

ELECTRIC FAN



General Information

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Pflizerstrasse 5-7, D-70184 Stuttgart
Tel. +49 (0)711 2191-343

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Project management: Gerhard Gasser
Technical product development: Dr. Petra Müller
Editing: lektorat & textlabor, Christiane Theis, Gärtringen;
Manual design: Atelier Bea Klenk, Berlin
Technical editing, manual layout: Natalie Rapka, reinisch AG, Karlsruhe; Packaging layout and illustrations and title image: Peschke Grafik-Design, Ostfildern; Manual illustrations: Nonsquare Mediendesign, Wuppertal

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Editing: Ted McGuire; Additional Graphics and Layout: Dan Freitas

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Dear Parents!

Before starting these experiments, read through the manual together with your child and discuss the safety information. Check that the electric fan has been assembled properly, and help your child with the experiments.

Have fun with the experiments!

Photos: BeTa-Artworks (girl with fan); arthurdent (feather); ksen32@ukrpost.ua (resistors); FMUA (colorful fan); Marzanna Szymer (children with pinwheels); Chris Fisher (hovercraft) (all ©fotolia.com)

Franckh-Kosmos Verlags-GmbH & Co. KG, Pflizerstr. 5-7, 70184 Stuttgart, Germany | +49 (0) 711 2191-0 | www.kosmos.de
Thames & Kosmos, 301 Friendship St., Providence, RI, 02903, USA | 1-800-587-2872 | www.thamesandkosmos.com
Thames & Kosmos UK Ltd, Goudhurst, Kent, TN17 2QZ, United Kingdom | 01580 212000 | www.thamesandkosmos.co.uk

Hey Kids!

There are bound to be more hot summer days coming at some point. Why not build your electric fan now so you can enjoy its cool breeze?

You will also be able to use its speedy propeller to perform some exciting experiments. You can learn how simple electric circuits work. And you'll have fun getting a little dizzy as you watch the fan spin around and around!

So let's get to it!

Have fun!



Safety Information

NOTE! Not suitable for children under 3 years of age. There is a danger of choking due to small parts that may be swallowed or inhaled.

NOTE! Only for use by children 8 years and older. Instructions are included for parents or other supervising individuals. Please follow them! Save the packaging and instructions. They contain important information.

BATTERIES

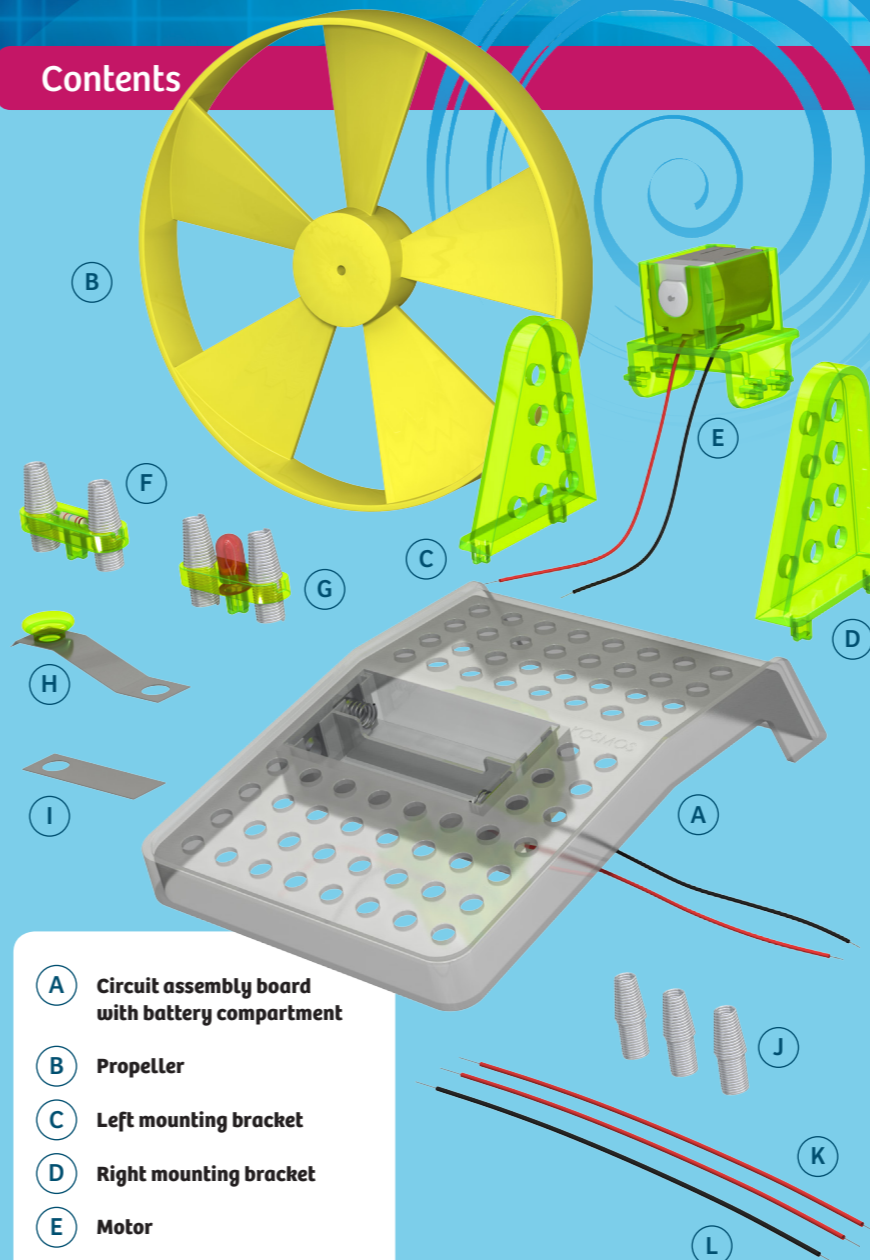
- Two AA batteries (1.5-volt, type AA/LR6/penlight) are required. They are not included in the kit due to their limited storage life.
- The supply terminals are not to be short-circuited. A short circuit can cause the wires to overheat and the batteries to explode.
- Different types of batteries or new and used batteries are not to be mixed.
- Do not mix old and new batteries.
- Do not mix alkaline, standard (carbon-zinc), or rechargeable (nickel-cadmium) batteries.
- Always insert batteries in the right polarity orientation, pressing them gently into the battery compartment.
- Do not recharge non-rechargeable batteries. They could explode!
- Rechargeable batteries are only to be charged under adult supervision.
- Rechargeable batteries are to be removed from the toy before being charged.
- Exhausted batteries are to be removed from the toy.
- Dispose of used batteries in accordance with environmental provisions.
- Be sure not to bring batteries into contact with coins, keys, or other metal objects.
- Avoid deforming the batteries.
- The wires are not to be inserted into socket-outlets.

