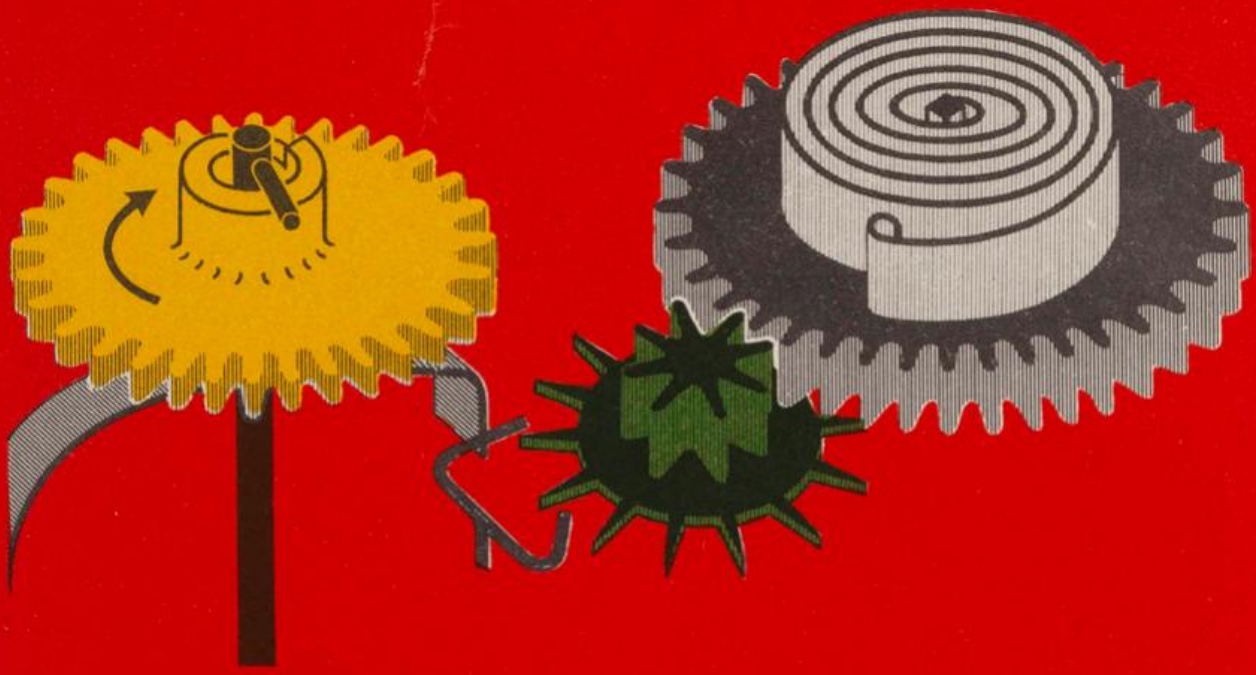
MACHINES which seem to think





A PARRISH COLOUR BOOK FOR CHILDREN

MACHINES

WHICH SEEM TO THINK

by Marie Neurath

If the great Tutankhamen, Pharaoh of all Egypt, could be confronted with the things in this book, he would undoubtedly think they were magic. And in one way he would be right, for are they not stranger than magic, these things which machines *can do for themselves?*

Consider some of the things we know: The alarm which rings at the right time — The door which opens by itself — The lights which must not make a mistake — The silent burglar and the loud alarm — The moving belt and the counting wheels — The kettle which calls you when it boils — The aeroplane which steers straight without the pilot — The machine that can give the correct change — The train which seems to stop itself — The lamps which darkness lights.

These are magic still to the children — until they understand them. And it is these things which are explained in this book—clearly, accurately and excitingly, in colourful, one-idea-at-a-time pictures and short, simply written text.

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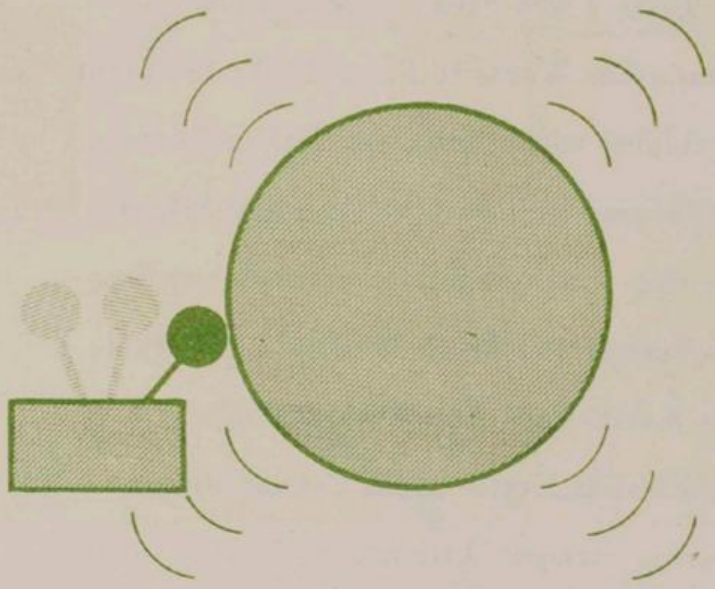
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MACHINES which seem to think

Marie Neurath



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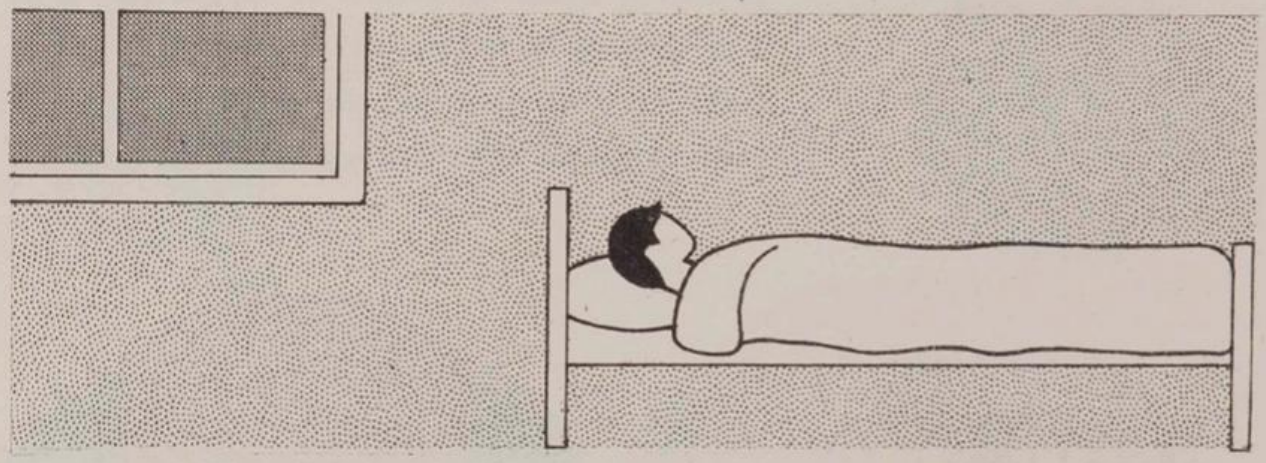
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The Clock which Knows When to Wake You



All night long this clock ticks away the seconds while the boy sleeps. Its two big hands creep round the clock-face; the hand of the small alarm dial, pointing to ten minutes to five, never moves.





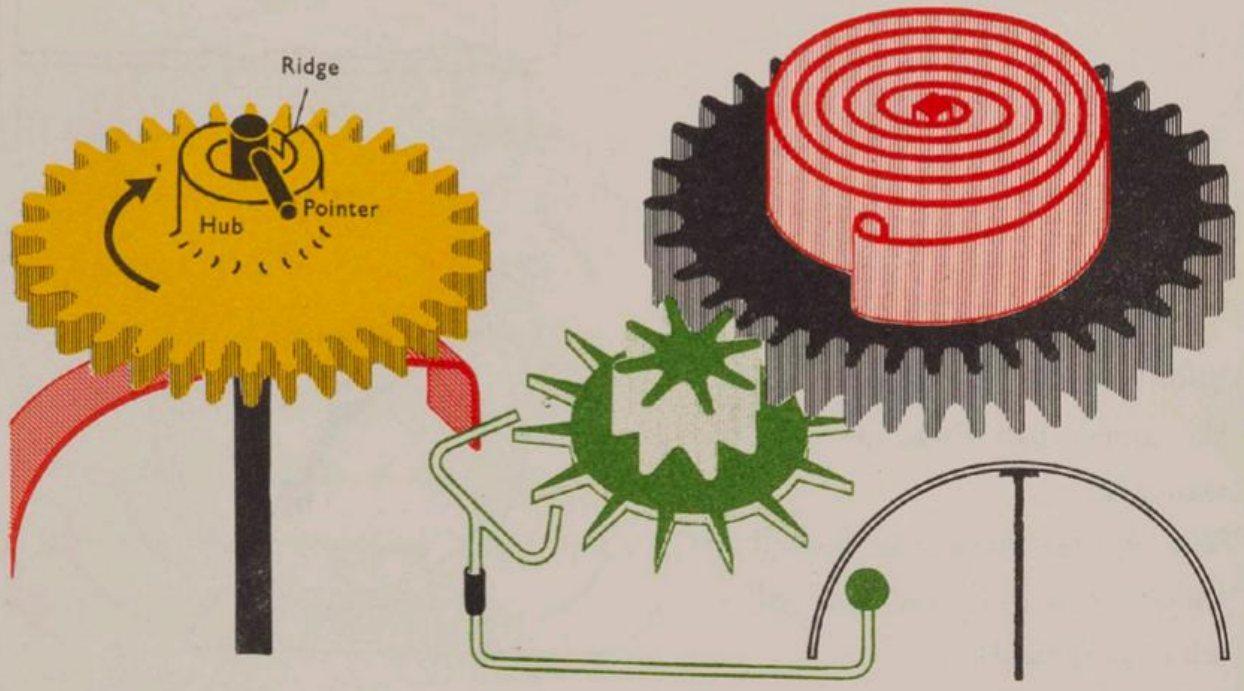
Suddenly, at ten minutes to five, the alarm bell rings and the boy wakes up.

Why did the clock ring the bell just then? Turn over and you will see what happened.

How the Alarm Rings at the Right Time



When we "set" the alarm clock, we move the pointer above the yellow cog-wheel until it points to the waking time. As the hour hand moves round, its cog-wheel turns the yellow wheel at the same speed. The ridge on the yellow wheel keeps parallel with the hour hand. Now look at the bottom picture. During the night, a bent spring presses up below the yellow wheel, but the wheel is held down by the pointer above the hub. The end of the spring holds the green lever, which stops the green and black cog-wheels turning.

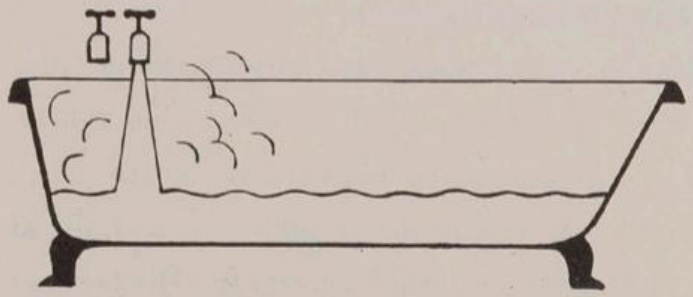


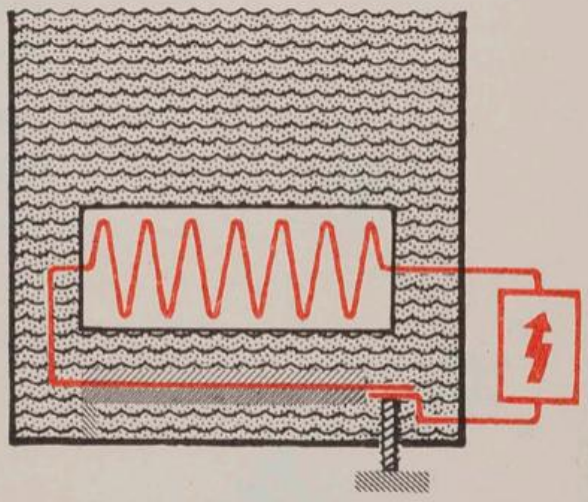
Slowly the hour hand of the clock moves round, and slowly the yellow cog-wheel moves round with it. At last the hour hand points to the waking time, and the ridge on the cog-wheel points in exactly the same direction.

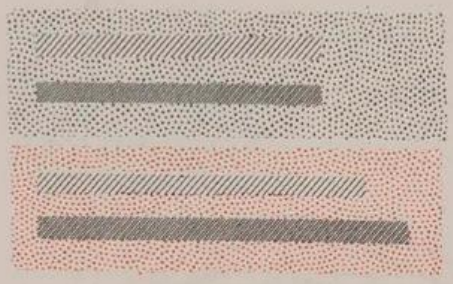
Suddenly, as the ridge passes under the pointer, the bent spring can lift the whole yellow wheel. The end of the spring jumps clear of the green lever. The strong coil-spring begins to unwind and the black and green cog-wheels turn. The teeth of the green wheel set the lever moving to and fro, the lever sets a little hammer moving to and fro, and the alarm bell rings.

