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The returning tin can

Pedagogical guidelines and construction instructions

This guide includes:

- How the machine can be used to learn STEM areas
- How to construct the returning tin can

How the returning tin can can be used to learn STEM areas

What is the returning tin can?

The machine consists of a rubber band that is twisted inside a cylinder shaped tin can. As the cylinder rolls across the floor, the twisted rubber band will make the can roll in the opposite direction as soon as it stops. Kinetic energy of the rolling cylinder is transformed to elastic energy stored by the rubber band and then back to kinetic energy as the cylinder rolls in the opposite direction.

Figure 1. The returning tin can

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The following are ideas how to introduce STEM concepts when constructing the returning tin can. The teacher can adapt these suggestions to their own class and context and plan their own activity (Plan template).

Target group

The returning tin can described here is designed for children from 4 to 7 years old. Teachers can adapt the proposal to other ages.

The teacher can decide depending on her/his knowledge of the children whether the children should work in groups or individually.

Learning goals

When constructing the returning tin can several learning goals can be achieved:

- To learn about physics and energy sources, in particular, kinetic energy and elastic energy. It can also be used to learn about energy transformation, namely transferring the kinetic energy in the moving cylinder into elastic energy stored in the rubber band and then back to kinetic energy as the cylinder starts rolling back.
- For the youngest children the main goal is to let them experience the phenomena of energy transformation rather than learning abstract concepts like kinetic and elastic energy
- To develop engineering competences of analysis and construction.
- To learn mathematical concepts within the construction and assembly process, including shapes.
- The machine is partly made of reusable material (the box). This is an opportunity to raise the awareness of sustainability and reusability.
- Other soft-learning goals can be included; problem solving and creativity.

Guide how to introduce STEM concepts during construction

Observing and making hypothesis

The first thing the teacher does is show a model of the returning tin can. The teacher can ask "why did it come back?"

Exploring and learning about physics and mechanisms.

Children can observe the returning tin can, and make comments and ask questions about how it functions. After this, the students can dismantle the box to explore the mechanism and make inquiries about its function.
Teachers can talk about energy sources in a very simple way. The teacher can stimulate the students to reflect on why the box is returning, and where the energy comes from. Other words for energy might be used in the start like force or power even if these are not exact synonyms of energy.

Effects similar to the Newton disk can be obtained by adding different kinds of colour-patterns on the surface of the toy. See video at https://youtu.be/O09nW9SqoW0 and the section on the Newton disk found elsewhere on the Autostem web pages.

Starting to construct the returning tin can, and learning mathematics and physics

Continuing with learning about shapes: During the construction of the machine, the children must identify the centre of a circle to place the holes for the rubber band correctly. They will also get experience with the surface area of the cylinder wall when cutting the paper coating to the correct size.

Constructing the mechanism to develop engineer competences

The students can identify the different parts of the machine after dismantling it. Together with the teacher, they can plan the building of the machine.
The teacher continues talking with the children about the pieces and materials to construct the mechanism.
Children construct the mechanism following the method described in "How to construct the returning tin can".

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Variations on the returning tin can

The machine can be made of a bottle instead of a cylinder-shaped box. The children can experiment with different colour patterns to explore the visual effects that might occur.

Figure 2. Variants of the returning tin can.

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How to construct the returning tin can

The different parts needed are shown in figure 3.

