

References and Recommended Reading

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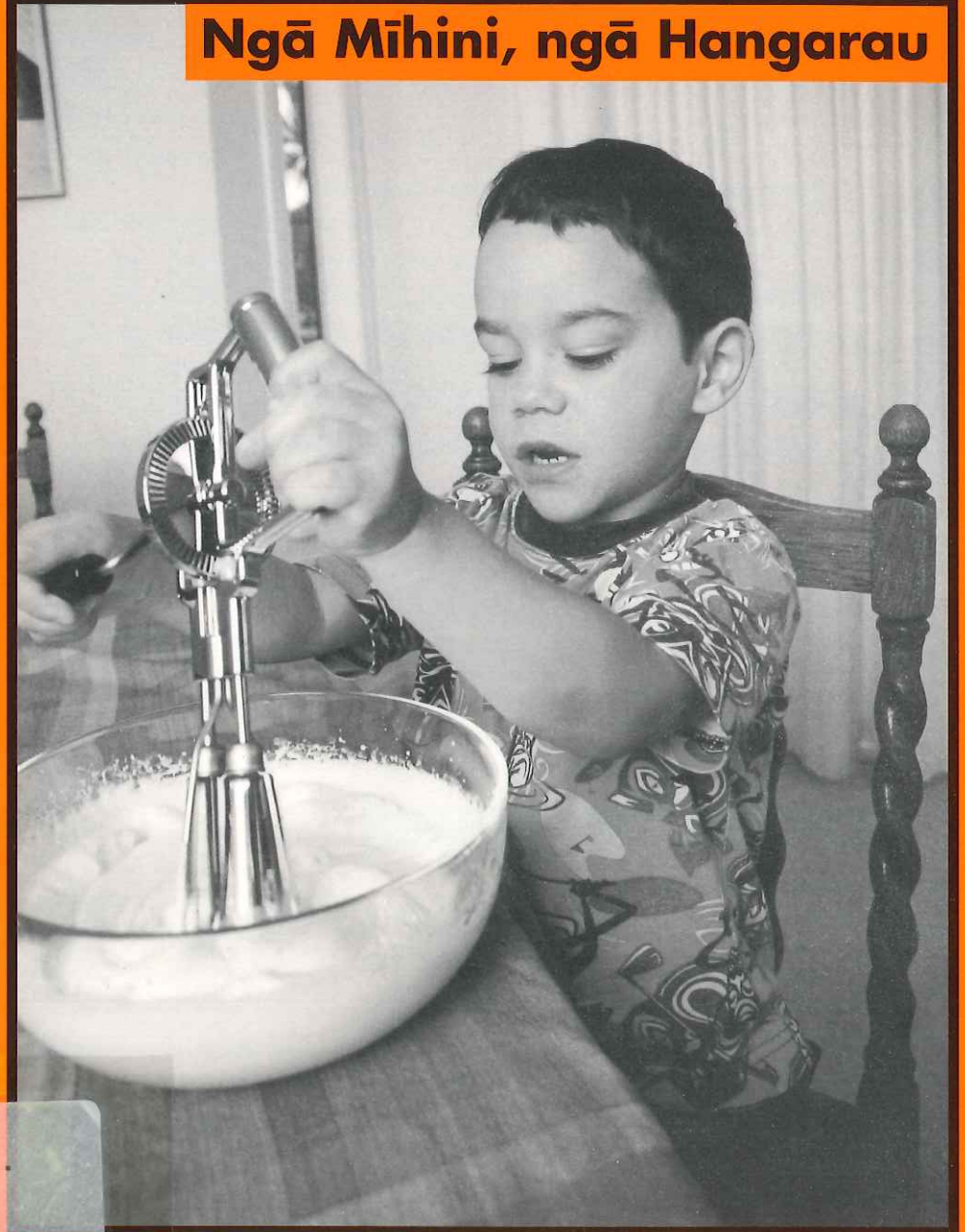


MINISTRY OF EDUCATION

Te Tāhuhu o te Mātauranga

Machines and Technology

Ngā Mīhini, ngā Hangarau



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Machines and Technology

Ngā Mīhini, ngā Hangarau

About This Resource *Mō te Rauemi Nei*

This picture pack is intended to be used with children in early childhood education settings. The twelve pictures show a variety of simple and complex machines in contexts that young children may be familiar with.

These teaching notes include:

- brief background information;
- links to *Te Whāriki*, the early childhood curriculum;
- suggestions for activities that will help young children to make sense of their physical world and to develop their understanding of technology and the relationship between people, technology, and the environment.

Although computers often play an important part in young children's lives, this resource focuses on aspects of technology other than information technology.

The Big Ideas *Ngā Whakaaro Nui*

The photographs and activities in this resource are designed to develop young children's interest in the power, magic, and simplicity of machines; to help them understand some basic principles of machines; and to introduce them to the relationship between technology and society. They will also help to prepare children for learning in technology at school.

What Is Technology? *He Aha te Hangarau?*

Technology is a creative, purposeful activity aimed at meeting needs and opportunities through the development of products, systems, or environments. Knowledge, skills, and resources are combined to help solve practical problems. Technological practice takes place within, and is influenced by, social contexts.

Technology in the New Zealand Curriculum, page 6

Acknowledgments *He Mihi*

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Specifically, the big ideas focused on in this resource are:

- **People make machines to meet a need.**
- **People use machines to make work easier.**
- **Some machines do things that people can't do.**
- **Machines affect the lives of people.**
- **Some machines are used in recreation.**
- **Some machines speed up work.**
- **Machines can be dangerous.**
- **Machines have moving parts.**
- **Machines need to be maintained.**
- **Some mechanical principles were discovered a long time ago.**
- **Machines can change the direction or speed of movement.**
- **Machines need energy to work.**
- **Some machines change energy from one form to another.**
- **Some machines are tiny, and some are very large.**

Links with the Early Childhood Curriculum

Ngā Hononga ki te Marautanga Kōhungahunga

The principles and strands of *Te Whāriki*, the early childhood curriculum, are well reflected in the activities and experiences that arise from this resource. In the following outlines of such experiences, examples of principles and strands are highlighted.

- Experimenting with simple machines and technology in a safe physical and emotional environment allows children to feel **empowered** in their learning.
- Discovering basic technological ideas through open-ended exploration and play enhances **holistic development**.
- Seeing the links between their early childhood educational setting and the machines and technology in the known wider world affirms children's sense of **belonging**.

- Predicting, planning, reasoning, and guessing are essential platforms for the development of effective **communication skills**.

The **exploration** strand is particularly relevant to this resource, as shown by the following goals related to typical experiences:

- **Children experience an environment where their play is valued as meaningful learning ...** when adults recognise and value that children are making decisions when playing and experimenting with machines and technology.
- **Children experience an environment where they gain confidence in, and control of, their bodies ...** through practice in using tools, materials, and equipment to make, recreate, or explore machines.
- **Children experience an environment where they learn strategies for active exploration, thinking, and reasoning ...** through problem solving, classifying, discussing, planning, observing, thinking logically, and making comparisons about different types of machinery.
- **Children experience an environment where they develop working theories for making sense of the natural, social, physical, and material worlds ...** through exploring the different ways machines work and discovering the impact of machines on society.

Background Information for Educators and Caregivers

Ngā Kōrero Katoa mā ngā Kaiako me ngā Kaitiaki Tamariki

Machines make work easier and reduce the time it takes to do some work. All machines, no matter how complex, are based on one or more of the six simple machines – the pulley, the lever, the wheel and axle, the inclined plane, the screw, and the wedge. There is great value in exploring the six simple machines individually while relating them to larger machines. By hands-on experience, a young child can discover the basic principles operating. Talking with an interested adult while using the equipment will reinforce or extend the child's knowledge.

A **pulley** is a wheel with a belt, rope, or chain running around its rim. It is used to lift or move heavy objects. The most common pulley system is the block and tackle. Basically, a system of three pulleys halves the weight of the lifted object, but to lift the object 1 metre, 2 metres of rope need to be pulled.