Information about Environmental Protection



None of the electrical or electronic components in this kit should be disposed of in the regular household trash when you have finished using them; instead, they must be delivered to a collection location for the recycling of electrical and electronic devices. The symbol on the product, instructions for use, or packaging will indicate this. The materials are reusable in accordance with their designation. By reusing or recycling used devices, you are making an important contribution to the protection of the environment. Please consult your local authorities for the appropriate disposal location.

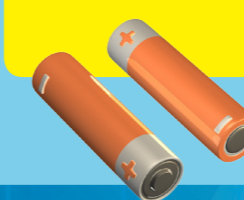
Contents



- A** Circuit assembly board with battery compartment
- B** Propeller
- C** Left mounting bracket
- D** Right mounting bracket
- E** Motor
- F** Resistor
- G** Red light-emitting diode
- H** Bent metal plate with button (for switch)
- I** Straight metal plate (for switch)
- J** 3 Springs
- K** 2 Red wires
- L** Black

You will also need:

- Two AA batteries, 1.5-volt (type AA/LR6/penlight)
- Two thin books
- One thick book
- Small, fluffy feather

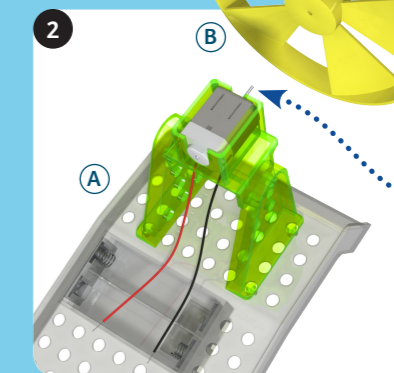
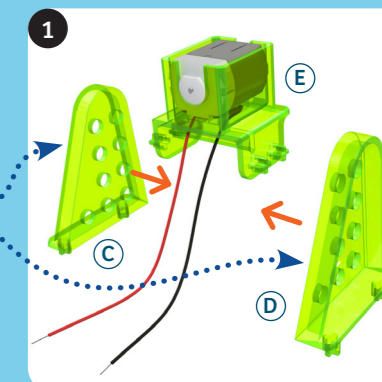


How to Assemble Your Fan

STEP 1

Press the two mounting brackets **C** and **D** onto the pegs on the left and right sides of the motor **E**.

Be sure that the slanted edges of the brackets are positioned on the side where the wires leave the motor.