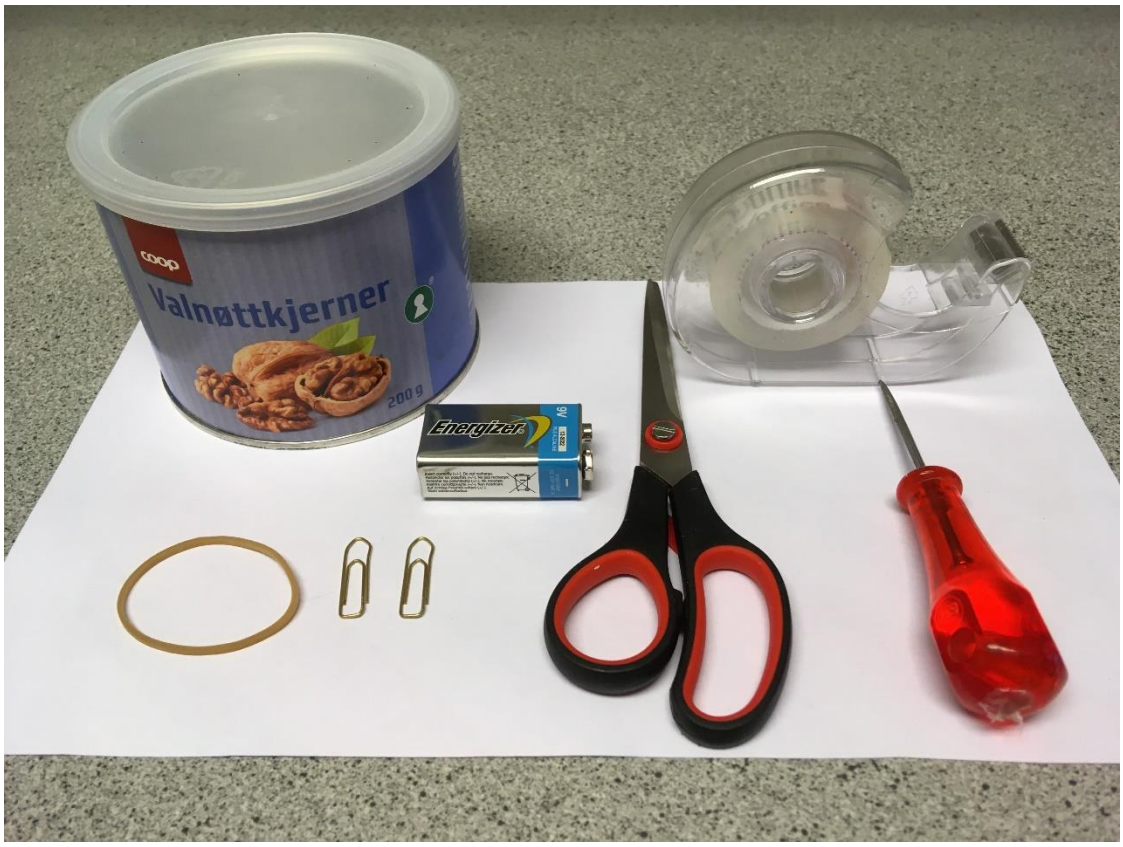

Figure 3 Parts and tools required

Parts and tools required

- Cylinder shaped box. In this case a box for nuts, be aware of allergies
- 9V battery. Use only discharged batteries. To be sure that there are no risk, the battery can be shortcut by the teacher prior to the activity by putting one blade of the scissors in contact with the two poles for a while
- Sticky tape
- Scissors
- Rubber band
- Paper clips
- Awl, another pointed tool could also be used, for example a four inch nail

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Method

It is best to watch the video at https://youtu.be/O09nW9SqoW0 before starting to make your returning tin can. Figure 4 and the guidelines below is a step by step guide on how to build the toy.



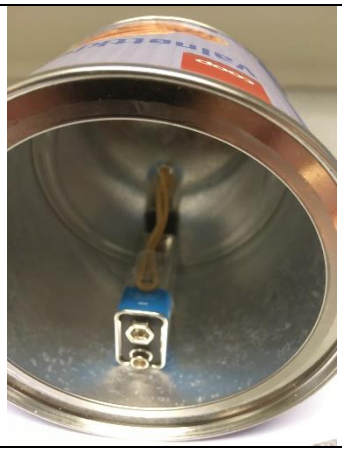
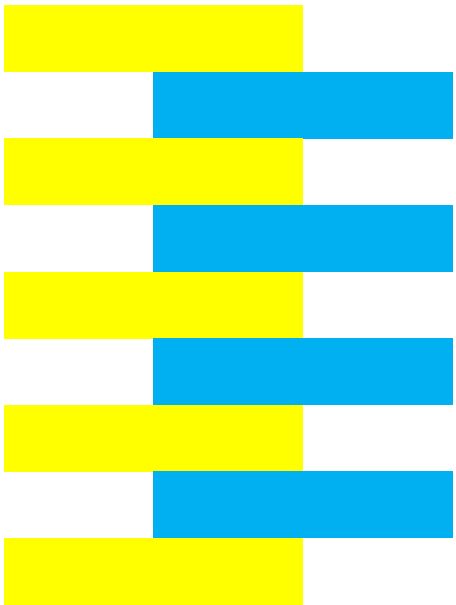



Figure 4. Building the always come back machine

1. Identify the centre of the lid and the bottom of the box and make holes with the awl. This may be done with the assistance of the teacher.
2. Using scotch tape, add the rubber band to the battery as shown above.
3. Unfold the paper clip and use it as a needle to thread the rubber band through the holes in the bottom and in the lid of the box.
4. Fold the paper clip so that it will not slip back into the box
5. Make the desired pattern on a paper and stick it to the box using scotch tape.