Levers are also used to lift or move objects. A lever pivots on a point called a fulcrum, and when one end of the lever is pushed down, the other end moves up. Examples of common levers are a teaspoon used to open the lid of a tin, the see-saw, and the crowbar.

Young children can see a **wheel and axle** on a tricycle. The axle is a rod onto which one or more wheels are secured. Examples of machines in this resource that use a wheel and axle are the egg-beater, the digger, and the skateboard.

An **inclined plane** is a smooth, sloping surface. Slides and wheelchair ramps are excellent examples. The principle of an inclined plane is that it's easier to pull or push an object up a slope than to directly lift it up from one level to another. Inclined planes also make it easier to move a load down a ramp in a controlled way.

A **screw** is either a cone or a cylinder with a spiral ridge on the outside. Screws are commonly used to fasten objects together. They are also used in lifting. When a screw is used in this way, it is called an auger. An example of an auger is a posthole digger, which lifts the soil from the ground around a revolving screw.

A **wedge** can be driven between two objects, or parts of an object, to separate them (for example, using a wood splitter and an axe) or to secure them (for example, using a doorstep). Examples of common wedges are knife blades, doorstops, pins, and nearly everything that cuts.

Suggestions for Using This Resource

He Āwhina he Whakamahi i te Rauemi Nei

Educators and caregivers should feel free to adapt this resource to suit their own approach and situation. Many of the opportunities for using it will arise incidentally. Be prepared to grasp the teachable moment, particularly if it is initiated by the child.

Using the booklet *Te whakamahi i te pukapuka nei*

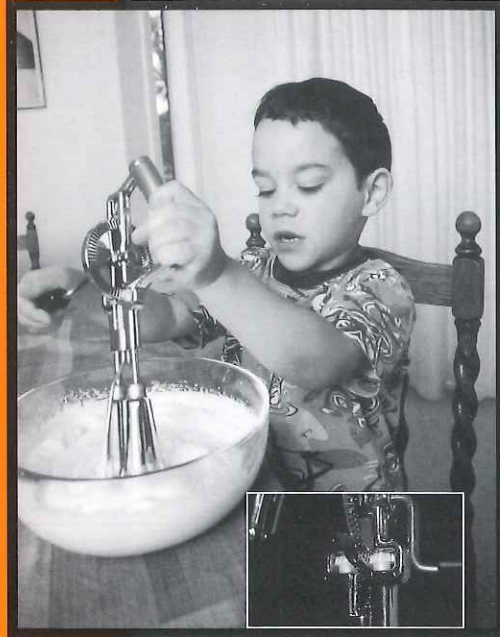
Use these notes as suggestions only, keeping in mind that play is fundamental to early learning. Refer to the sections The Big Ideas and Links with the Early Childhood Curriculum for useful information when planning programmes to meet the aims of the curriculum and the needs of the child. Read the notes with each picture for ideas to help children develop an understanding and appreciation of machines. Refer to the background reading about simple machines to clarify your understanding.

Using the pictures *Te whakamahi i ngā pikitia*

Use the pictures to promote discussion and to arouse curiosity in the children. Ask questions such as "Can you see a lever in this picture?" Make connections with the "real world" by, for example, moving from the picture to showing the child how to get the lid off a tin. Ask a variety of question types. Questions beginning with who, what, when, where, why, and how are useful prompts. Keep in mind that children need repeated experiences to reinforce concepts, as well as new challenges to promote growth. Use the pictures and their activities to provide children with a rich variety of experiences from which they can learn about the world around them in an enjoyable and meaningful way.

About the Pictures **Mō Ēnei Pikitia**

Picture 1: Egg-beater **Kōheri**



This picture shows a child using an egg-beater to thicken cream and a close-up of the beater's gear mechanism.

Big Ideas

Machines have moving parts.

Machines can change the direction or speed of movement.

Possible points for discussion

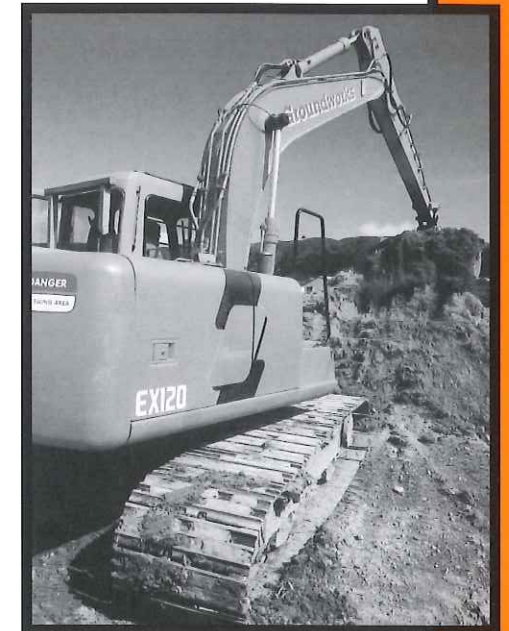
- The simple machine involved is the wheel and axle.
- This machine has gears.
- Gears make the blades turn faster than the handle turns.
- Gears make the blades turn in a different plane to the handle.

Suggestions for activities

Into a bowl of warm water, put a spoonful of dishwashing liquid or shampoo. Use a spoon or fork to mix the water and make bubbles. Repeat the activity using an egg-beater. Promote discussion about the time it took to make bubbles and about the amount of bubbles made.

Take a clear bowl with water in it. Dribble dye down the inside of the bowl so that it settles on the bottom. Use an egg-beater to mix the dye. Discuss how beaters are used to mix ingredients smoothly and quickly.

Picture 2: Digger **Mihini kari**



This is a photograph of a digger. It shows the self-laying tracks, the hydraulic hoses, and the scoop. Dirt is being dumped from the scoop.

Big ideas

Some machines are very large.

Some machines speed up work.

Machines can be dangerous.

Possible points for discussion

- The driver controls the arm of the scoop by pushing and pulling levers.
- Levers are simple machines.
- What's the difference between self-laying tracks, wheels, and skids?
- There is a safety warning on the digger.
- Diggers are noisy, so drivers wear earmuffs.
- Some machines are big, and some are small.

Suggestions for activities

Using toy diggers, make tracks, holes, hills, and tunnels in the sandpit. Repeat the same activities, using hands as scoops. Help the children to notice that muscles in their arms, called biceps, move when they use their arms as levers. When the child's arm is hanging straight, put a ribbon around the biceps and make a mark on the ribbon. Then measure the circumference of the child's biceps again when their arm is holding up a load.

Fill buckets with sand and then tip the sand into a wagon. Compare this to a digger loading a truck.

Look for safety warnings around the centre.

After observing a digger at work, encourage children to describe, in conversation and in drawings, what has occurred.

Picture 3: Helicopter *Waka topatopa*



This photograph shows a helicopter in flight.

Big ideas

Some machines do things that people can't do.

Machines affect the lives of people.

Possible points for discussion

- Helicopters help people, for example, by air rescue, logging, and firefighting.

- There are differences between planes and helicopters.
- Some helicopters have skids, and some have wheels.
- Helicopters can be dangerous, both on the ground and in the air.
- There are toys that fly, for example, skydancers.

Suggestions for activities

Make paper or fabric parachutes and attach them to weights, such as light toys or blocks. Drop them from the top of a slide or other playground equipment. For the best results, make a small hole in the top of the parachute. This will stop it from wobbling or collapsing.

Hold a small sheet of paper (about 10 centimetres by 10 centimetres) horizontal to the ground and drop it from a height. Ask what words describe the way it falls. Fold the same piece of paper up 2 centimetres on one side and down 2 centimetres on the opposite side. Drop the modified sheet from the same height. Ask what words describe how it falls. Encourage the children to experiment with paper in different weights and designs.

Either make your own paper windmills or use pre-made ones. Lead the children to conclude what makes the windmill spin faster.

Examine a sycamore seed with the children and encourage them to produce something similar at the collage table or the carpentry table.