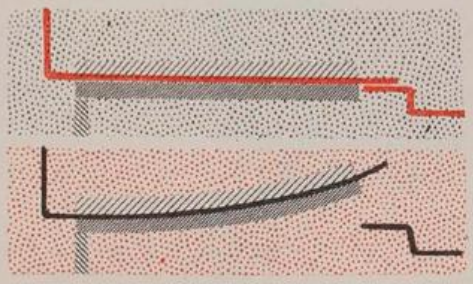


Neither Too Hot Nor Too Cold

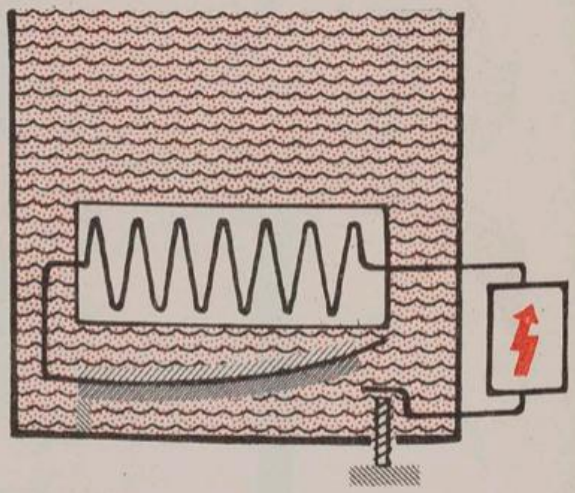




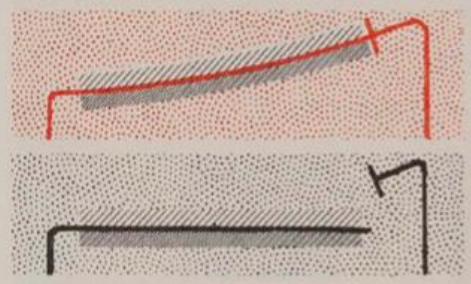




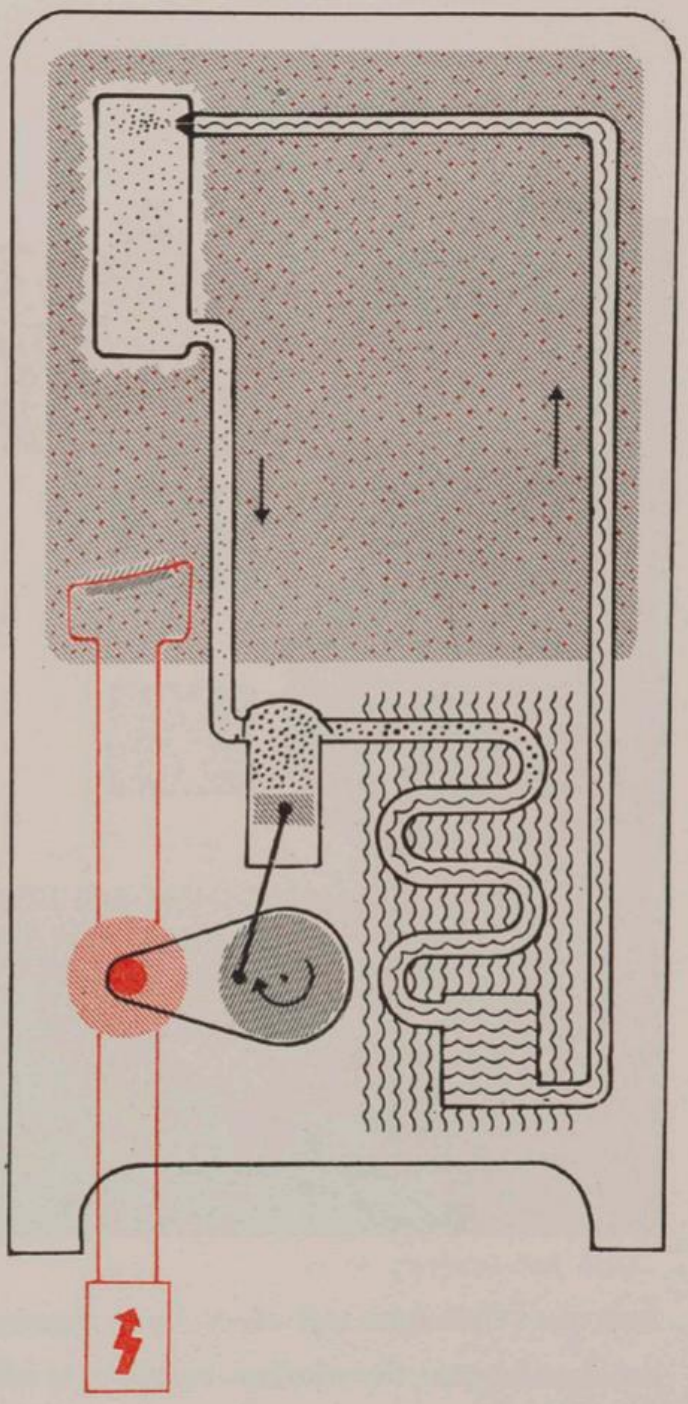
The bath water comes from this tap neither too hot nor too cold. Near the electric heater in the hot tank is a rod made of two strips of different metals. As the water gets hot, one metal expands more than the other, and the rod bends. When the water gets too hot, it has bent far enough to switch off the electric current. As the water cools, the rod straightens. When it gets too cool, it switches the current on again.



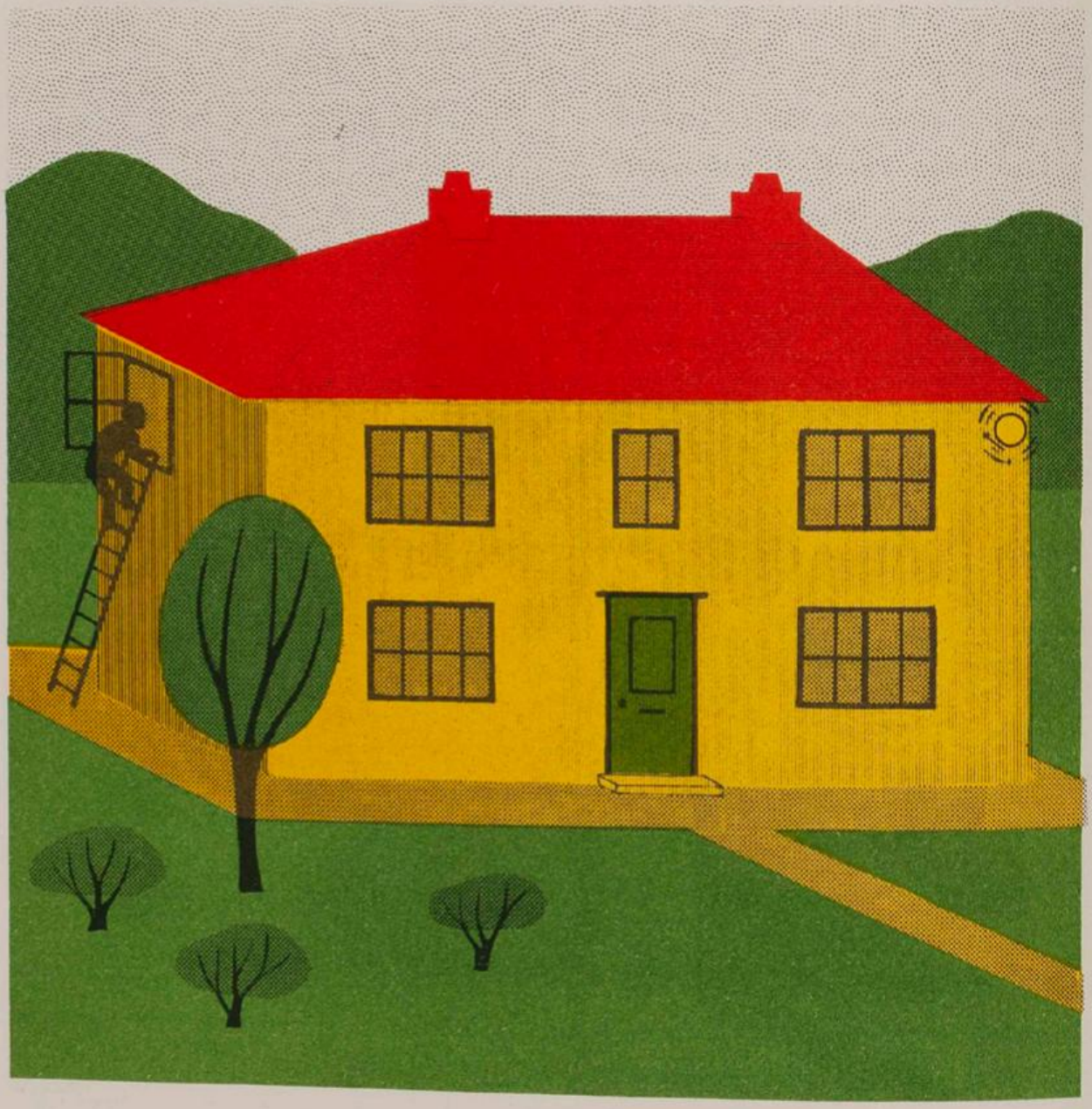
Inside this refrigerator, an electric motor compresses gas and sends it through pipes, where it is cooled and turned into a liquid. This passes into a chamber, where it turns into gas again. As it does so, it takes heat from where the food is stored.



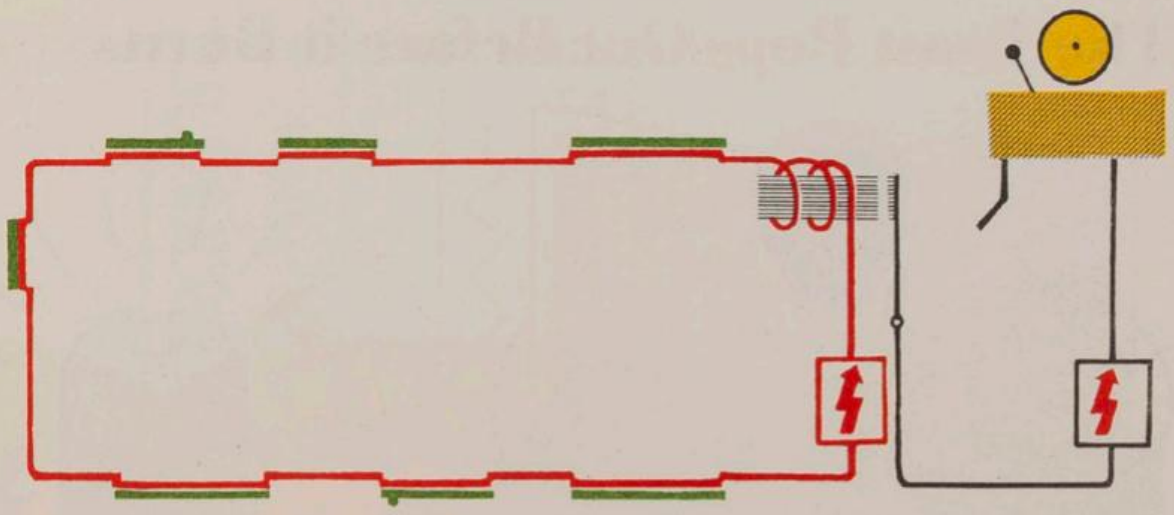
But the food must not get *too* cold. Inside the refrigerator is a rod like that in the hot-water tank. But here, as the rod becomes warm and bends, it switches the current *on*. When it becomes too cold and straightens, it switches the current *off* again.



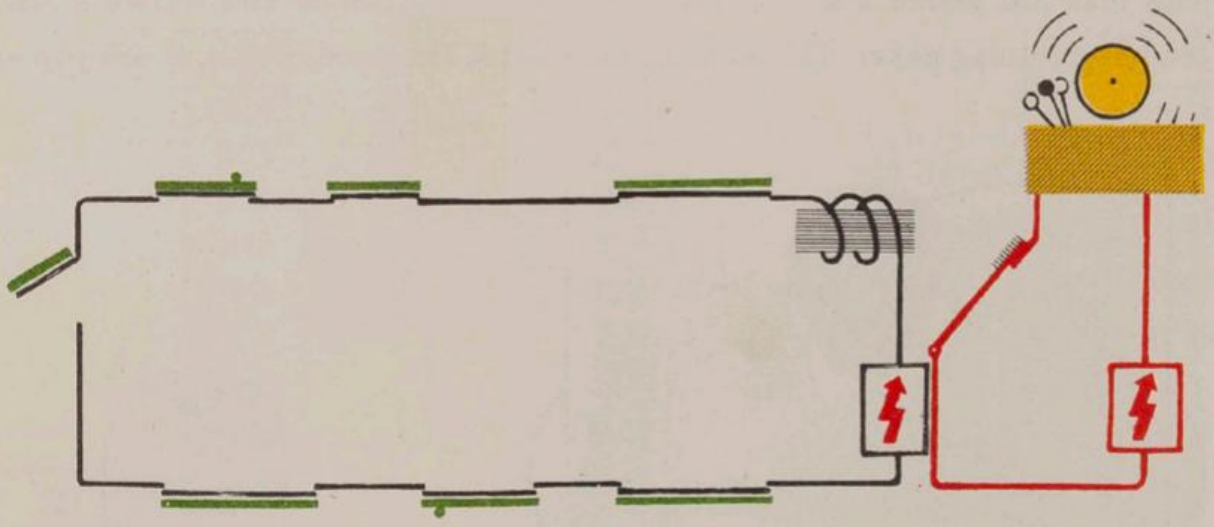
The Silent Burglar and the Loud Alarm



It is past midnight and everyone is sound asleep. Silently the burglar slips the catch and opens the window. Suddenly a bell rings and wakes the household.

