# WIND POWER 2.0

Renewable Energy

Thames & Kosmos

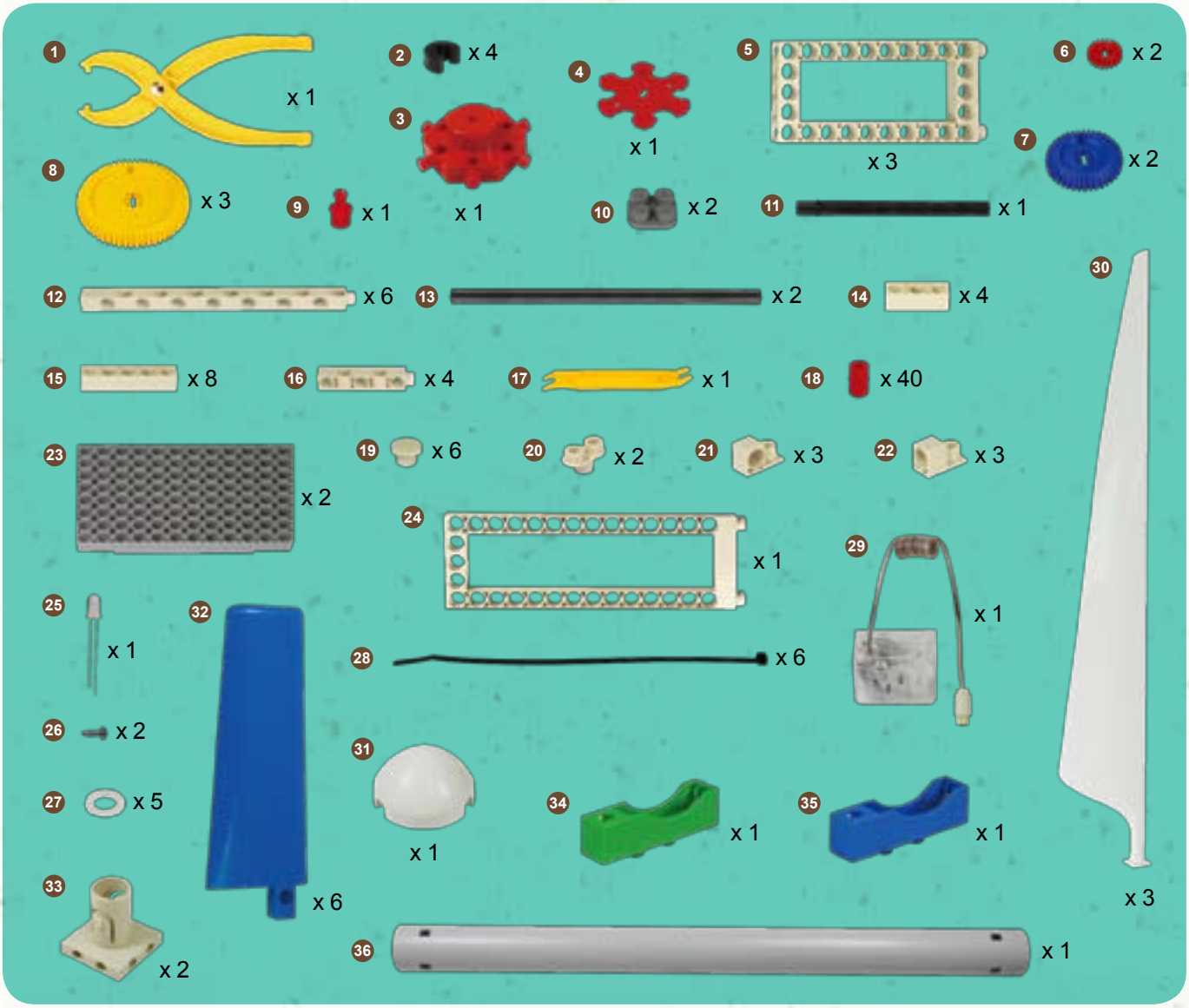
Instruction Book

# WIND POWER 2.0 | Parts List

| No | PARTS NAMES | PCS |
|---|---|---|
| 1 | RELEASE PLIERS | 1 |
| 2 | AXLE LOCK | 4 |
| 3 | UNIVERSAL ADAPTOR - BODY | 1 |
| 4 | UNIVERSAL ADAPTOR - COVER | 1 |
| 5 | SHORT FRAME | 3 |
| 6 | SMALL GEAR | 2 |
| 7 | MEDIUM GEAR | 2 |
| 8 | LARGE GEAR | 3 |
| 9 | SHAFT PLUG | 1 |
| 10 | BASE PLATE CONNECTOR | 2 |
| 11 | LONG AXLE | 1 |
| 12 | LONG ROD | 6 |
| 13 | EXTRA LONG AXLE | 2 |