Picture 4: Electric drill *Tūwiri hiko*

This picture shows an electric drill, the results of using the drill, and a close-up of the drill bit.

Big ideas

Machines can be dangerous.

Machines need energy to work.

Possible points for discussion

- Some drills use electric power, and some are powered by hand.
- Narrow drill bits make narrow holes, and wide drill bits make wide holes.
- People using tools often wear safety equipment, such as gloves, goggles, and earmuffs.

Suggestions for activities

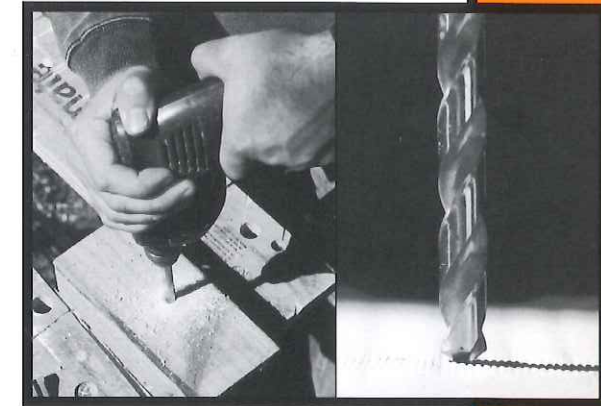
Show the children how a drill bit is changed. Note the sharpness of the spiral edge.

Show the children a set of cards (made previously), each one depicting a different item of building equipment. Have the children match the cards. For example: the hammer goes with the nail, the drill goes with the drill bit, the screwdriver goes with the screw, the paint goes with the paintbrush, the builder's rule goes with the builder's pencil. Describe the way the equipment is used and why it is used.

Demonstrate and play with an Archimedes screw. Discuss the way in which the water flows.

Use hand drills to bore different-sized holes in a variety of materials. Discuss how some materials are easier to drill into than others.

When constructing, children can be supported to develop basic design skills. Encourage them to discuss and then draw their ideas. Keep the initial drawings as a record of the process. Photograph the actual construction. Relate the product to the initial ideas they had. (Construction at the carpentry table is an excellent opportunity for children to plan their work.)



Picture 5: Pulley *Wira whakatere*



This picture shows the pulley mechanism and mainsheet (the rope) on an optimist yacht. They are used to help pull the sail tight.

Big ideas

Some machines are used in recreation.

People use machines to make work easier.

Possible points for discussion

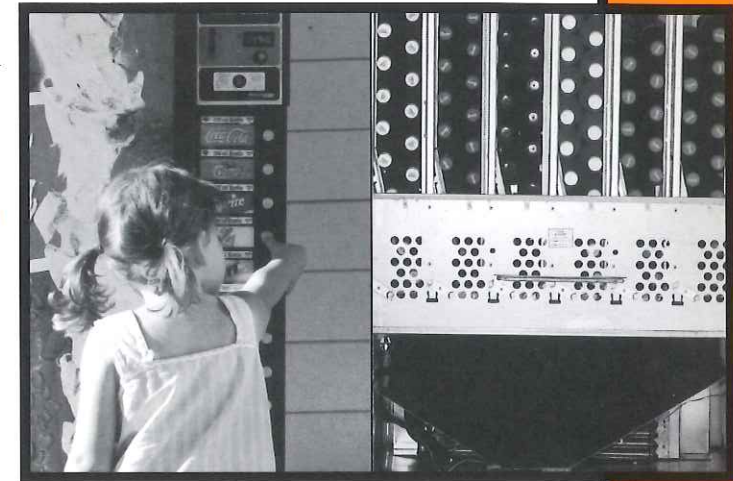
- The main parts of a pulley mechanism are the rope and the pulley block itself.
- Discuss other places where a pulley might be used, such as the painting rack at the centre or boats the children may have been on.

Suggestions for activities

Set up a simple pulley system in the playground. Give children the opportunity to raise and lower loads.

Consider storing soft-cover picture books by hanging them from the ceiling on separate pulleys. Attach a number of rings to the ceiling, each far enough from the other to prevent tangling. Punch a hole in each book in the corner by the spine, and put a metal loop in the hole. Attach string to each book's loop and thread it through a ring on the ceiling. Anchor the other end of the string to the floor or wall. When a child wants to look at a book, they will enjoy lowering it from the roof. An alternative is to have light objects of different sizes and colours attached to the pulleys. Children can then lower objects according to their colour or size.

Picture 6: Drink machine *Mihini tuku wai*



This picture shows a child using a drink machine and the internal workings of the machine.

Big ideas

Machines affect the lives of people.

People make machines to meet a need.

Possible points for discussion

- Parking meters, arcade games, and coin-operated telephones are some other machines that people put money into.
- Discuss what is inside the machine.
- Why is this type of machine usually found in places with lots of people?
- Talk about how people feel when the machine doesn't work.
- Some kinds of drink are better for your health than others.

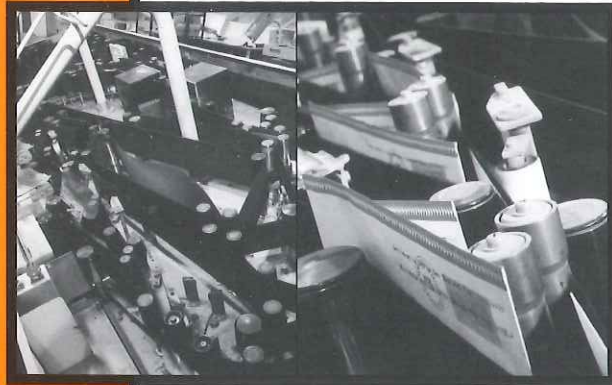
Suggestions for activities

Go for a walk to a drink or vending machine. Discuss in the simplest terms the principle of input and output. For example, the actions of putting money in the slot and pressing a button cause a drink or sweets to be released.

Stand rectangular blocks on their ends in a straight line. Have a child tip the first one and observe the domino effect as they fall. Discuss how this is similar to the stack of cans in the drink machine.

Use the centre's marble run equipment. Roll a marble down the tube so that it pushes a block or toy when it reaches the end. Achieve the same effect by rolling a large ball down a slide.

Picture 7: Mail sorter *Whera mēra*



This picture shows a mail-sorting machine that performs three tasks. Using electronics and mechanics, the machine removes envelopes that are too big or do not have postage. It also turns envelopes so that they face the right way, and it cancels the stamps.

Big ideas

People make machines to meet a need.

Some machines speed up work.

Possible points for discussion

- Machines sometimes need people to operate them.
- Some machines have many moving parts.
- Letters the children may have received could have been through this machine or one like it.
- What are the red and green buttons for?

Suggestions for activities

Have a selection of cardboard postboxes available. Colour-code them. Ask children to find yellow items to put in the yellow box, red items to put in the red box, and so on. An extension activity might be to have boxes the same colour but to cut different-sized holes in the lids. Children can then post letters or objects that match the sizes of the holes.

Have children write letters or paint pictures for their parents/caregivers. They could put the letters in an envelope, “address” them, and “post” the letters in the parents’ pigeonholes. Alternatively, put a stamp on the letters and post them.

Make a simple conveyor belt on which children can put objects and move them. One way of doing this is to loop a strip of fabric or heavy paper around the surface of a table. If the strip is made of paper, children could draw or paint on it so that the movement of the conveyor belt is more obvious.

Picture 8: Toilet cistern *Taika wharepaku*

This picture illustrates the internal workings of a toilet cistern.

Big ideas

People make machines to meet a need.