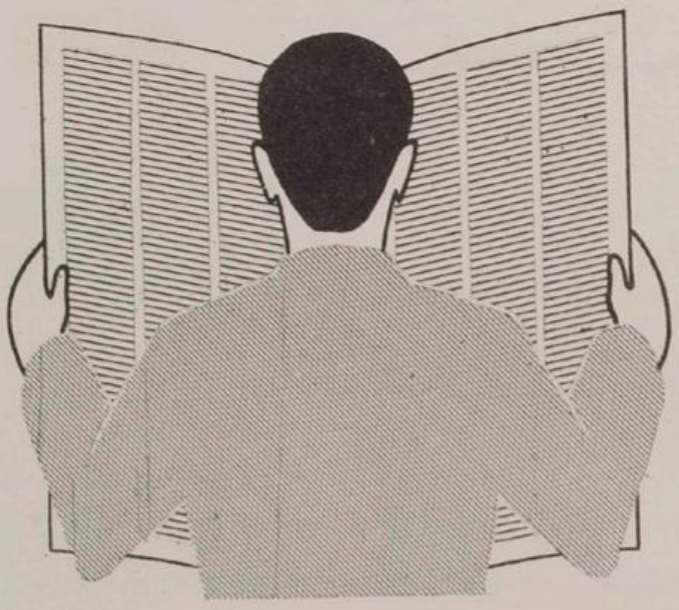


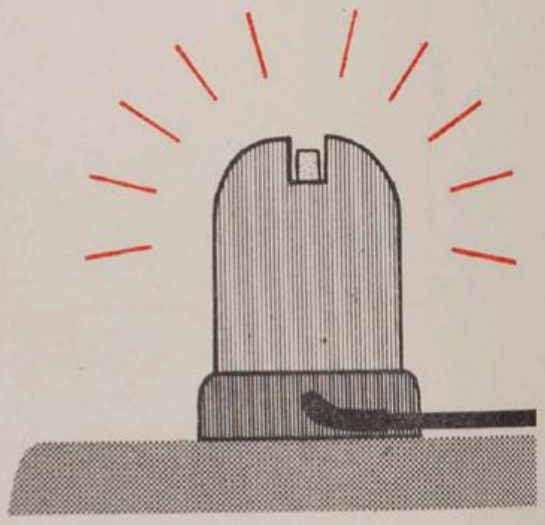
The house is fitted with a burglar alarm. A wire, connected to every window and door, carries an electric current which flows round an iron rod and turns it into a magnet. While the current flows, this magnet holds back a metal switch.



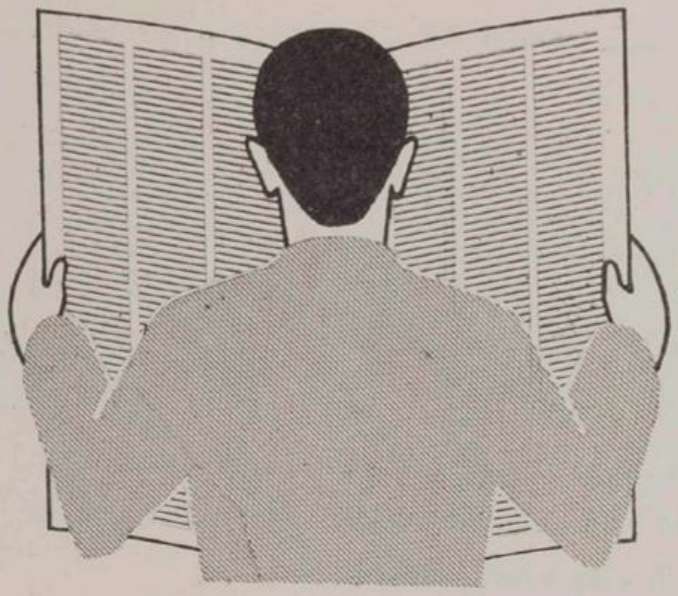
When a window or door opens, a gap is left in the wire and no current can flow. The iron rod is no longer a magnet and cannot hold back the metal switch. As the switch falls, it starts another current flowing which rings the bell.

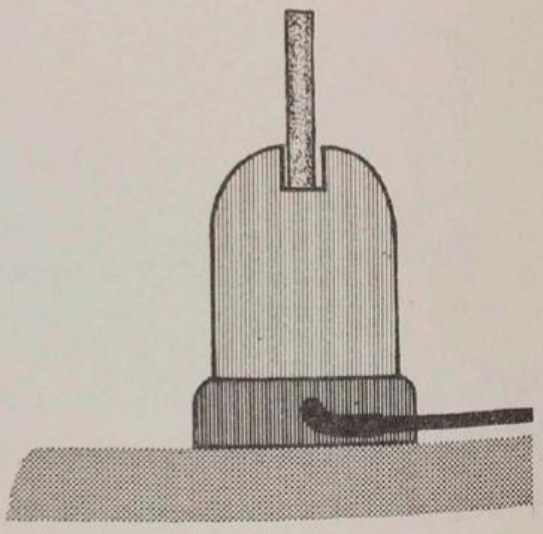
The Toast Pops Out Before it Burns

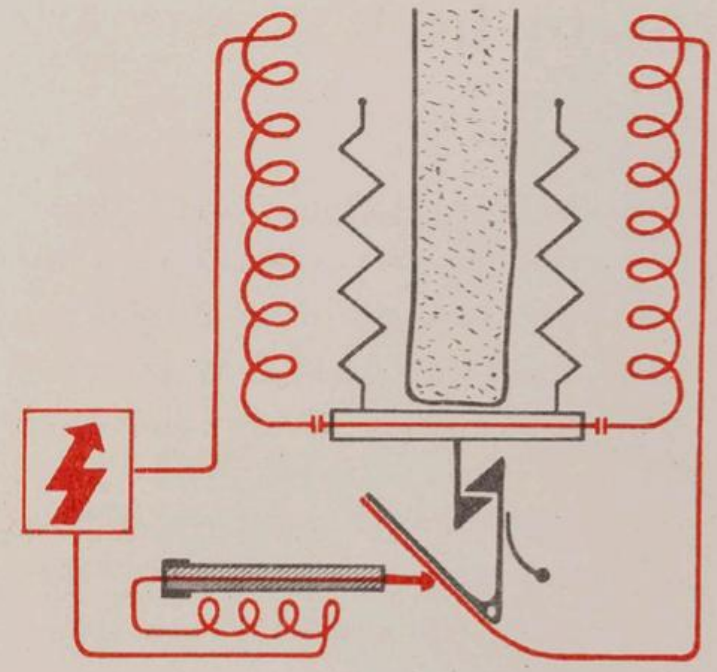




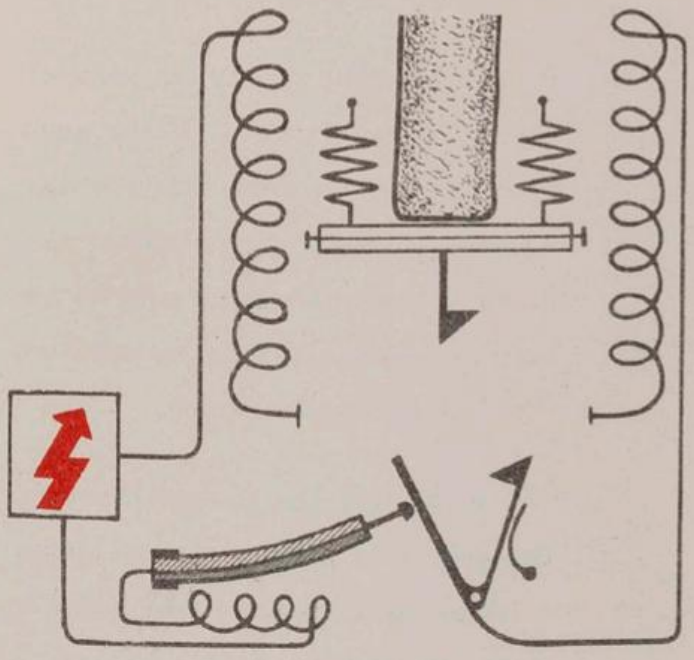
This man has placed a slice of bread in the electric toaster and settled down to read his morning paper. The moment the toast is crisp and brown, it will pop out.







When the bread is put in, the platform on which it rests is pressed down and held in place by the catch below it. The current can now flow and heat the fine wires to cook the toast. But current can also flow through the smaller coil which heats a rod of two metals. As the rod becomes warmer, it bends upwards and begins to push the catch aside.



At the right time, just when the toast is nicely brown, the catch slips off, the springs pull up the platform and the toast pops out.

The current is cut off and the rod cools and bends back. The toaster is ready for the next slice.

The Door which Opens by Itself



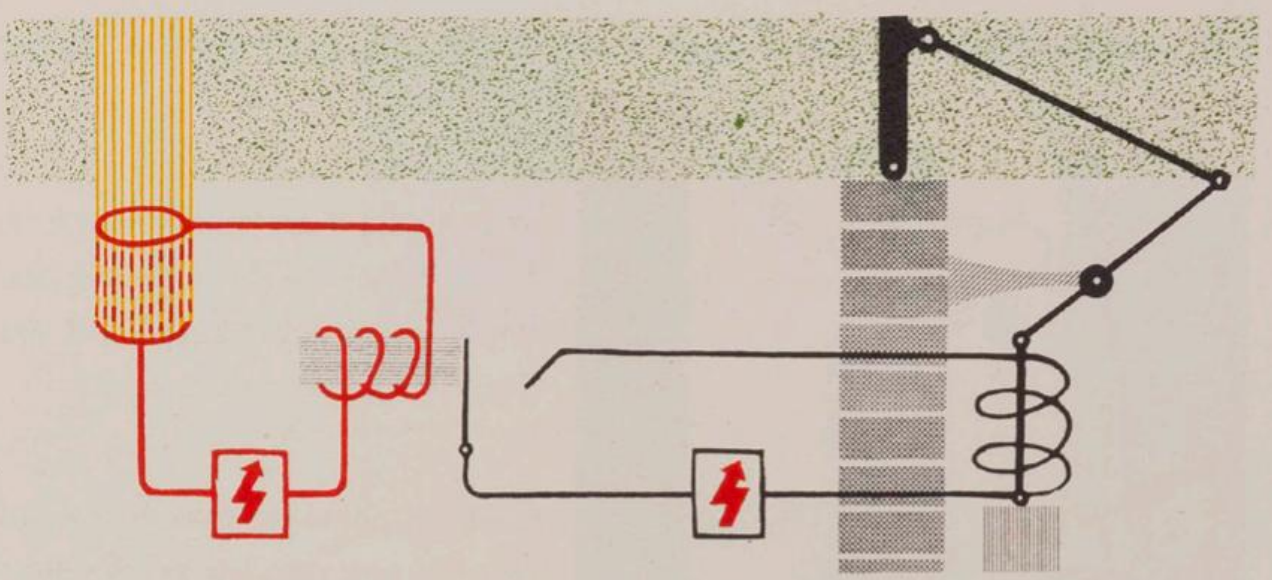


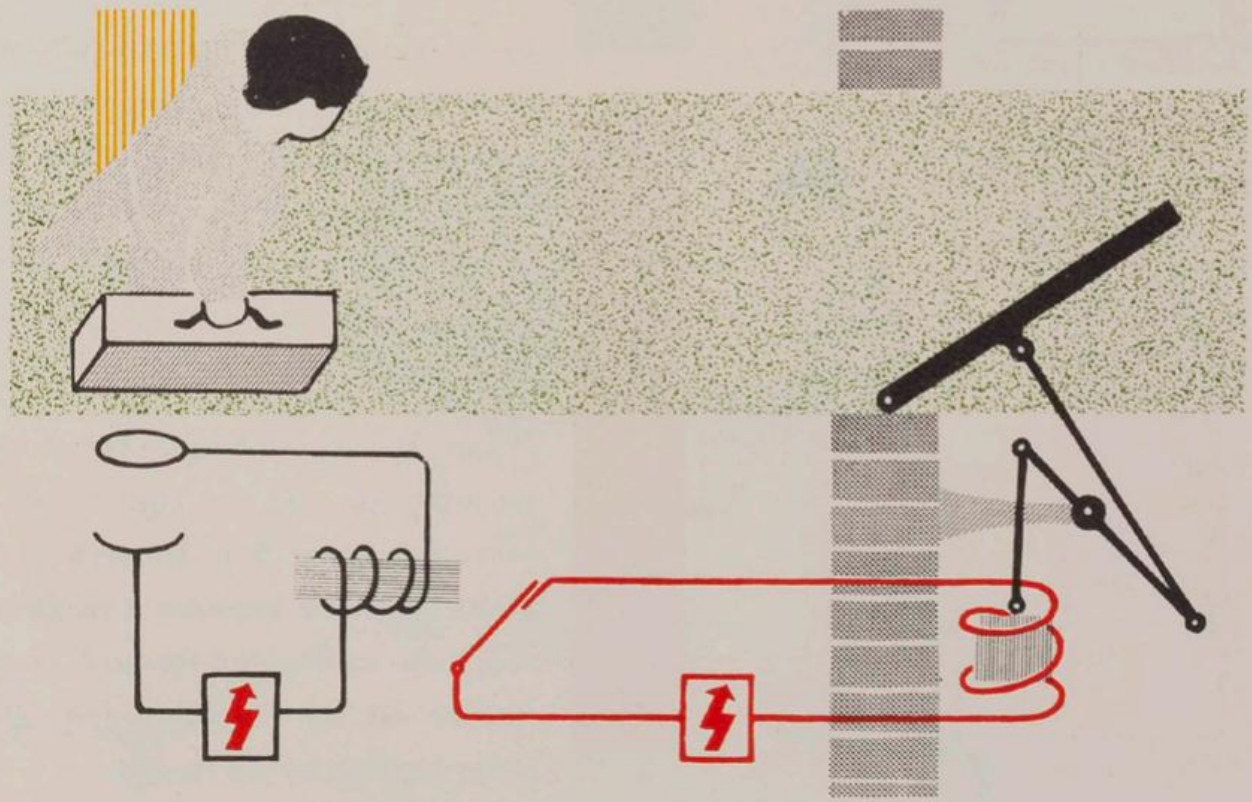
In front of this door, a light shines from one post to the other. As the boy crosses the beam of light, the door swings open; as he enters the house, it closes slowly behind him.