| No | PARTS NAMES | PCS |
|---|---|---|
| 14 | 3-HOLE ROD | 4 |
| 15 | 5-HOLE ROD | 8 |
| 16 | 7-HOLE DUAL ROD | 4 |
| 17 | PART SEPARATOR TOOL | 1 |
| 18 | ANCHOR PIN | 40 |
| 19 | BUTTON PIN | 6 |
| 20 | TWO-TO-ONE CONVERTER | 2 |
| 21 | 90 DEGREE CONVERTER - L | 3 |
| 22 | 90 DEGREE CONVERTER - R | 3 |
| 23 | BASE PLATE | 2 |
| 24 | LONG FRAME | 1 |
| 25 | LED (LIGHT EMITTING DIODE) | 1 |
| 26 | SCREW | 2 |

| No | PARTS NAMES | PCS |
|---|---|---|
| 27 | WASHER | 5 |
| 28 | CABLE TIES | 6 |
| 29 | REVERSIBLE GENERATOR/ MOTOR WITH WIRE CONNECTOR | 1 |
| 30 | LONG TURBINE BLADE | 3 |
| 31 | TURBINE HUB | 1 |
| 32 | SHORT TURBINE BLADE | 6 |
| 33 | TUBE ADAPTOR | 2 |
| 34 | BATTERY CHARGER | 1 |
| 35 | BLUE BATTERY HOLDER | 1 |
| 36 | TOWER TUBE (41 CM) | 1 |
| | TOTAL | 133 |



## 2. WIND TURBINE BLADE DESIGN AND NUMBER

Traditional windmills come with more blades, a variety of shapes in cross-section, and low efficiency in converting wind into energy.

The cross-sections of modern wind turbine blades and airplane wings show convex tops and flat bottoms. When air passes over and under the blade, a faster air flow on the top creates a lower pressure, while the slower air flow on the underside is due to a higher pressure (Bernoulli's principle). Therefore, the side with the higher pressure pushes against the side with the lower pressure to reduce the frontal pressure in the blades. The teardrop-shaped cross section is less likely to produce a vortex (or turbulent, spinning air flow) when air passes around the blades; thus, higher energy conversion and efficiency is achieved. The windmill blades in this kit have a cross-sectional design developed using the principles of fluid mechanics.

Fig. 3 Dutch windmills, and water-pumping windmills found in the Midwestern and Western United States.

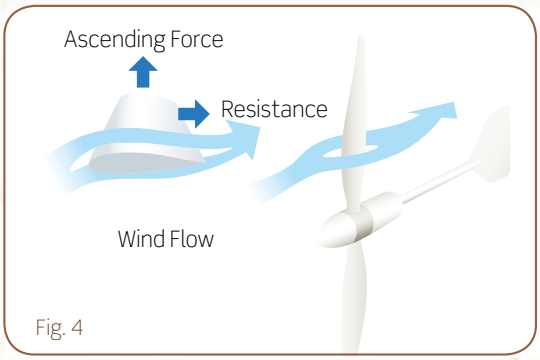



Fig. 4

Fig. 5

Fig. 6

Most commercial, electricity-generating wind turbines in use now use a three-blade design. Experimental findings show that the power generation capacity of turbines with three blades is optimal because, while the efficiency increases a little with more blades, turbines with more than three blades start to have structural problems. Also, enormous rotational torque is produced by ultra long blades. All blades therefore take on an elongated design.

This wind power kit facilitates the completion of numerous alternative energy-related experiments. Although it is true that the model's efficiency cannot match that of a commercial wind turbine, you will gain valuable scientific knowledge through this hands-on experience.

Fig. 7 Modern wind turbines are very large. This diagram shows you the size, as compared to a person standing on it.