Possible points for discussion

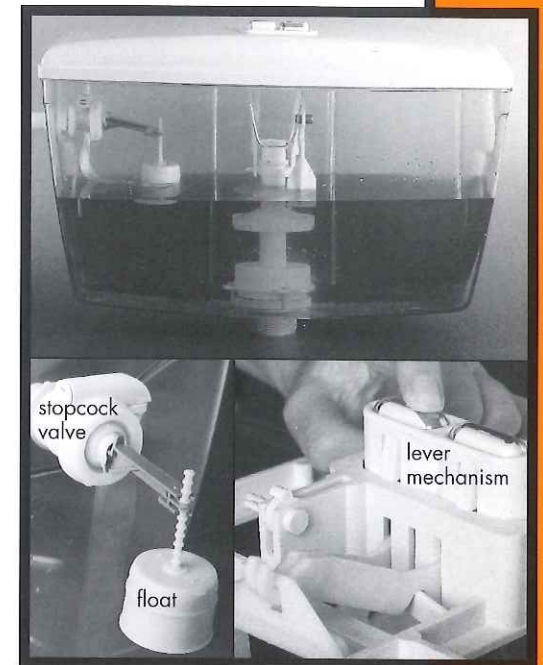
- Talk about where water enters and leaves the cistern.
- When the water enters the cistern, it is as pure as drinking water.
- What action releases the water into the pan?
- As the cistern refills, the float rises, eventually shutting off the stopcock valve.

Suggestions for activities

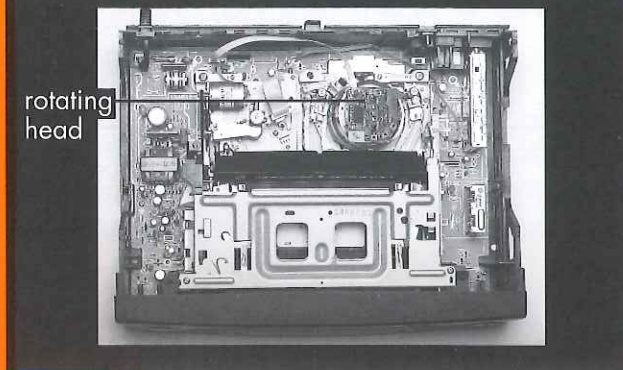
To show that the same water moves from one place to another in the toilet system, put a few drops of dye in the cistern. Flush the toilet (a lever mechanism) and discuss how the water in the pan changes colour.

Put some dye or dishwashing liquid (or both) in an empty water tray or basin. Have the children squirt clear water from a nozzled drink bottle into the tray or basin. Lead them to understand that the greater the pressure applied to the bottle, the greater the reaction in the tray or basin.

Take the lid off the cistern in your centre. In small groups, let the children see and feel the lever in action, the water leaving and entering the cistern, and the action of the float and stopcock.



Picture 9: Video cassette recorder *Pūrere ataata*



rotating head

This picture shows a child putting a cassette into a video cassette recorder (VCR) and the internal workings of a VCR.

Big ideas

Machines need to be maintained.

Some machines change energy from one form to another.

Possible points for discussion

- What are the children's favourite videos?
- Do VCRs break down?
- If a VCR breaks, does it get repaired or thrown away?
- Talk about the photograph of the internal workings and about where the cassette might go once it's inserted.
- A VCR reads information from a magnetic tape.

Suggestions for activities

If the technology is available, make a video recording of the children.

Take apart an old video cassette. Have children undo the screws. When the casing is off, allow them to unravel the magnetic tape inside. Let them move the levers and cogs inside the cassette.

Make and play an audiotape of the children. Discuss how tape recorders and VCRs use magnetic tape to store information and heads to read the information.

Picture 10: Milking machine *Mihini miraka kau*

In this picture, cows are being milked.

Big ideas

Some machines speed up work.

People use machines to make work easier.

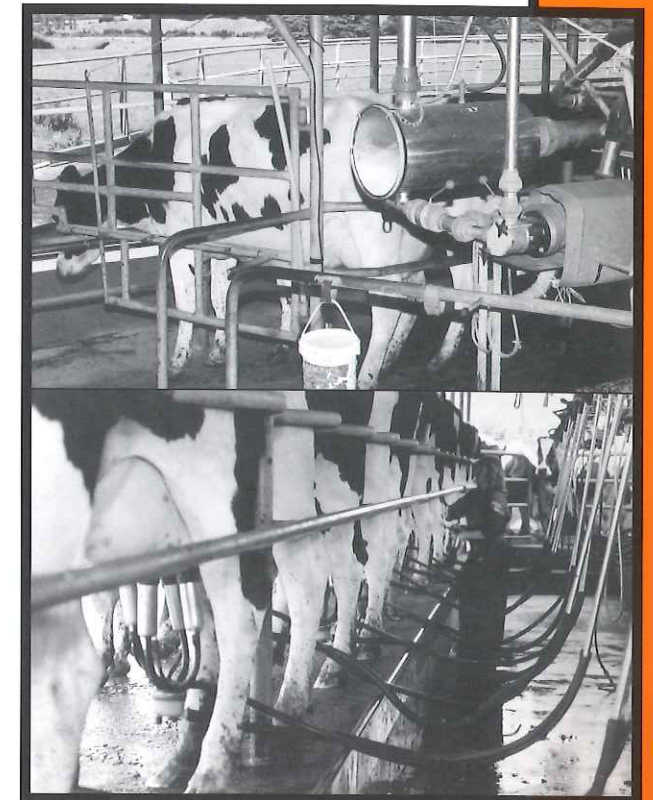
Possible points for discussion

- Many cows are being milked at the same time.
- Use words such as "udder" and "teats" to describe where the cups are attached.
- Talk about the process of grass to cow to milk.
- Why is there milk in the glass-fronted cylinder?

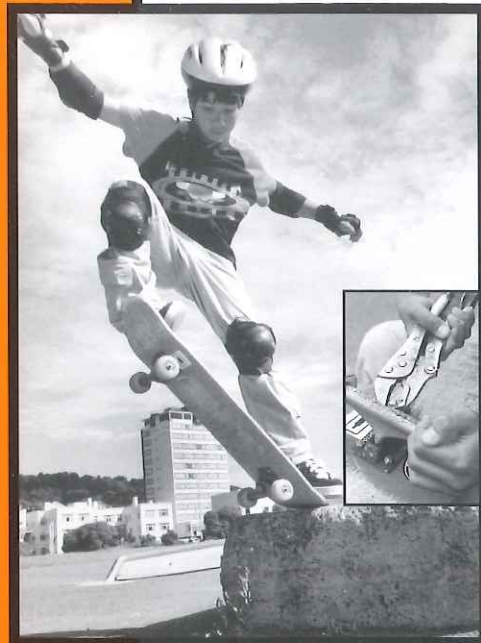
Suggestions for activities

Use flexible, clear bottles (such as soft drink bottles) to create a "vacuum" and then to fill it, as follows. Squeeze the air from the bottle and then put the neck into a bowl of milk. Watch as the milk is sucked up into the bottle.

Have children put milk and flavouring into a plastic container and shake it vigorously. They can then open the lid and use a straw to drink the milk drink. Discuss how the milk moves up the straw (sucking).



Picture 11: Skateboard **Papawira**



This picture shows a skateboarder in action and adjusting his skateboard.

Big ideas

Some machines are used in recreation.

Machines need to be maintained.

Possible points for discussion

- What safety equipment is the skateboarder wearing, and why?
- Where can people skateboard, where can't people skateboard, and why?
- Why do some people enjoy this sport?
- Ball bearings let the wheels spin freely.
- What is the skateboarder doing with the vice grips? Talk about other tools used for tightening nuts.
- The child landed safely.

Suggestions for activities

From within the children's environment, choose items with wheels (or use magazine pictures). Classify the items into groups, such as items with one wheel, items with two wheels, and items with three wheels.

Use a number of cylindrical blocks, lengths of dowel, or inners from paper kitchen towels as a row of rollers on the floor. Put a container with a load onto the rollers and push. Note how far the container goes. Try the experiment again (without rollers) on surfaces ranging from carpet to lino to concrete. Use informal measures, such as body length, to measure and compare the results.

Put marbles in a tray to show how a block moves easily when rolling on top of the marbles.

Make a ramp. Roll a variety of objects down the ramp. Have the children mark where each object finishes moving. Objects might include a large ball, a small ball, a box, a cylinder, a teddy bear, or anything else the children might want to try.

Picture 12: Jack **Hikiwaka**

This is a photograph of a car being raised by a jack.