Inside the right-hand post there is a special cell, through which a current can flow so long as light shines upon it. As long as the current flows, it makes a magnet which holds back a switch.

When the light is cut off, the cell cannot carry a current. The magnet loses its power and the switch drops. At once another current flows and makes a more powerful magnet behind the door. This works a machine which pulls the door open.

When the boy has passed through, the powerful magnet is no longer working, and the heavy door slowly closes itself again.





How a Machine Can Give the Correct Change



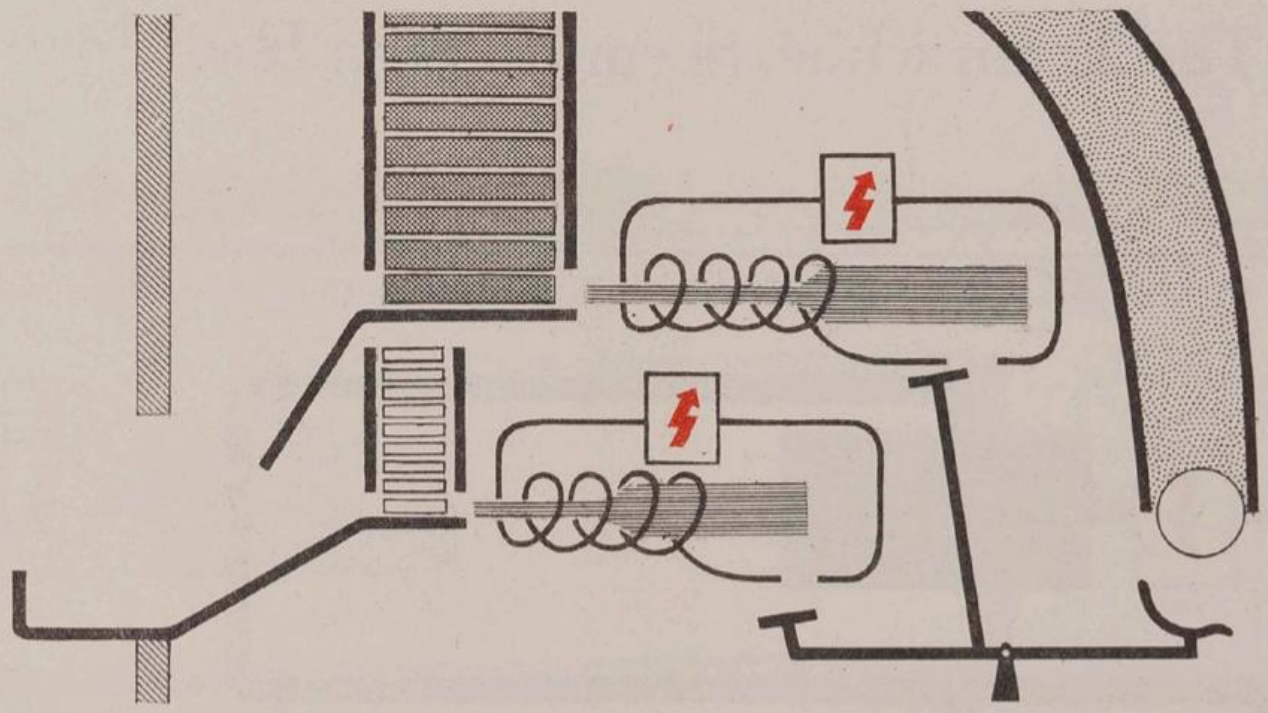
When the shops are shut, it is handy to get chocolate from a slot-machine. But what happens if you don't have the exact money?

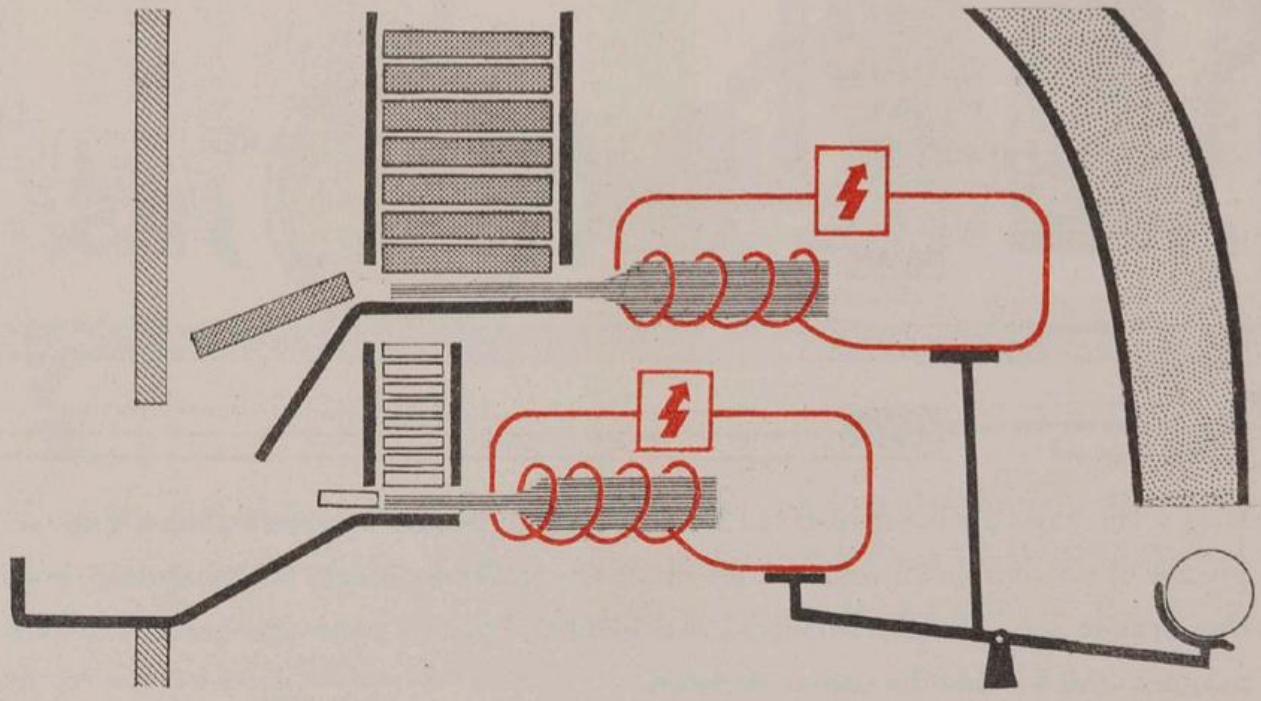
You place another coin in the slot and out comes a bar of chocolate and the correct change.



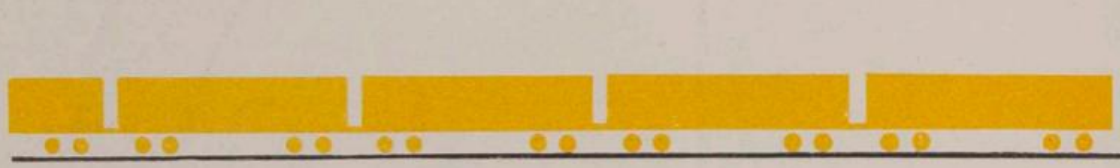
Inside the machine are two coils of wire, ready to carry electric currents. A lever just below them is placed so that the coin will drop on to one end of it. At its other end there are two small switches.

When the coin drops, the two switches rise and the electric currents can then flow through the coils. Each coil becomes a magnet and pulls an iron rod forward. One pushes out the chocolate and the other pushes out the change.

