheel and the connecting rod are installed to act as a crank shaft, which transforms rotational energy in up- and downward movements.

A crank shaft may also be found in motor cars and motorcycles, in which the crank shaft transforms the up- and downward movements of the engine into the rotational energy for the wheels.

Crank mechanism

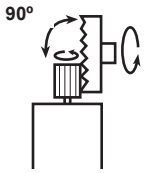


INFORMATION ABOUT GEARS

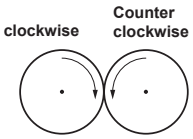
The transmission of power

Gears, transmission belts, shaft, crank, chains: They all can transmit power. In the soccer robot four gears transfer the motor power into the crank. Such a transmission is called a gear box. The power is transmitted by the teeth of the gears. At the same time three conversions take place:

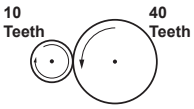
a. Change in rotating direction
b. Change in rotating speed
c. Change in torque



a. Change in rotating direction
When two gears are connected, there will be a change in rotation direction. One gear will rotate clockwise, the other gear will rotate counterclockwise.

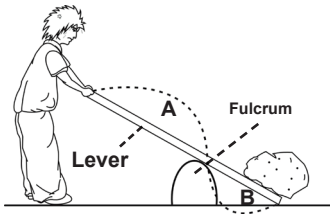


b. Change in rotation speed
The change in rotating speed depends on the relation of the teeth in the gear. As an example we describe a gear with 10 teeth and a gear with 40 teeth. When the first gear (10 teeth) makes a full rotation, the second gear 40 (teeth) only makes a quarter of a rotation. So before the second gear makes a full rotation, the first gear already makes four rotations. You may understand that this effect also changes the rotating speed.

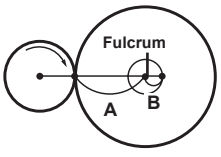


c. Change in torque
The torque can be seen as a lever construction with a fulcrum. Imagine a person who lifts a stone with a lever.

$$\text{Gear Ratio} = \frac{\text{Motor rotation}}{\text{Number of last gear rotati-}}$$



The person who lifts the lever must use more power when the distance A gets shorter or when the distance B gets longer.



This is about the same for gears. The power on the teeth increases on the inner side of the gear. For that function we are using spur gears.

NOTES

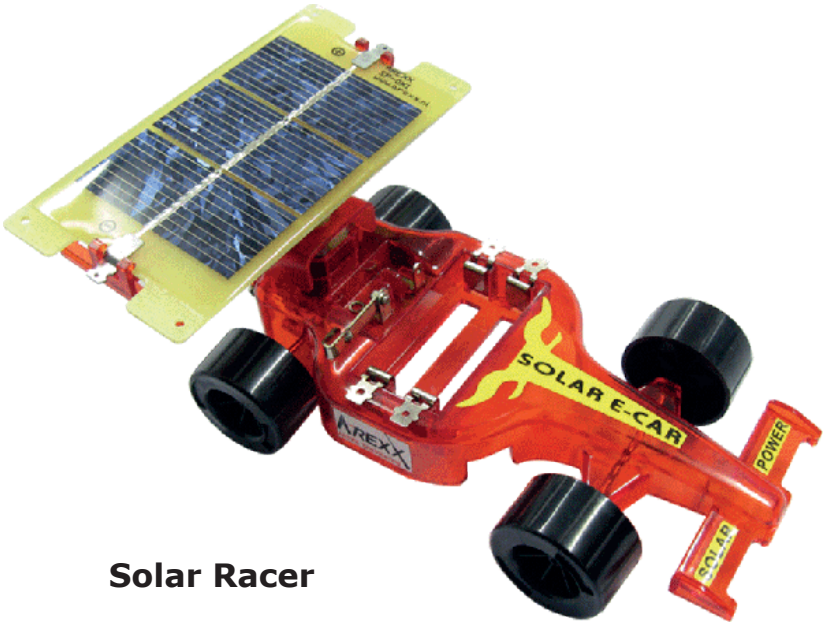
SCHOOL LAB KITS

Galvani Racer

Solar Cosmonaut

Tumbling robot

Solar fan



Solar Racer