Big ideas

Some machines do things that people can't do.

Some mechanical principles were discovered a long time ago.

Possible points for discussion

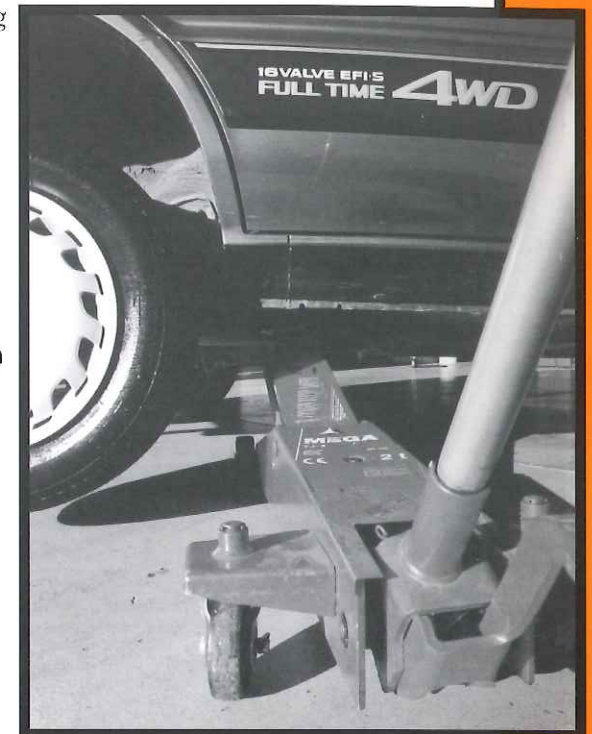
- What does a jack do?
- How many wheels are there in the photograph?
- Why do people need jacks?
- What is the long metal pole used for?

Suggestions for activities

Have children lift the lid off a large tin, using different-sized levers to pry it off. Discuss which lever made it easiest to remove the lid.

Using a jack from a car, place it under a heavy load and show the children how it can be used to raise the load. If it can be done safely, give children the opportunity to use the jack to lift a load that they couldn't lift by hand.

Set up a board or plank so that it can be moved on a central fulcrum. Encourage the children to lift loads using the makeshift see-saw. Guide them to discover for themselves how moving the plank along the fulcrum makes the same load easier or more difficult to raise.



Machines and Technology: Ngā Mīhini, ngā Hangarau

Machines and Technology: Ngā Mīhini, ngā Hangarau is a picture pack for developing young children's understanding and appreciation of machines and technology. It consists of 12 large pictures and a 20-page booklet of notes.

Educators can use the pictures to develop children's understandings of machines and to promote discussion about them. The booklet for educators includes:

- sections on the early childhood curriculum and technology;
- the big ideas and possible discussion points for each picture;
- suggestions for activities that will help young children to make sense of their physical world and to develop their understanding of technology and the relationship between people, technology, and the environment.

Machines and Technology Ngā Mīhini, ngā Hangarau



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11 **Skateboard**
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Papawira
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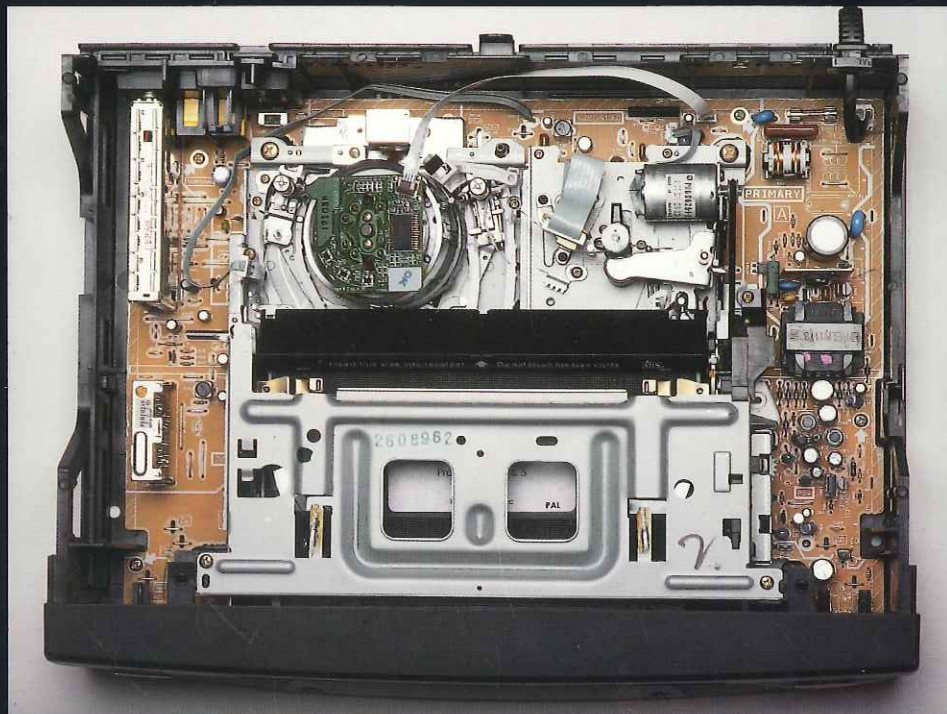
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9 Video cassette recorder
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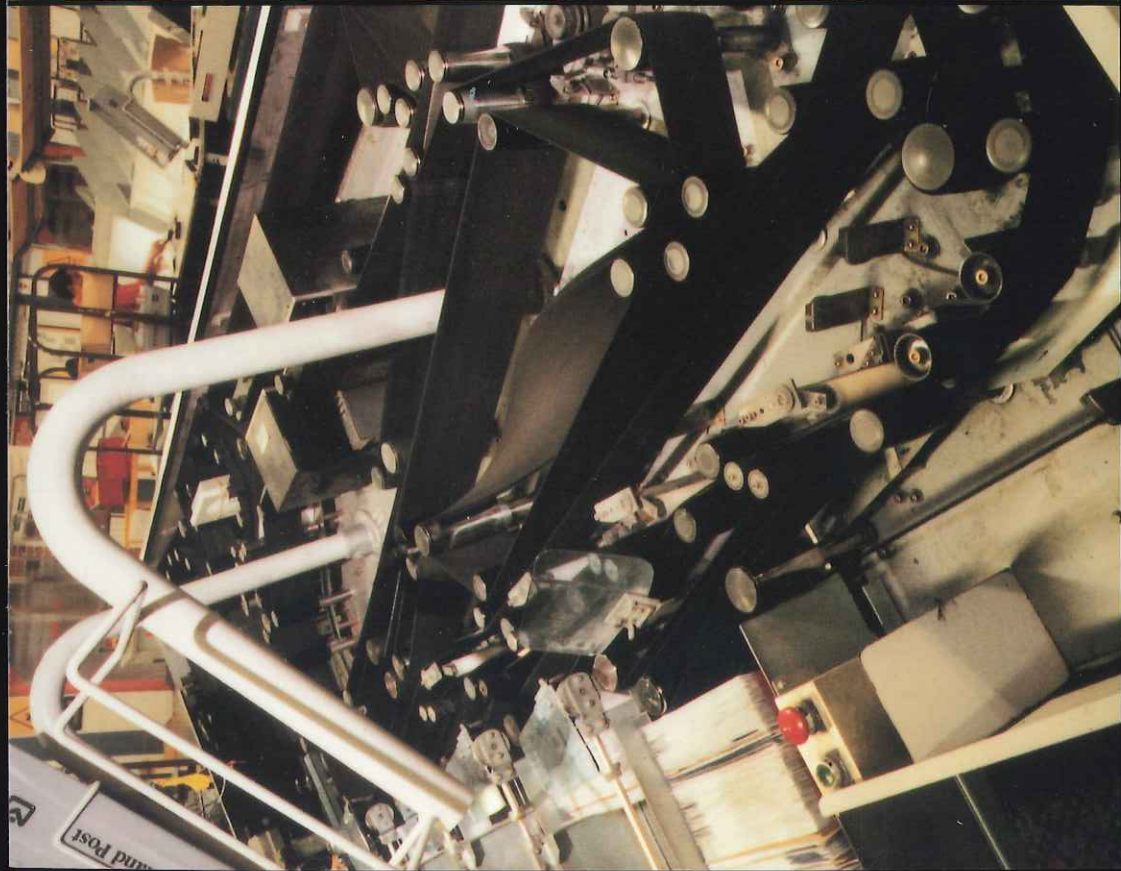
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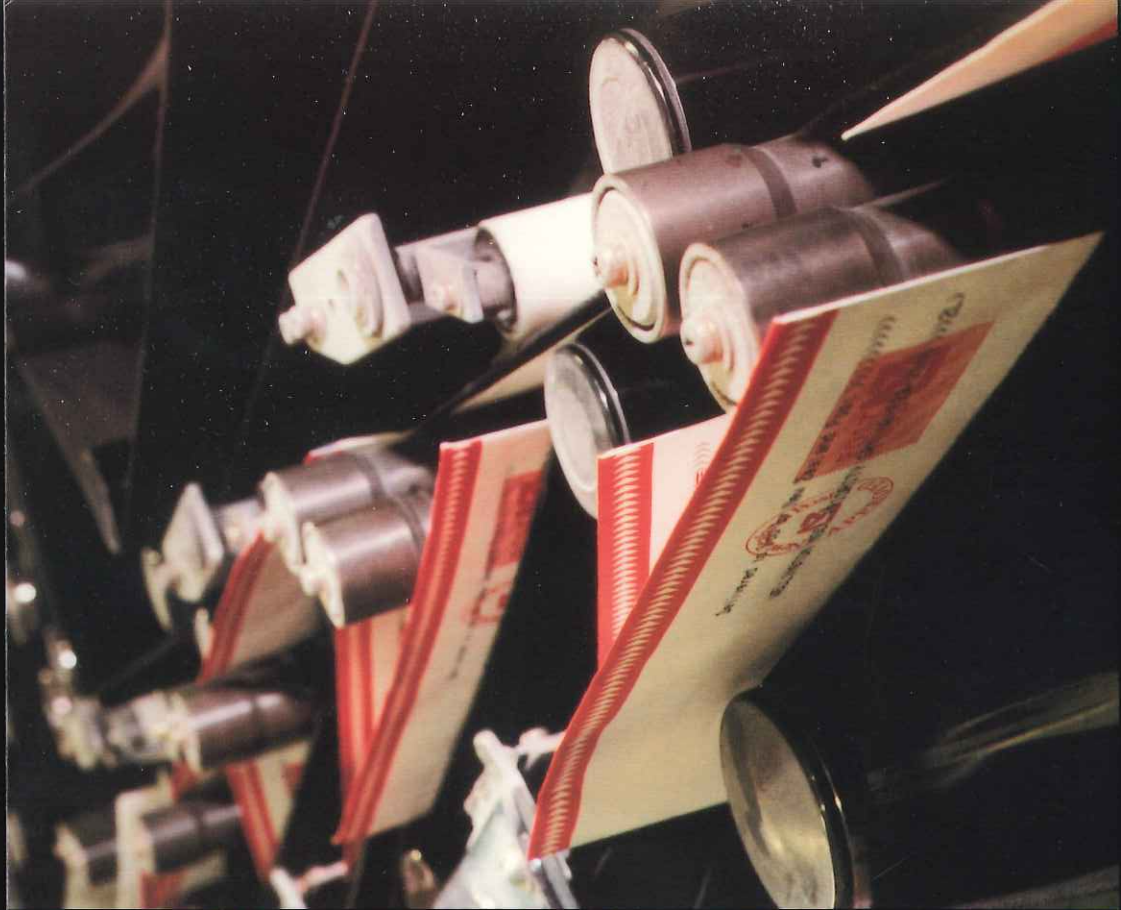
10 Milking machine
Machines and Technology