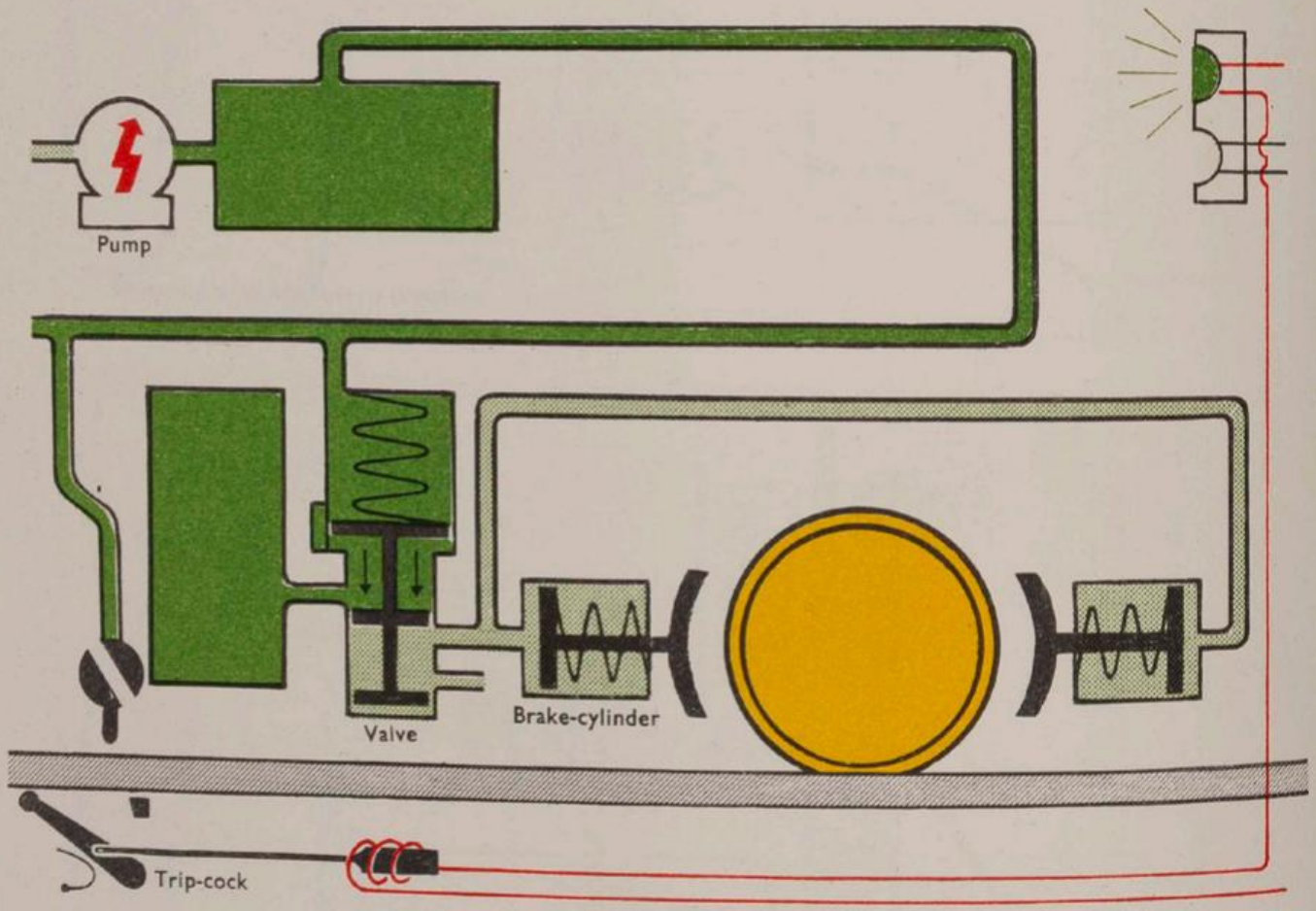




The Train which Seems to Stop Itself



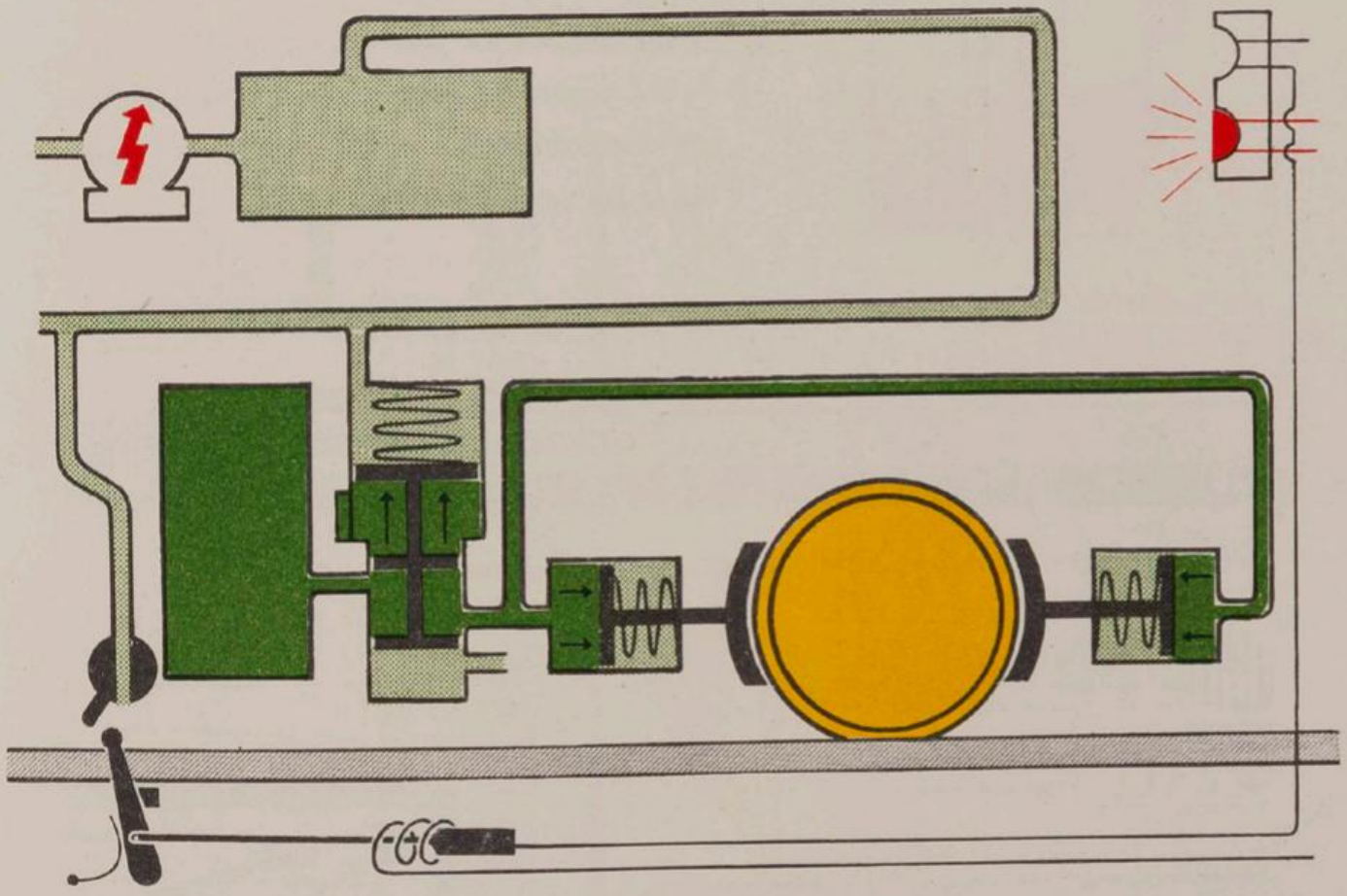
While the green signal-lamp shines, this train can safely go ahead.



Under the cars, air is compressed by electric pumps and stored in tanks. This air pushes the valve down and cannot enter the brake-cylinder, where springs hold the brakes away from the wheel. An electric current near the track makes a magnet which holds the trip-cock down.

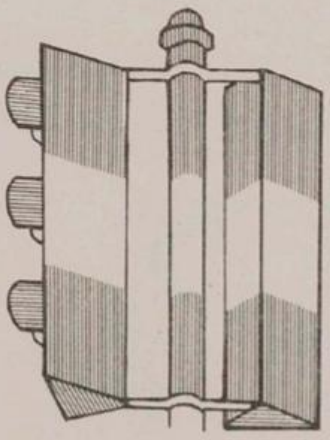


Red means danger. Even if the driver is taken ill the train *must* be stopped.

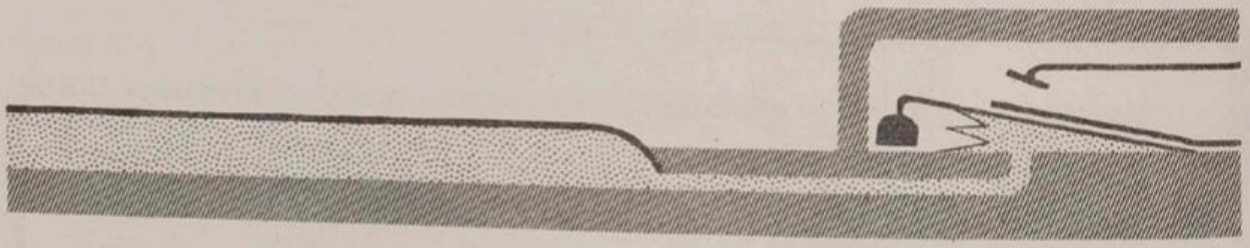


When the red light glows, the current near the track is cut off. The trip-cock springs up and strikes a lever under the train. Air rushes from the centre pipe and weakens the pressure. Compressed air from the lower tank pushes up the valve, enters the brake-cylinder, and puts on the brakes.

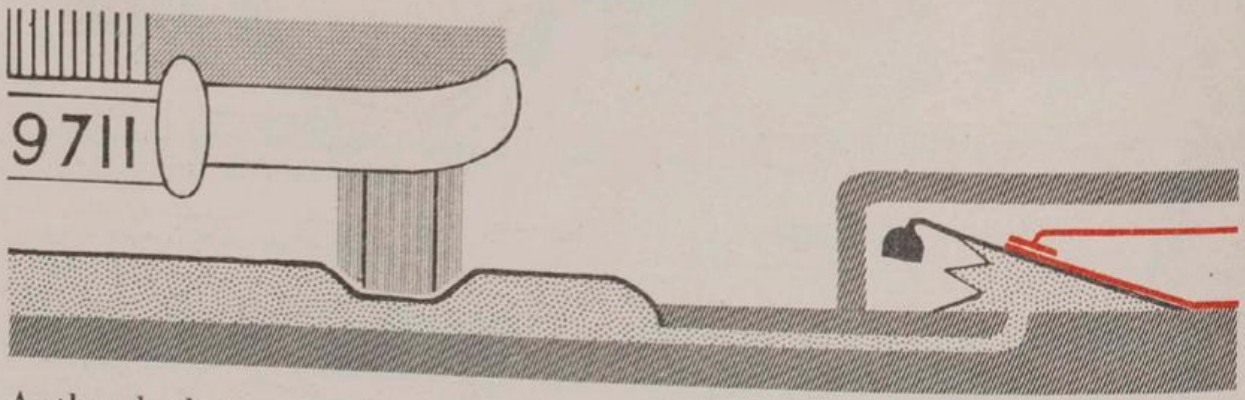
When a Car Wants to Pass, the Traffic Lights Change



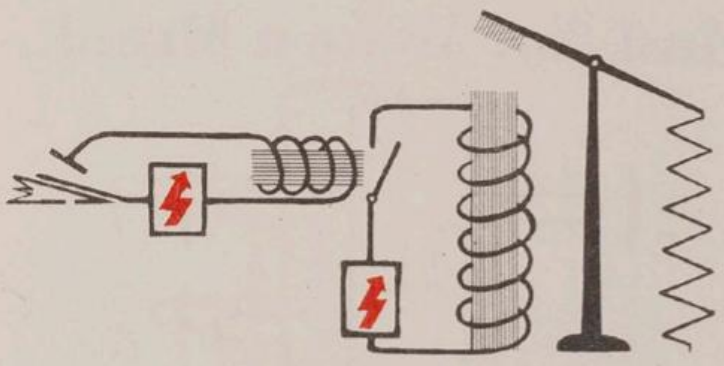
This traffic signal stands where a quiet side street joins a busy main road. Most of the time the signal shows green for the main road and red for the side street. But when a car comes along the side street and wishes to turn into the main road, the light changes to green to let it pass.



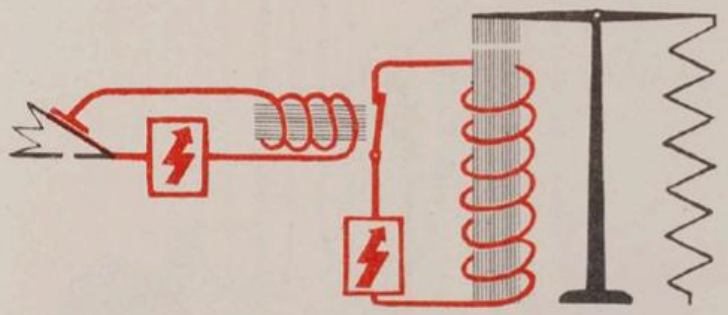
Near the lights, a rubber pad filled with air is laid across the roadway.



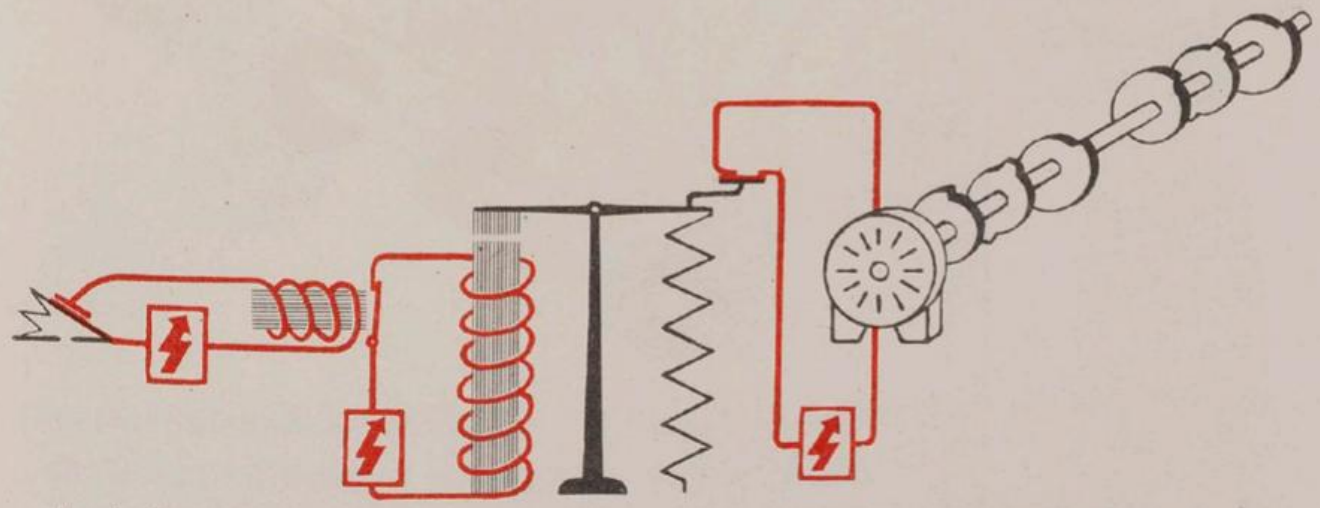
As the wheels pass over it, air is forced into a pair of bellows. The bellows swell up and close a contact switch which turns on an electric current.



Before the current flows, a spring holds down one arm of a lever.