Appendix:

Example of pattern for adding optical effects to the returning tin can



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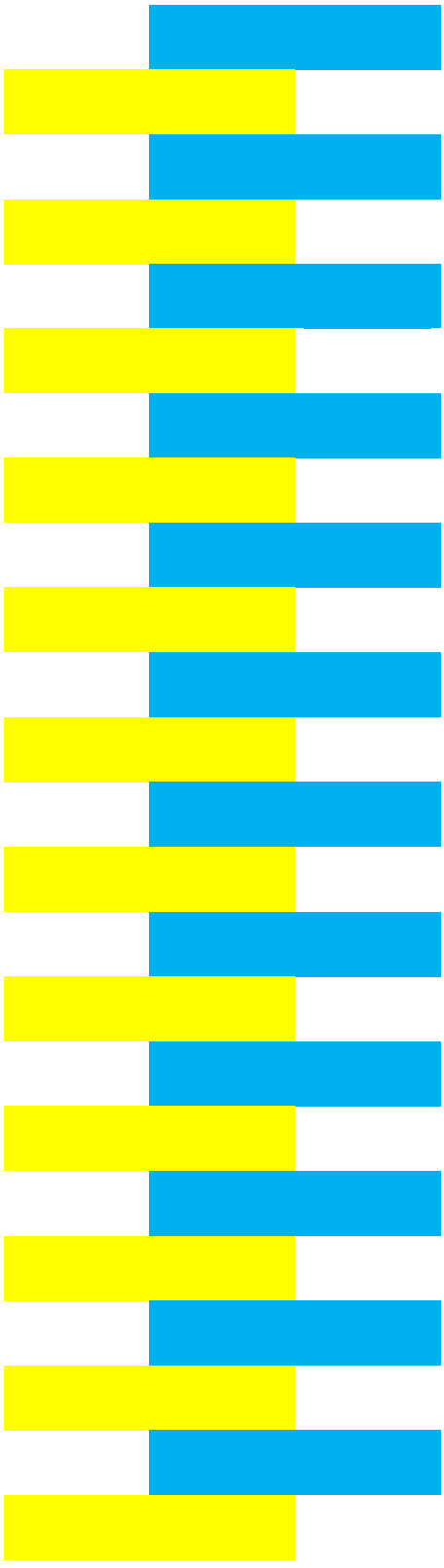

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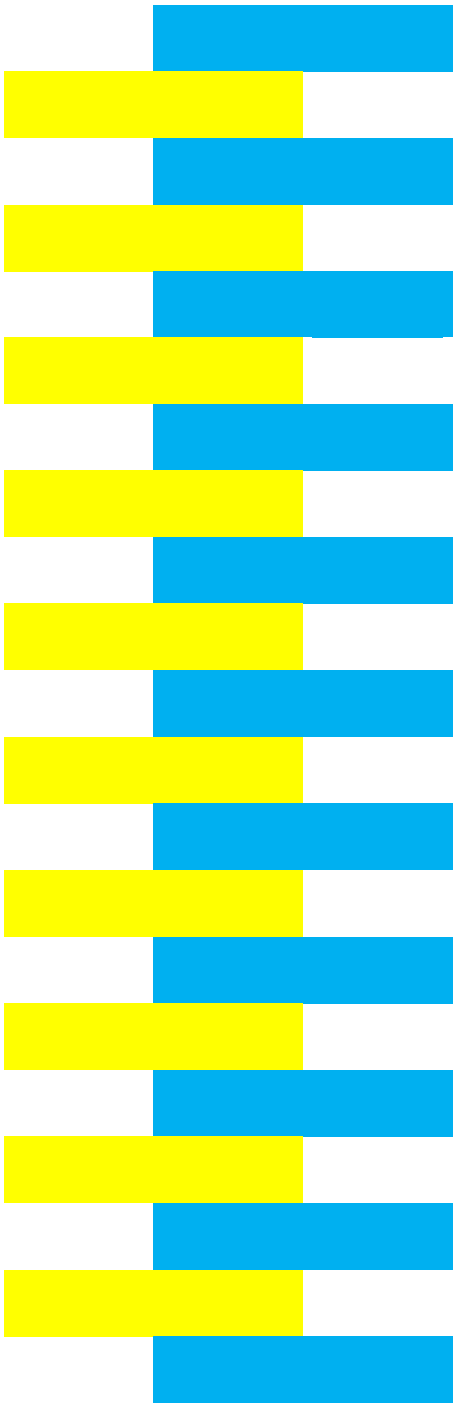

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