## 3. WIND POWERED ELECTRIC GENERATORS

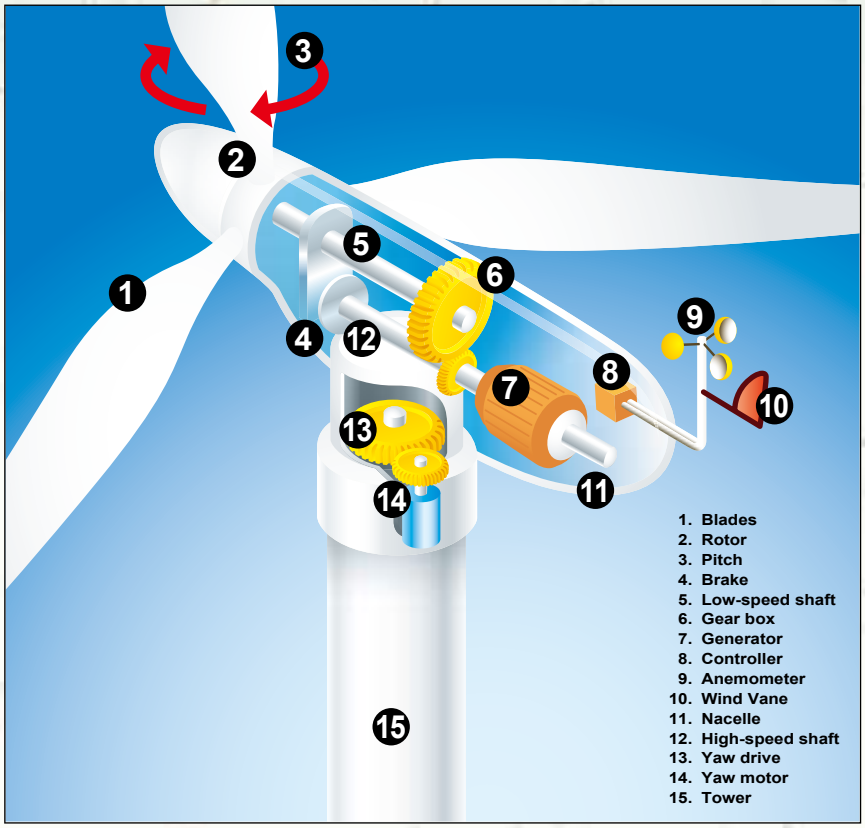



Fig. 8

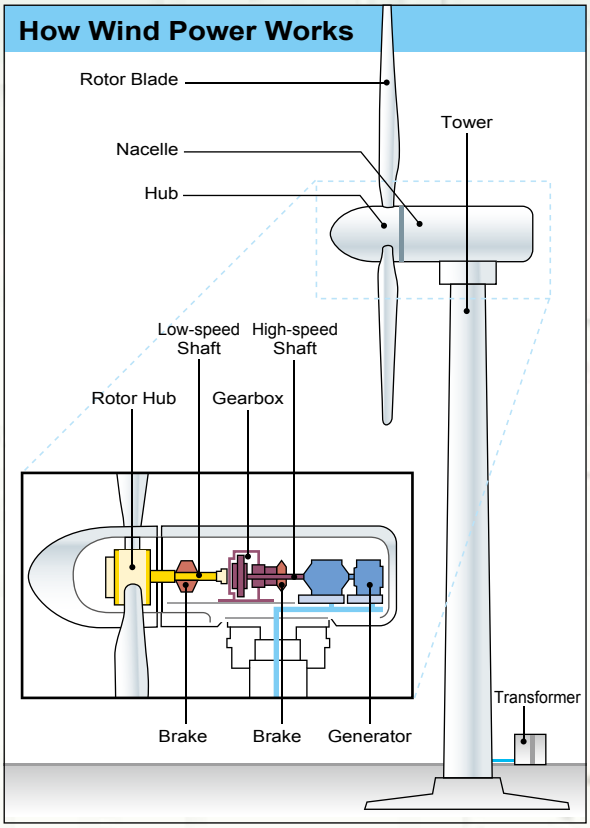



Fig. 9

Wind is a clean and favorable source of sustainable energy with few drawbacks. Because wind is clean and renewable, and wind turbine technology has reached a practical efficiency, people around the world have started to manufacture more and more wind turbines for commercial use, making wind the fastest growing renewable energy source. When wind turns windmill blades, torque is generated to turn the gearbox, power the generator, and then create electricity. The process shows how wind power is converted into mechanical power, and then turned into electrical power through generators. For home use, the electrical power needs a further transformation by transformers, and is finally distributed to consumers via the electrical grid. The real-world wind power generator uses an alternating current (AC) generator. Its electrical power has to be rectified into direct current (DC) when stored in a battery.

## 4. DIRECT CURRENT GENERATOR

According to Fleming's right hand rule, when the right index finger is pointing towards a magnetic field, the thumb is meanwhile indicating the direction of motion of the conductor, and the middle finger is showing the direction of the electrical current (positive charge of current). This is the principle behind power generator.