Mīhini miraka kau
Ngā Mīhini, ngā Hangarau





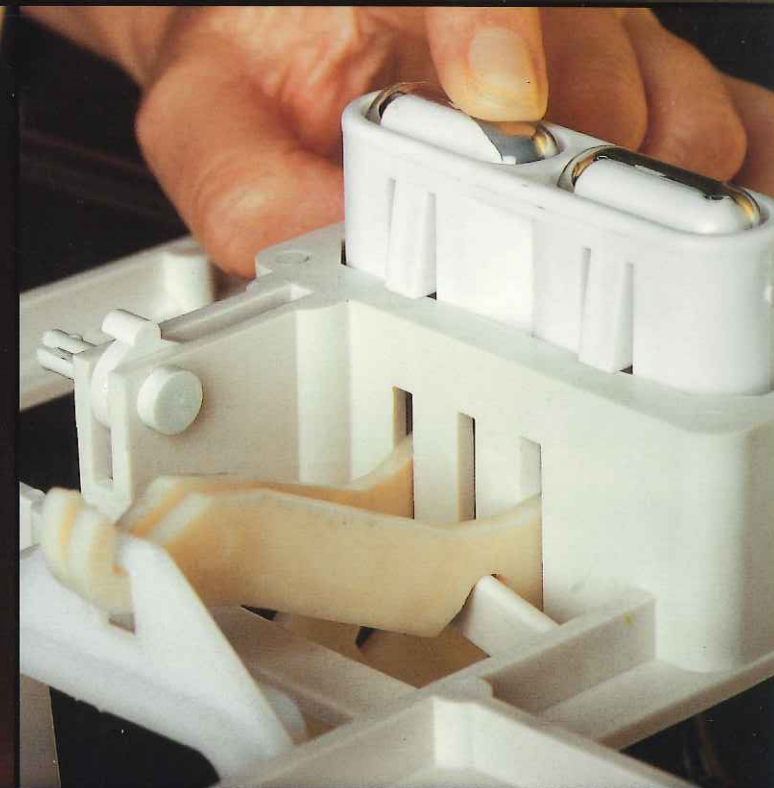
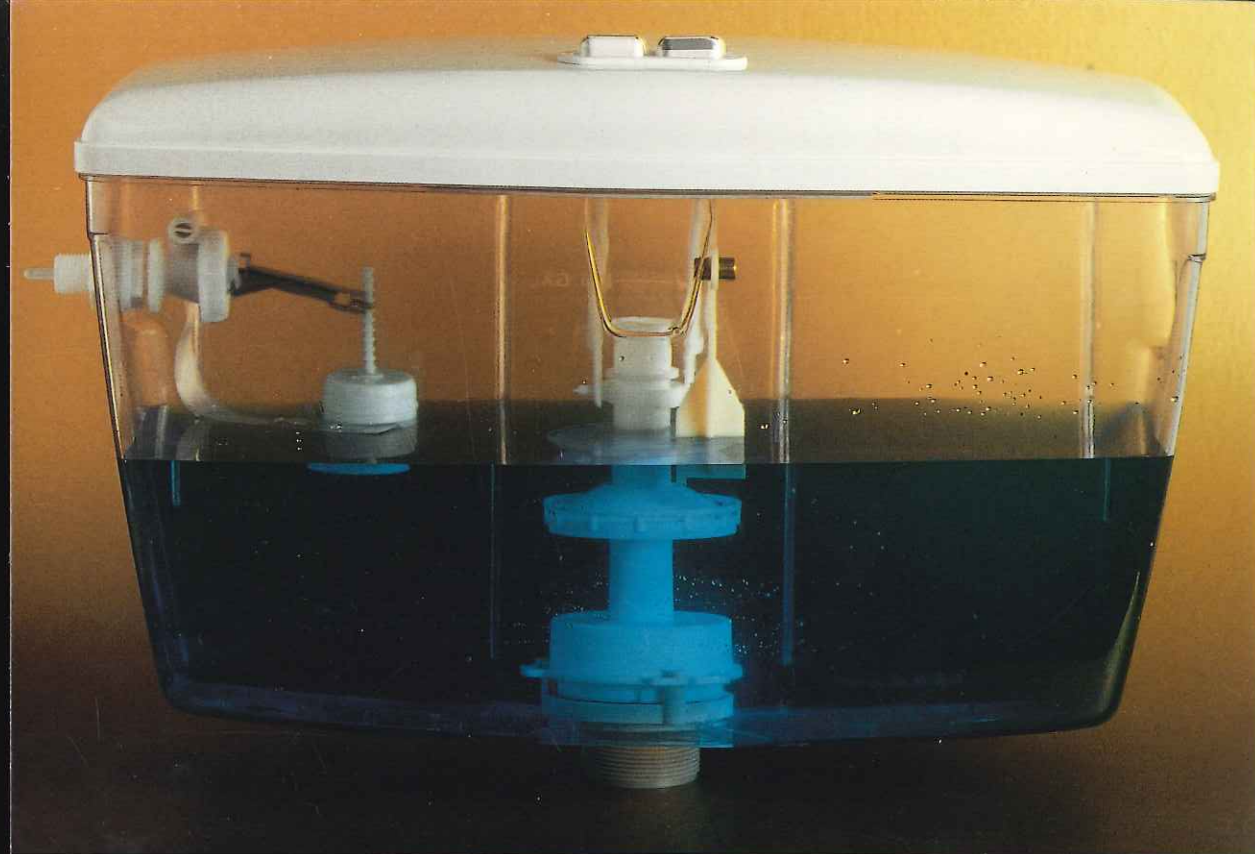
7 Mail sorter
Machines and Technology