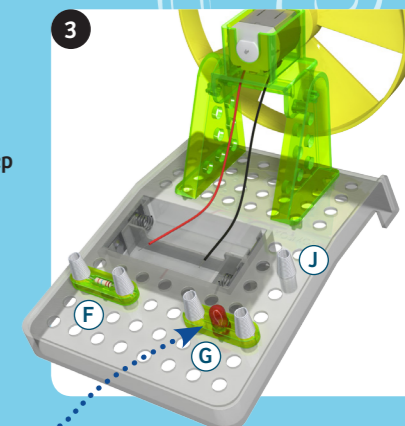
STEP 2

Set the brackets together with the motor onto the assembly board **A** and mount the propeller **B** on the motor shaft.

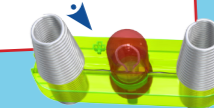
STEP 3

Insert the spring **J**, the resistor **F** and the LED **G** into their positions. The springs should be mounted as deep as possible in the holes of the board.

By the way: "LED" is an abbreviation for "Light Emitting Diode."



IMPORTANT! The LED must be placed so that the little plus sign is on the left.

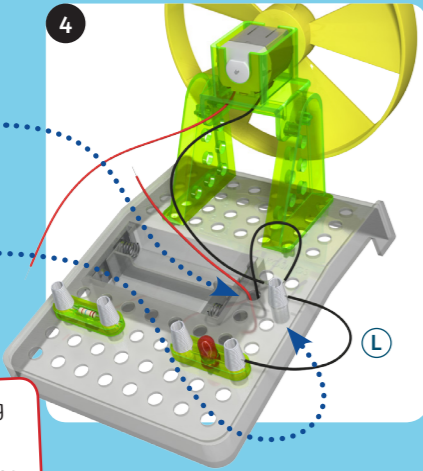


TIP! Be sure to insert the narrow end of the spring into the hole. If a spring gets stuck in the assembly board, just push it out from the other side.

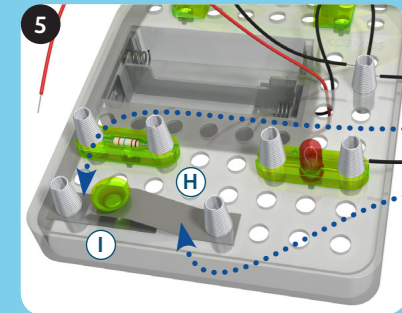
How to Assemble Your Fan

STEP 4

Guide the two battery compartment wires from below up through the hole to the left of the spring. Connect the two black wires — the one from the motor and the one from the battery compartment — to the spring. The loose black wire (L) will be connected here too — it leads from the LED to the single spring.



TIP! To attach the wire, bend the spring in order to create a small gap. Insert the free end of the wire into this gap. As soon as you let go of the spring, the wire will be clamped tight.



STEP 5

First attach the straight metal plate (I) with a spring to the assembly board, and then the bent metal plate and button (H) with the third spring.

TIP! This is how the assembled switch looks from the side.

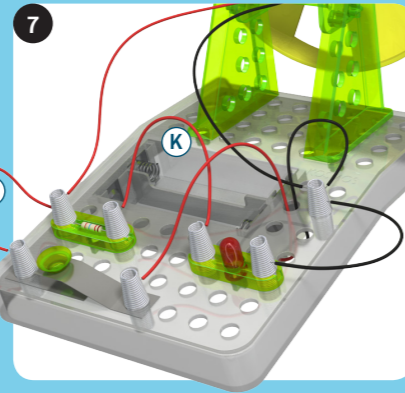
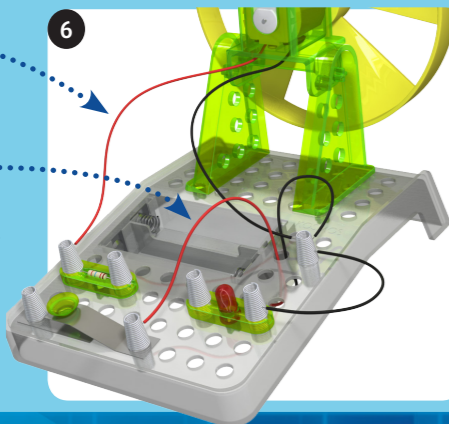


The switch is now assembled!

STEP 6

Connect the red motor wire to the resistor's left spring.

Attach the red battery compartment wire to the spring on the right side of the switch.



STEP 7

Mount one of the two red wires (K) between the left resistor spring and the spring on the left side of the switch. Then, use the second red wire to attach the right resistor spring to the spring on the left of the LED.

STEP 8

Insert the batteries into the assembly board's battery compartment.