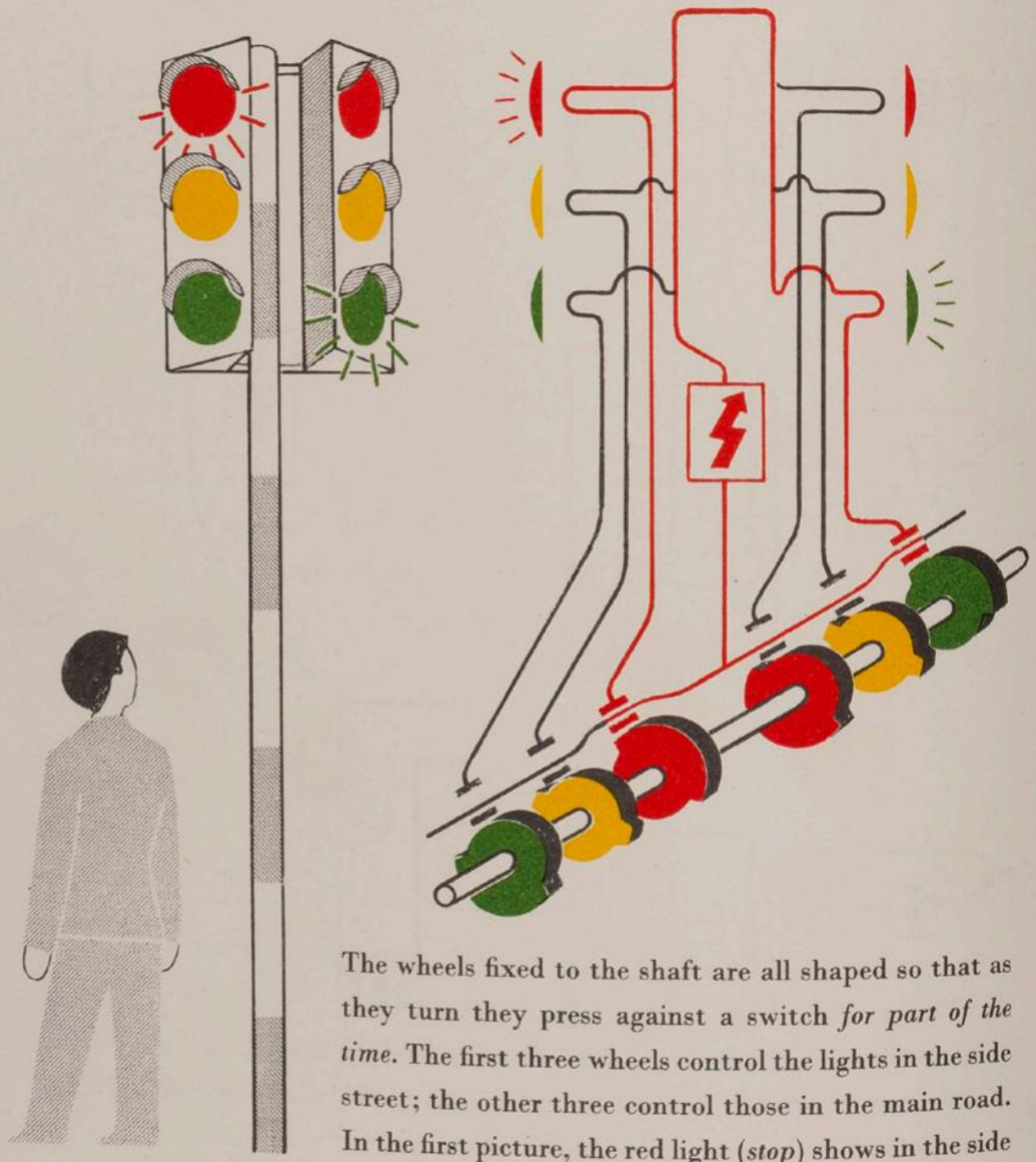


When the current is switched on, an electric magnet pulls down the opposite arm.

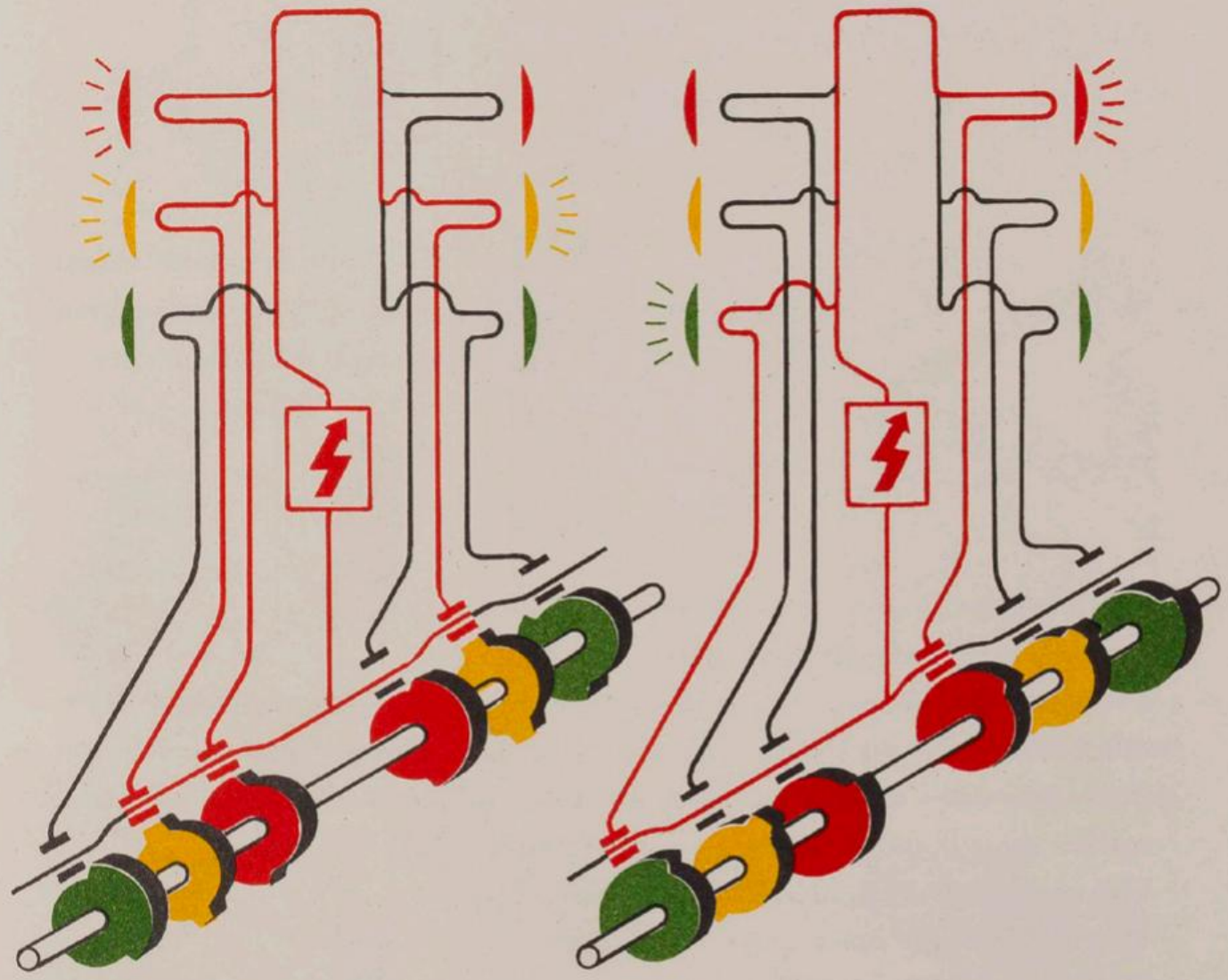


As the lever moves, it closes a switch that starts an electric current, which sets an electric motor working. The motor turns a long shaft which controls the traffic lights. Turn over and you will see how it works.

The Lights which Must Not Make a Mistake

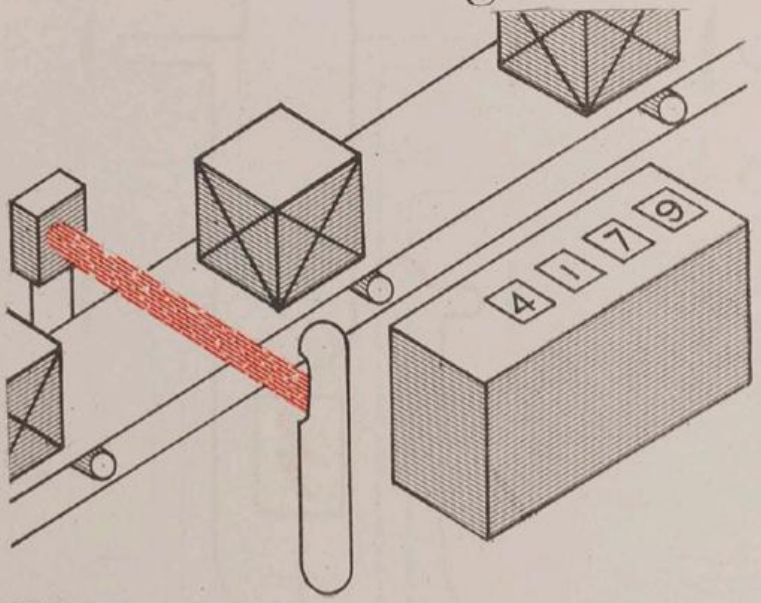


The wheels fixed to the shaft are all shaped so that as they turn they press against a switch *for part of the time*. The first three wheels control the lights in the side street; the other three control those in the main road. In the first picture, the red light (*stop*) shows in the side



street, and the green light (*go*) in the main road. As the shaft begins to turn, all the wheels turn together. Now both the red and yellow lights show in the side street – *stop, but be ready to go*. In the main road, only the yellow light shows – *be ready to pull up*. When the shaft turns still farther, the green light (*go*) shows in the side street, and the red light (*stop*) in the main road.

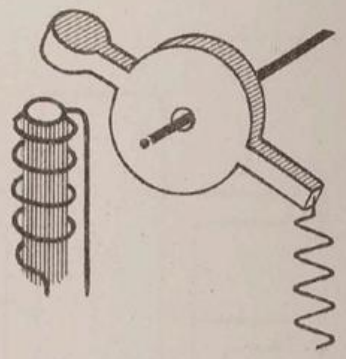
The Moving Belt and the Counting Wheels



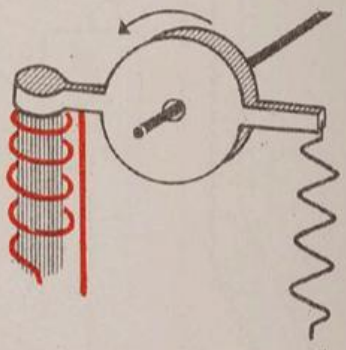
Every day this machine counts thousands of packages as they pass along a moving belt.

Just above the belt, a beam of light shines on to a cell which carries an electric current. But each time a parcel goes by, it breaks the beam; no light reaches the cell and it cannot carry the current. This current works a switch that controls the main current. When the small current flows, the main one stops; when the small current stops, the main one flows.

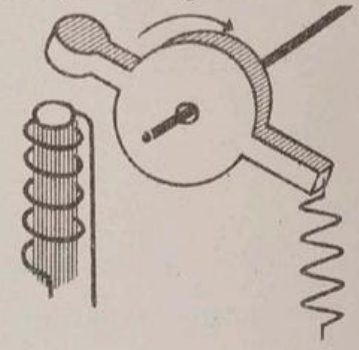
The main current is used to turn an axle inside the counting machine. Around the axle are four "barrels" with figures on them—one for units, one for tens, one for hundreds, one for thousands.



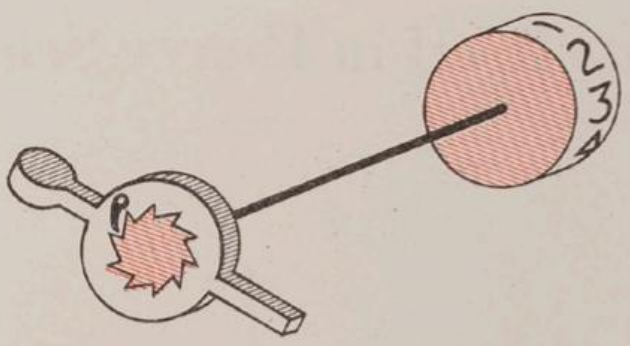
(1) While the main current is off, a spring holds down the right arm of a lever.



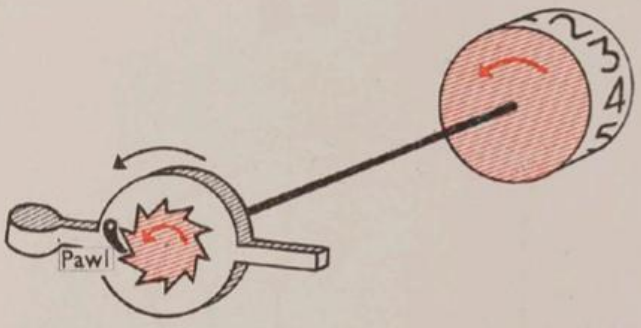
(2) When the current flows, a magnet pulls the left arm down, turning a disc.



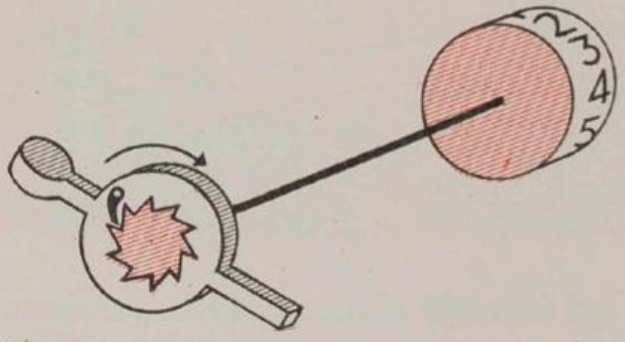
(3) When the current stops, the spring pulls lever and disc back to the right.



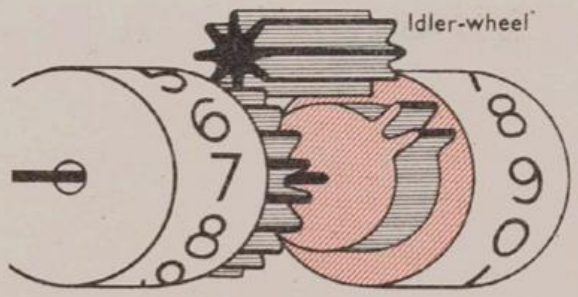
(4) The disc slips round the axle. *Fixed* to the axle is a cog-wheel, and at its far end, the barrel with unit figures.