Whera mēra
Ngā Mihini, ngā Hangarau



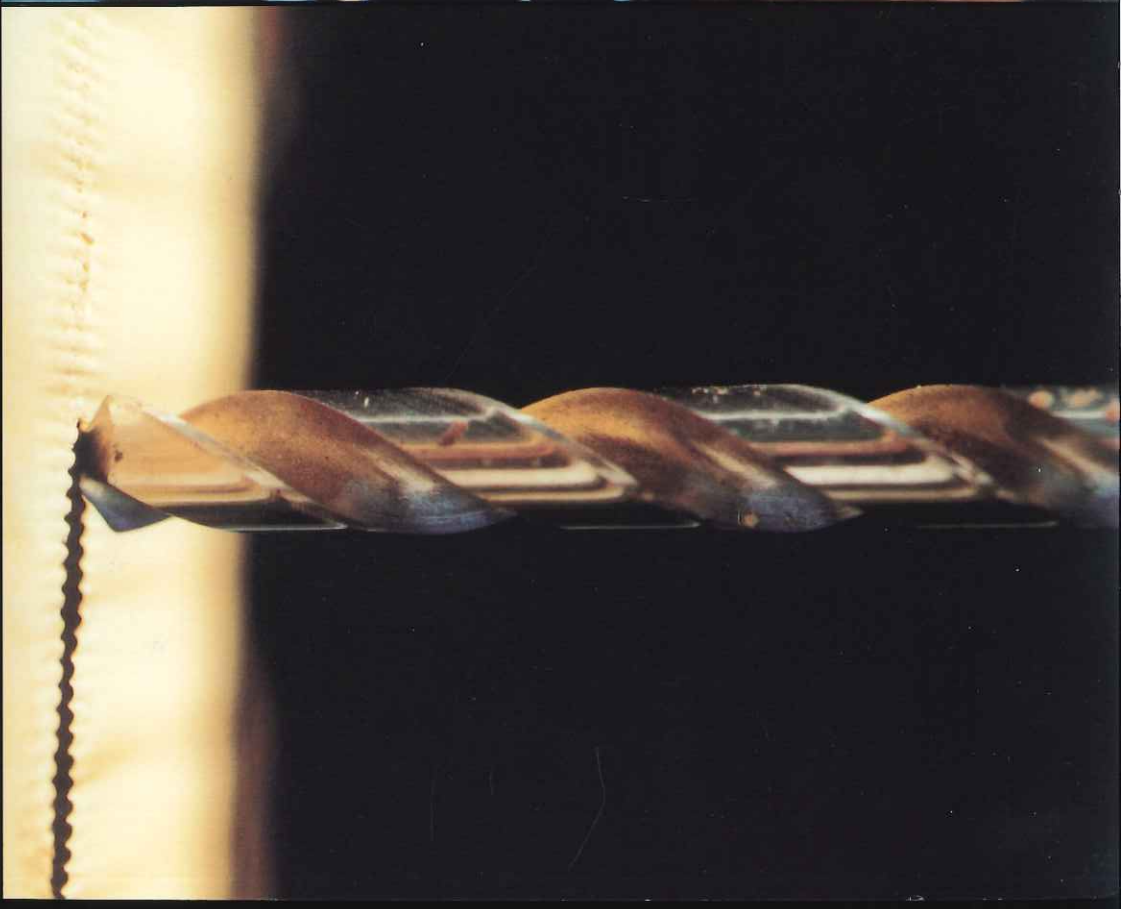
8 Toilet cistern
Machines and Technology



Taika wharepaku
Ngā Mihini, ngā Hangarau



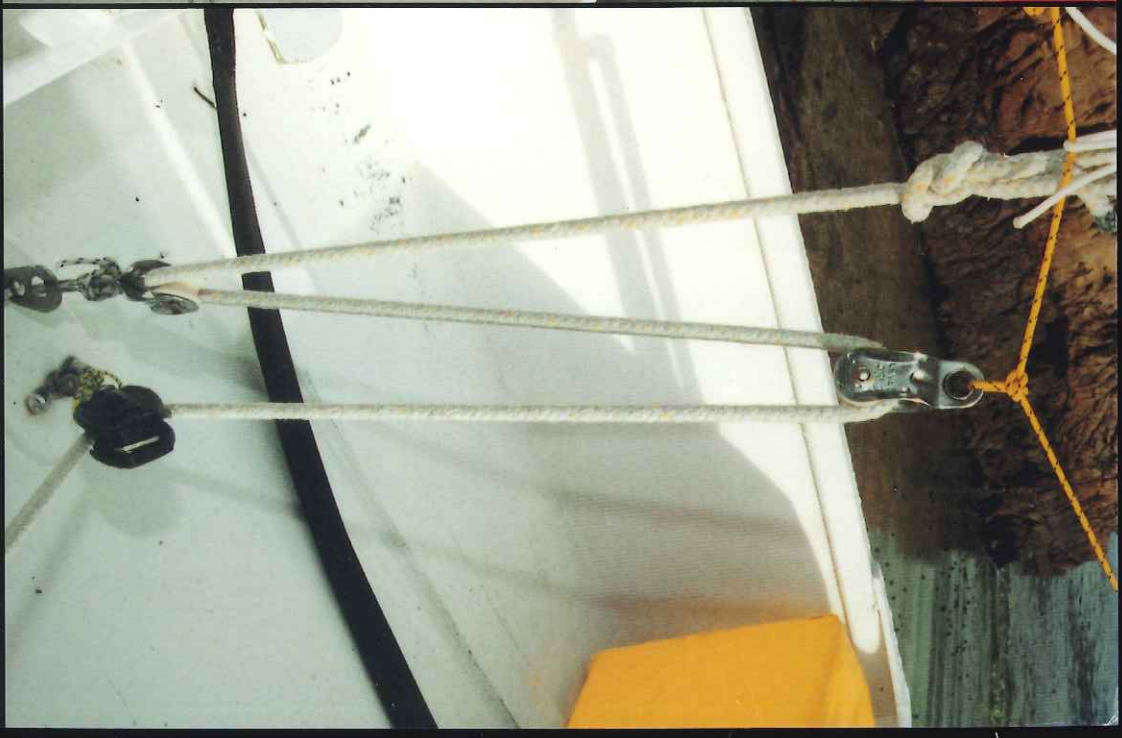
4 Electric drill
Machines and Technology