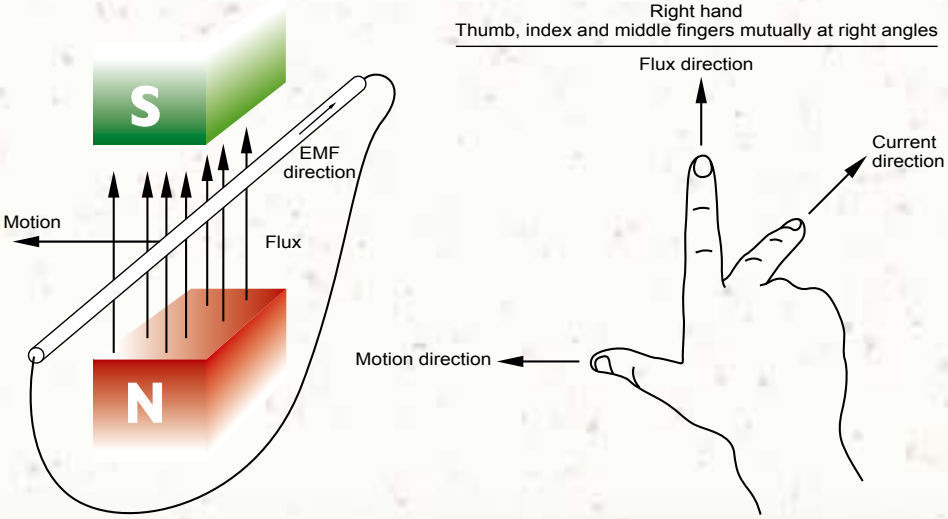
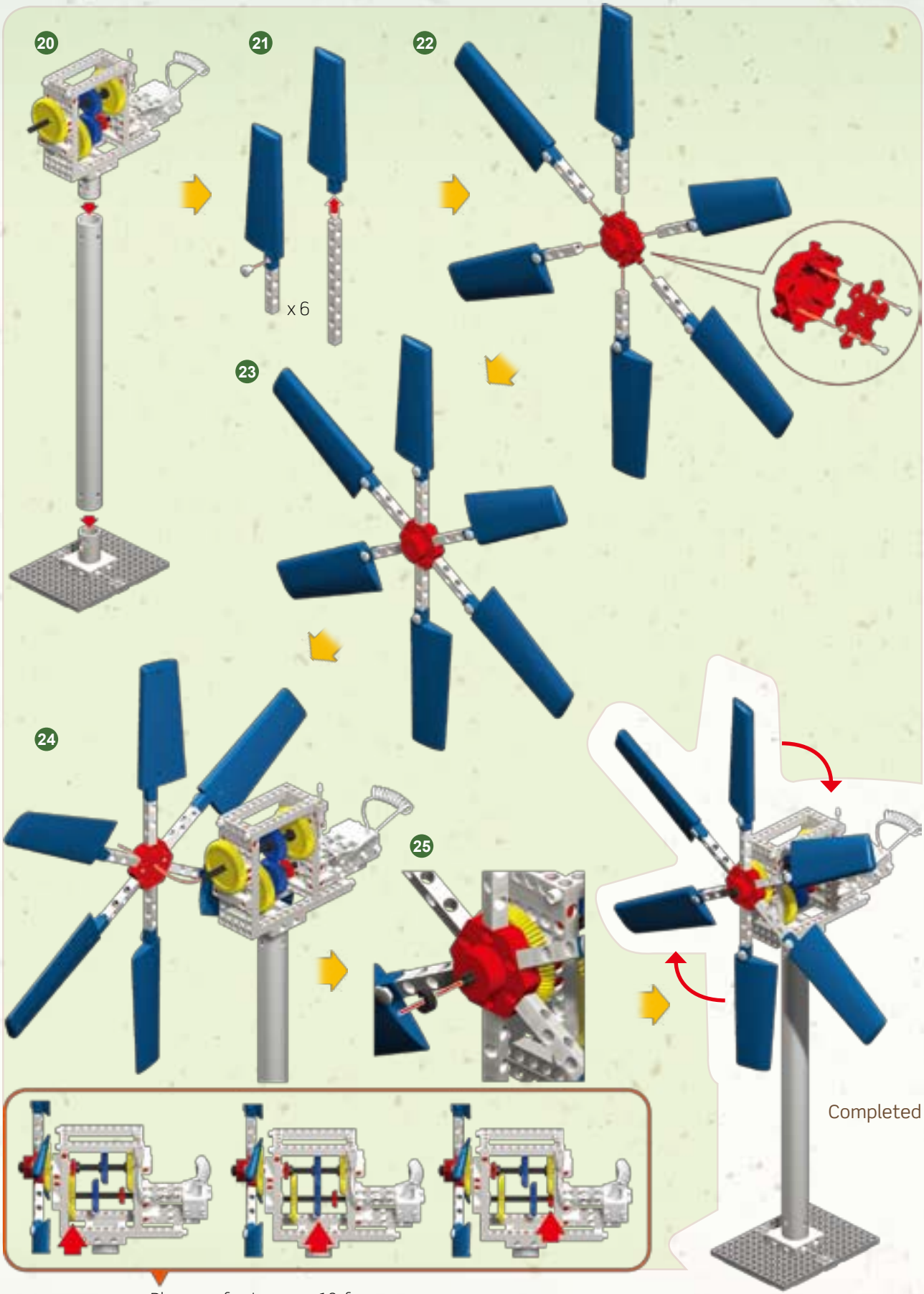
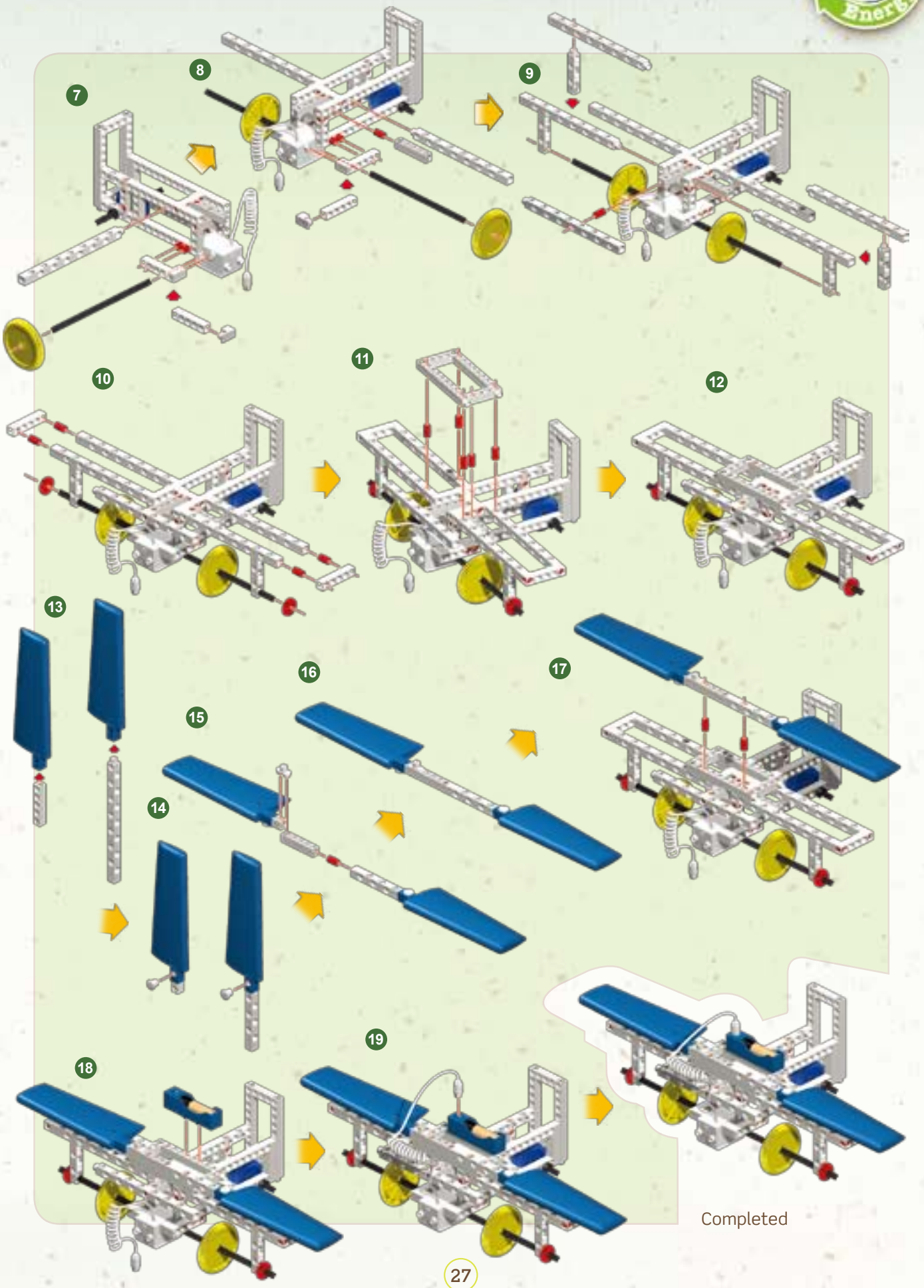



Fig. 10 The biggest difference between a direct current generator and an alternating current generator is the commutator connecting the coil, also known as the "brush" structure.




Please refer to page 10 for gearbox instructions.

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