NOTE! You must pay careful attention to polarity. You will see a plus sign and a minus sign on the battery, and the same symbols in the battery compartment. Insert the battery in such a way that the positive (plus) end lines up with the plus sign and the negative (minus) end lines up with the minus sign.



Your electric fan is now ready to run!

A Little Fresh Air

EXPERIMENT 1

Have you already figured out how to start up the fan? If not, let's do it now.

YOU WILL ALSO NEED:

> Your electric fan, two thin books

1. Press the button on the switch. The LED will light up and the propeller will gradually start turning — and then spin faster and faster.
2. Let go of the button and the propeller will gradually slow down and finally come to a stop. The LED will go out.

NOTE! As soon as the fan gets up to full speed, the assembly board will start to move sideways. Place books to the left and right of the board to secure it.

TIP! Does the LED not light up? In that case, your batteries are probably too old. Try using some fresh ones.

WHY? When you press the switch, it closes the circuit.

When that happens, the current is able to flow from the batteries through the resistor and the LED to the fan motor, and then back to the batteries again.

As soon as you let go of the button, the flow of current is broken and the motor and LED stop receiving electricity.

Feather-Light Flight

EXPERIMENT 2

What will happen if you place a feather in front of the propeller?

YOU WILL ALSO NEED:

> Your electric fan, two thin books, one thick book, a feather

1. Set the thick book in front of the propeller. Don't let them touch.
2. Place the feather on the book close to the propeller. As soon as the propeller gets up to speed, the feather will be blown away.

WHY? The spokes of your propeller are called "rotor blades." They are shaped in such a way that they grow larger as they extend out from the center. They are mounted at a slight angle so air is pushed away as they turn. This stream of air is what pushes the feather away.

Turning Right or Turning Left?

EXPERIMENT 3

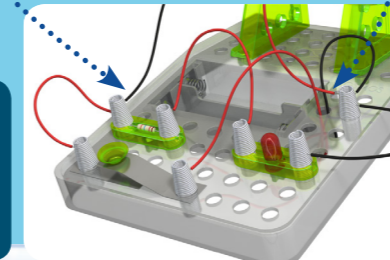
Does your propeller turn to the right or the left?

YOU WILL ALSO NEED:

> Your electric fan, two thin books

1. Press the switch. Viewed from the front, the propeller turns to the left.
2. Switch the two motor wires. Press the switch again, and the propeller will turn to the right.

WHY? When you switch the two motor wires, you change the direction in which the current flows through the motor. As a result, the propeller turns in the opposite direction too.



Permanent Propeller

EXPERIMENT 4

Reconfigure the switch so you can get cool air without having to keep your finger on it.

YOU WILL ALSO NEED:

> Your electric fan, two thin books

TIP! If the spring is stuck to the sheet of metal, carefully twist it to remove it.



NOTE! For long-term operation, stabilize the fan with two books.

1. Take out the two batteries!
2. Remove the spring holding the bent metal plate.
3. Release the button from the metal plate.
4. Reattach the metal plate upside down in the same location. Be sure that the two metal surfaces are in contact with each other.
5. Reinsert the batteries. The propeller will turn even if you don't push the switch.

WHY? The permanent contact between the switch's two metal plates lets the current flow without interruption. The propeller turns and turns.

Check It Out

WHAT IS AN ELECTRIC CIRCUIT?

In a circuit, an electric current connects a power source with electronic components that do specific things. In your fan, the power source is the batteries, while the components are the motor and LED.

WHY DO YOU NEED RESISTORS?

Electrical resistors pose an obstacle to current — hence their name. The resistor is an absolute necessity in your circuit, since it protects the LED from being destroyed by an overly strong current. The resistance value is indicated in ohms (Ω). The resistor in your kit is 100 ohms.

HOW DOES AN ACTUAL FAN WORK?

It works just like the one in your kit. The only differences are that it's bigger and its motor turns faster.

BEHIND BARS?

When large propellers spin quickly, they are very dangerous — the blades will chop up anything that gets between them. That's why there's a cage, so you don't inadvertently stick your hand into the blades.

WHY DO THE ROTOR BLADES "DISAPPEAR" WHEN THEY SPIN?

The human eye can only see things clearly below a certain speed. The fan's rotor blades spin much too quickly for our eyes and our brain to see them clearly.

WHAT CAN FANS DO?

Fans are used in countless applications where a stream of air is needed to perform a function. There are boats that are powered by large fans!

AIR-CUSHION VEHICLES (HOVERCRAFT)

They can travel over flat land and water, gliding along on a cushion of air created under the boat by motors and propellers. A rubber skirt around the boat prevents the air from escaping too quickly. For horizontal movement, there are powerful propellers on the back. When they push out air, the boat moves forward. If they suck in air, the boat moves in reverse.