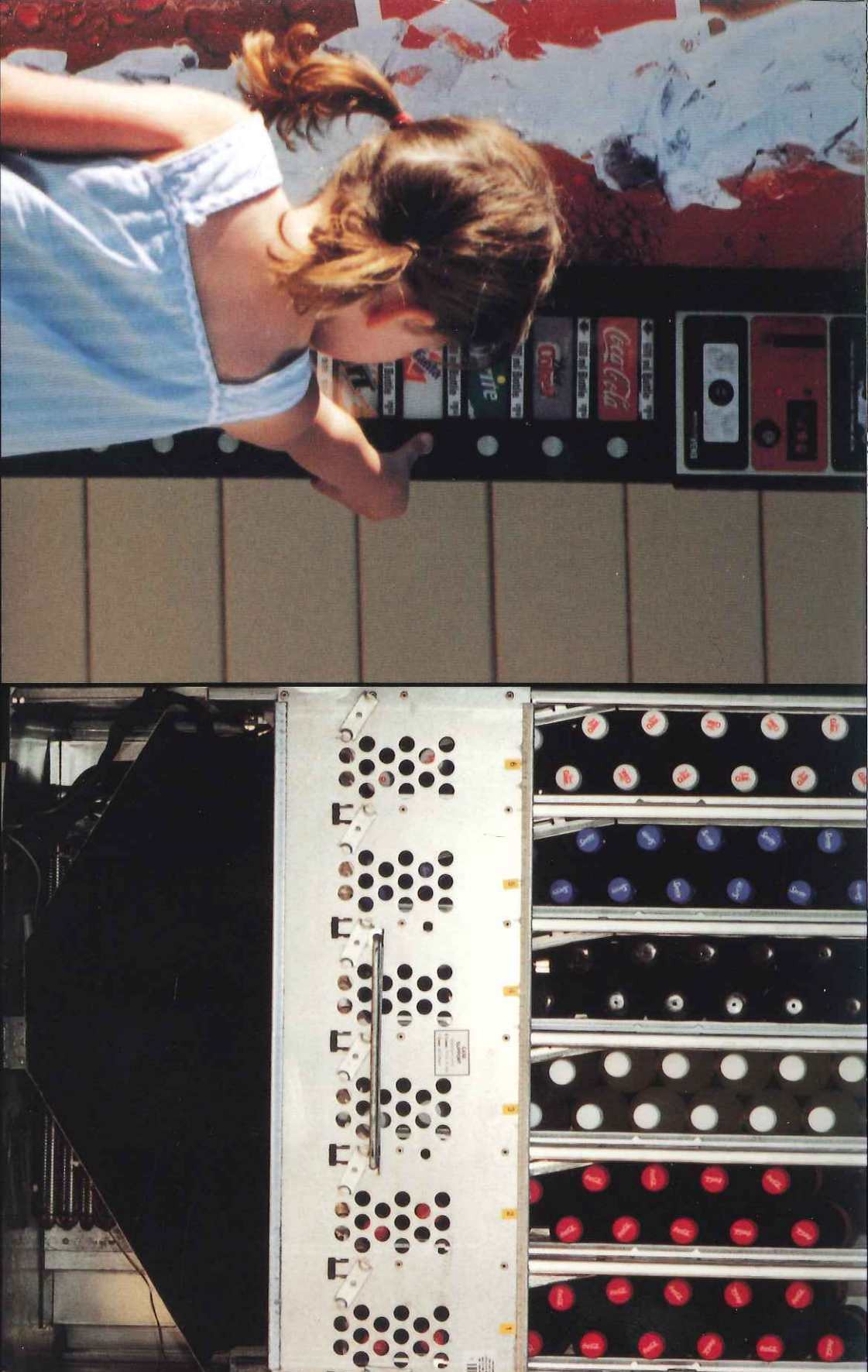
Tūwiri hiko
Nga Mihini, nga Hangarau



5 Pulley
Machines and Technology



Wira whakatere
Nga Mihini, nga Hangarau



6 Drink machine

Machines and Technology

Mihini tuku wai

Ngā Mihini, ngā Hangarau

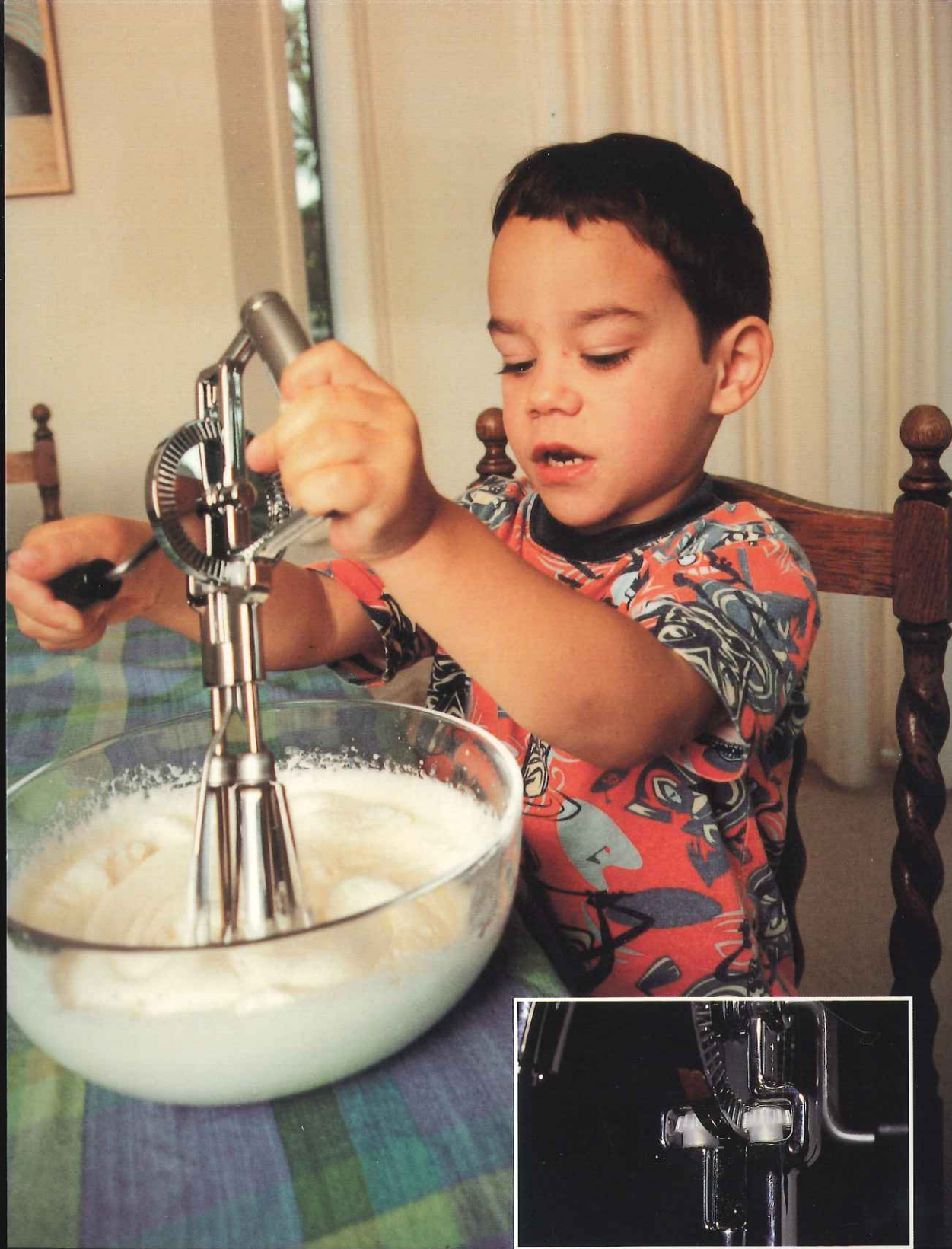


3 Helicopter

Machines and Technology

Waka topatopa

Ngā Mihini, ngā Hangarau



1 **Egg-beater**
Machines and Technology

Kōheri
Ngā Mihini, ngā Hangarau



2 **Digger**
Machines and Technology

Mihini kari
Ngā Mihini, ngā Hangarau