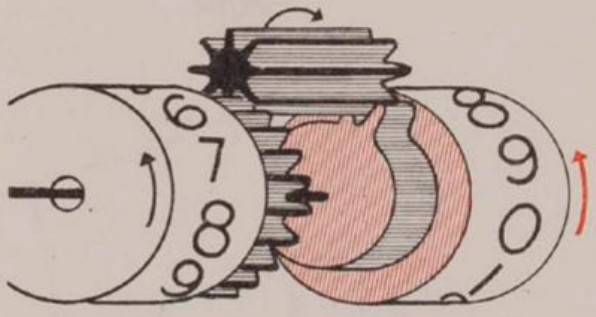
(5) When the disc turns left, a pawl pushes the wheel one cog forward, and the barrel moves to the next figure.



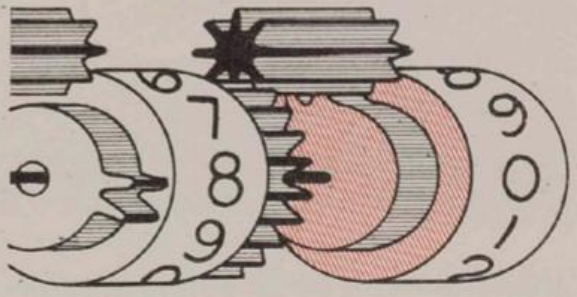
(6) When the disc turns right, the pawl slips loosely over the cogs. The wheel and the barrel do not move.



(7) The barrel showing tens is fitted to slip round the axle. It moves only when the small idler-wheel turns it.

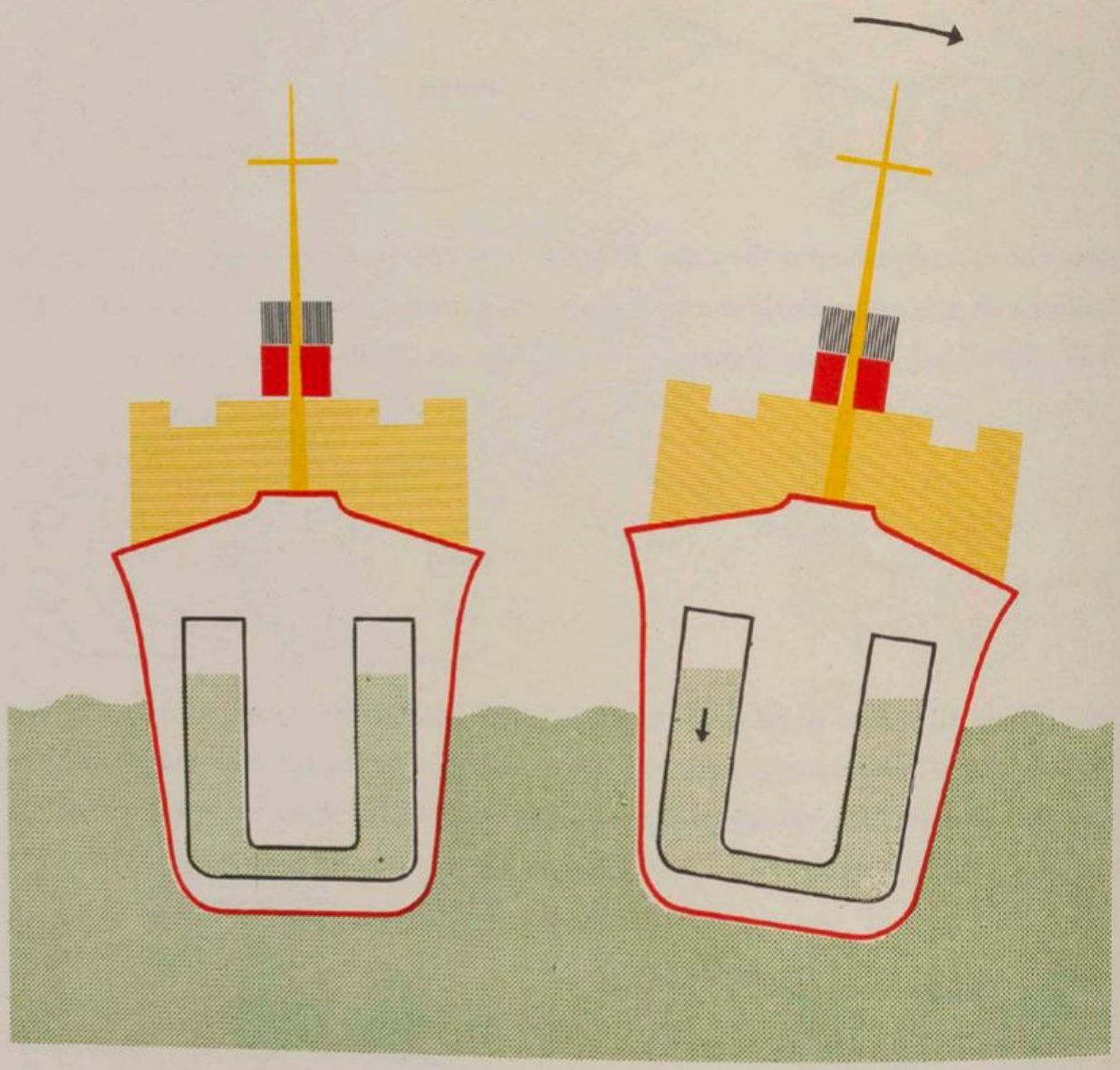


(8) Inside the units barrel are two teeth. As the unit figure changes from 9 to 0, they set the idler-wheel turning.

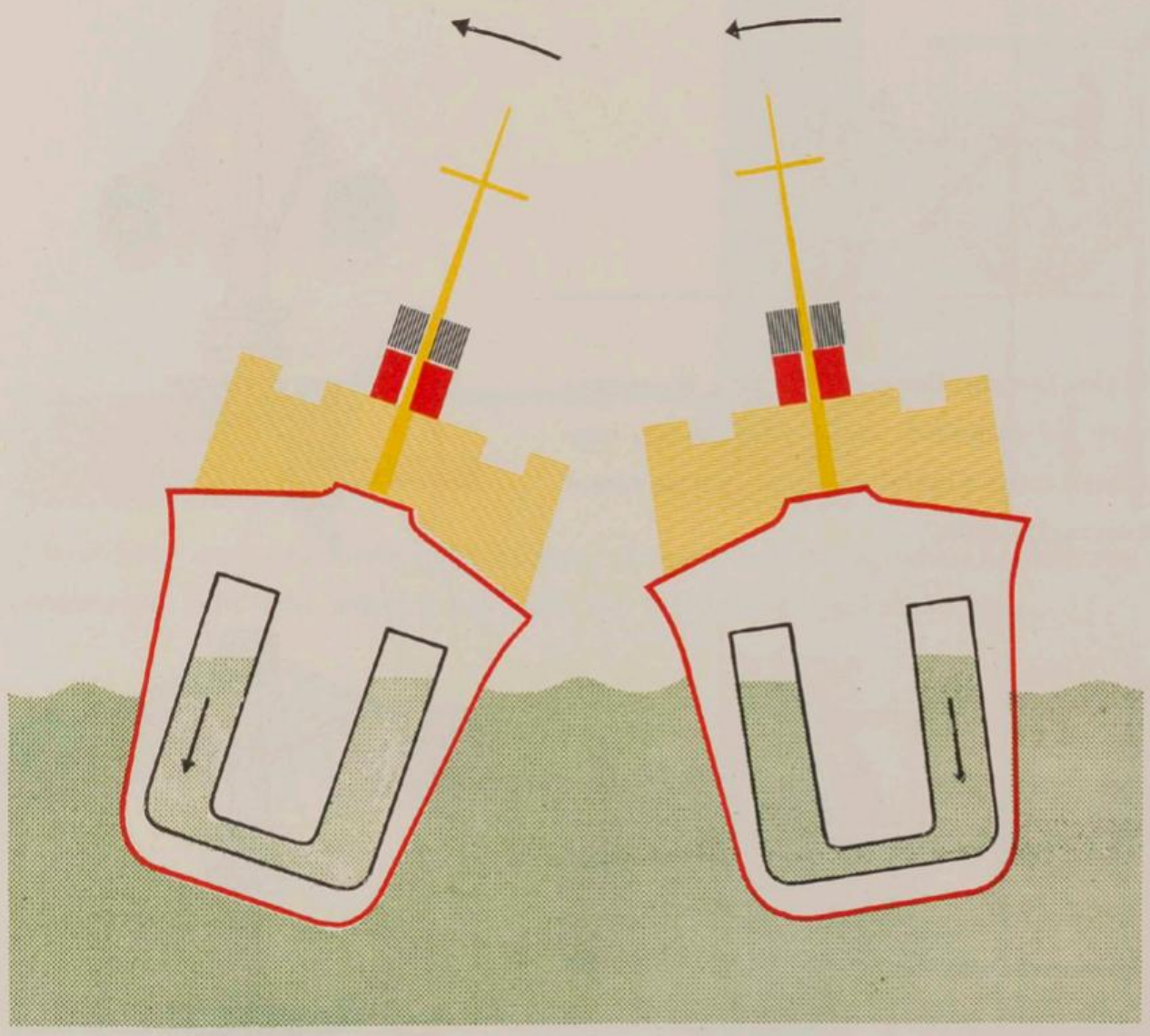


(9) The idler's teeth move the tens barrel to the next figure. Hundreds and thousands work the same way.

The Ship which Rights Itself in Heavy Seas

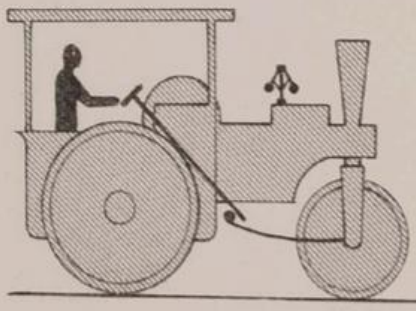


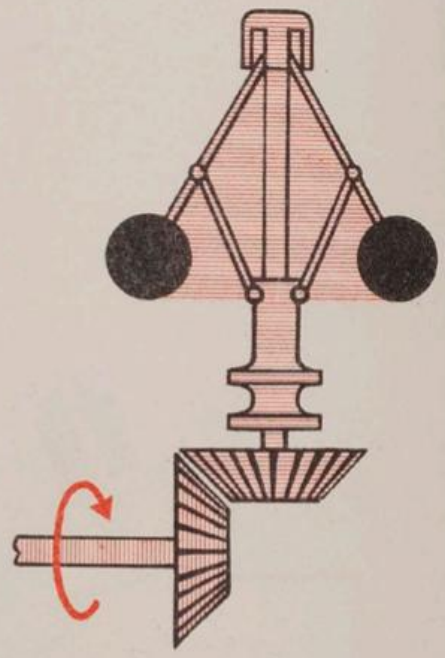
If heavy waves strike a ship, it begins to roll from side to side. If it rolls too much, its cargo may be damaged. This ship is fitted with two huge water tanks, connected by a narrow pipe. As it begins to roll to the right, the water in the left-hand tank is higher, and its weight slows the movement down.



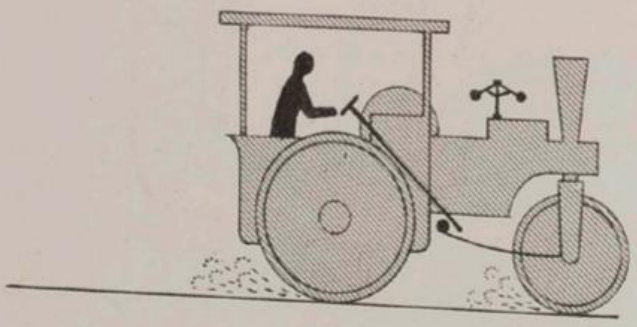
By the time it is beginning to roll back, some of the water has flowed through the pipe, and there is more on the right-hand side. So the roll back to the left is slowed down too. If the water tanks were not there, the swing would be faster and the ship would roll farther.

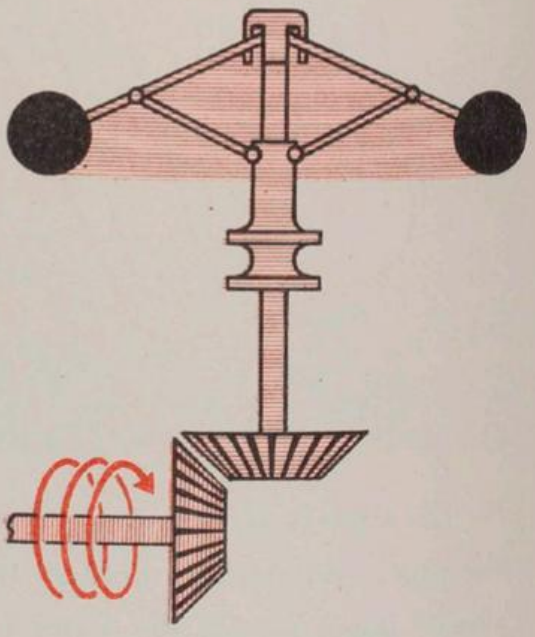
The Steamroller which Won't Go Too Fast



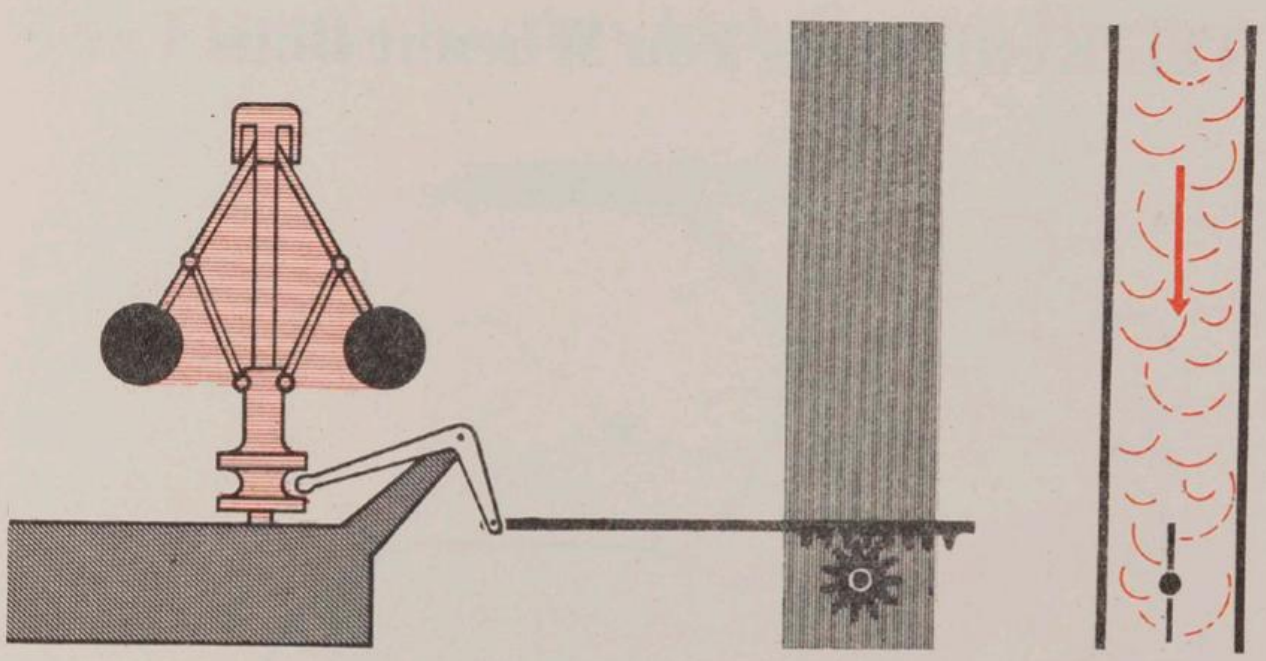


If this steamroller goes too fast, its engine may be damaged. As it runs along, cog-wheels turn a spindle, which swings round two metal balls.

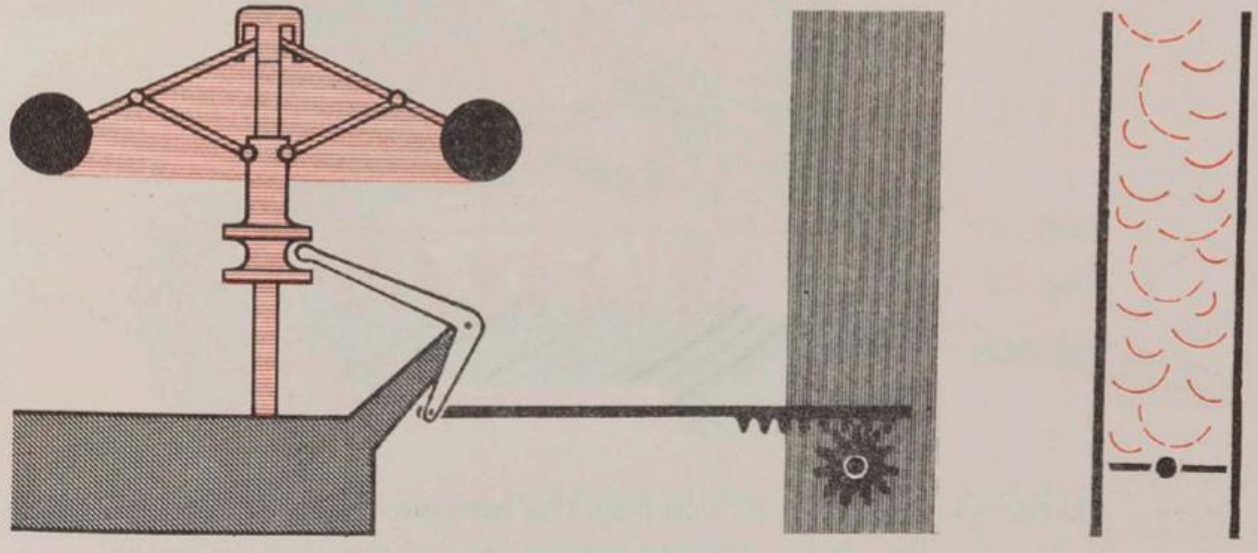




If the roller travels too fast, the spindle spins rapidly and throws the balls outwards and upwards. This slows the roller down again.



A bent lever and a rod with teeth connect the spindle to a cog-wheel outside the steam-pipe. While the wheel is held still, the valve in the pipe stays open.



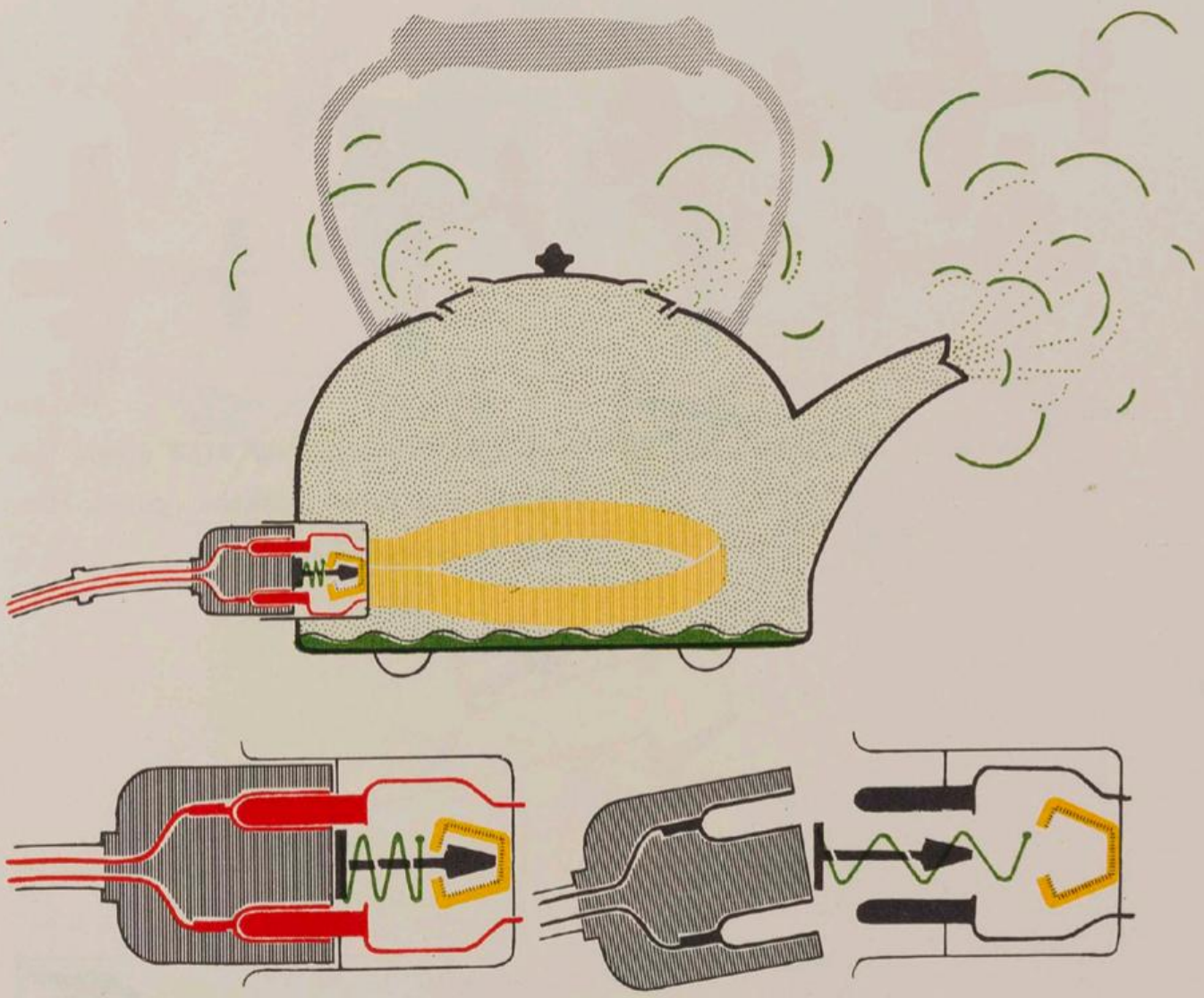
When the metal balls lift, the lever tilts, moving the rod and turning the wheel. The valve closes and no steam can pass along the pipe to drive the roller.

This Kettle Calls You When it Boils



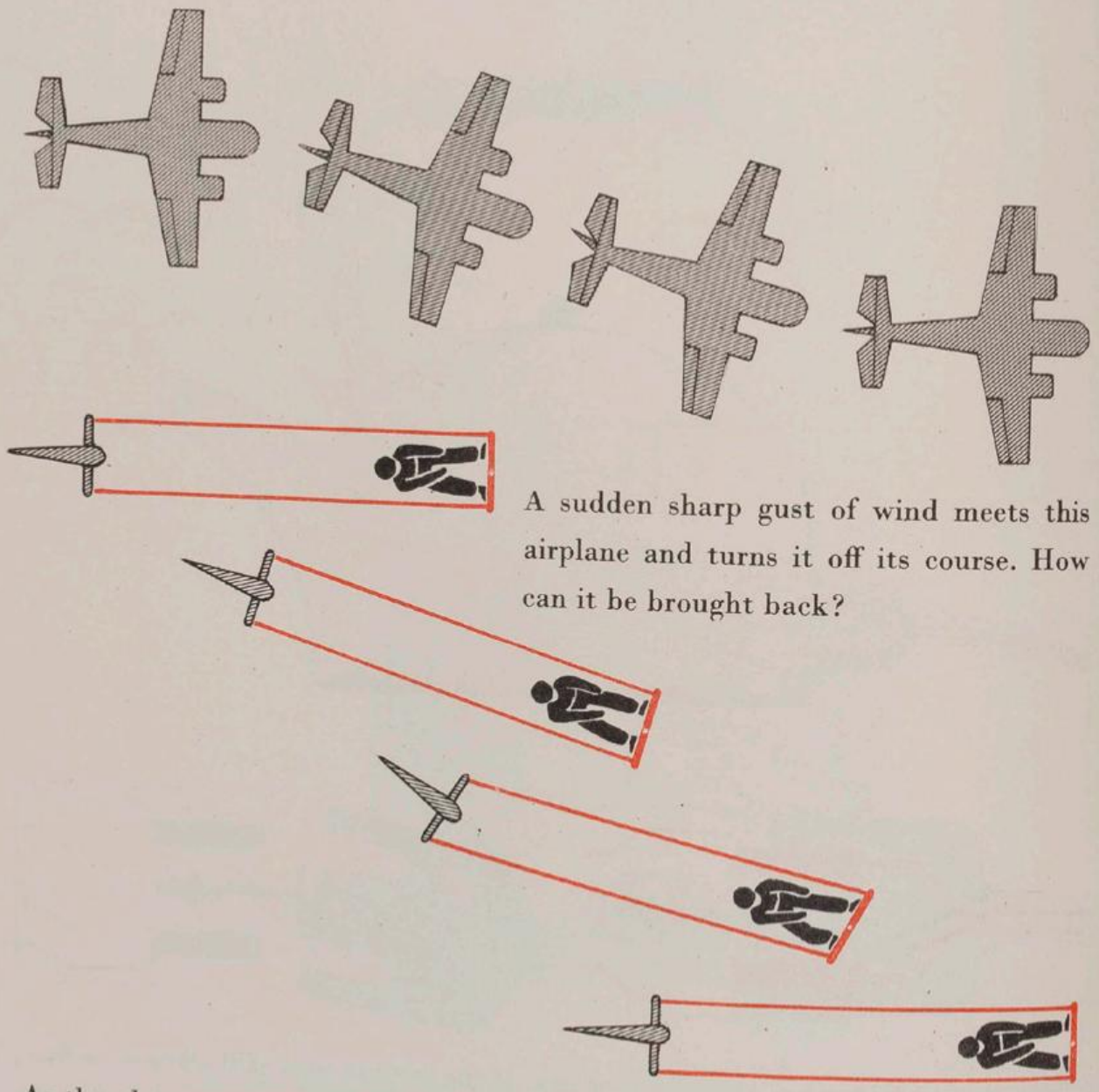
Here is a kettle which will not let you forget to turn out the gas when it comes to the boil. In the middle of the lid, which fits rather tightly over its wide spout, are two small holes. When the kettle boils, steam comes rushing through them with a shrill whistle before it escapes from the holes at the top.

The Electric Kettle which Cannot Burn



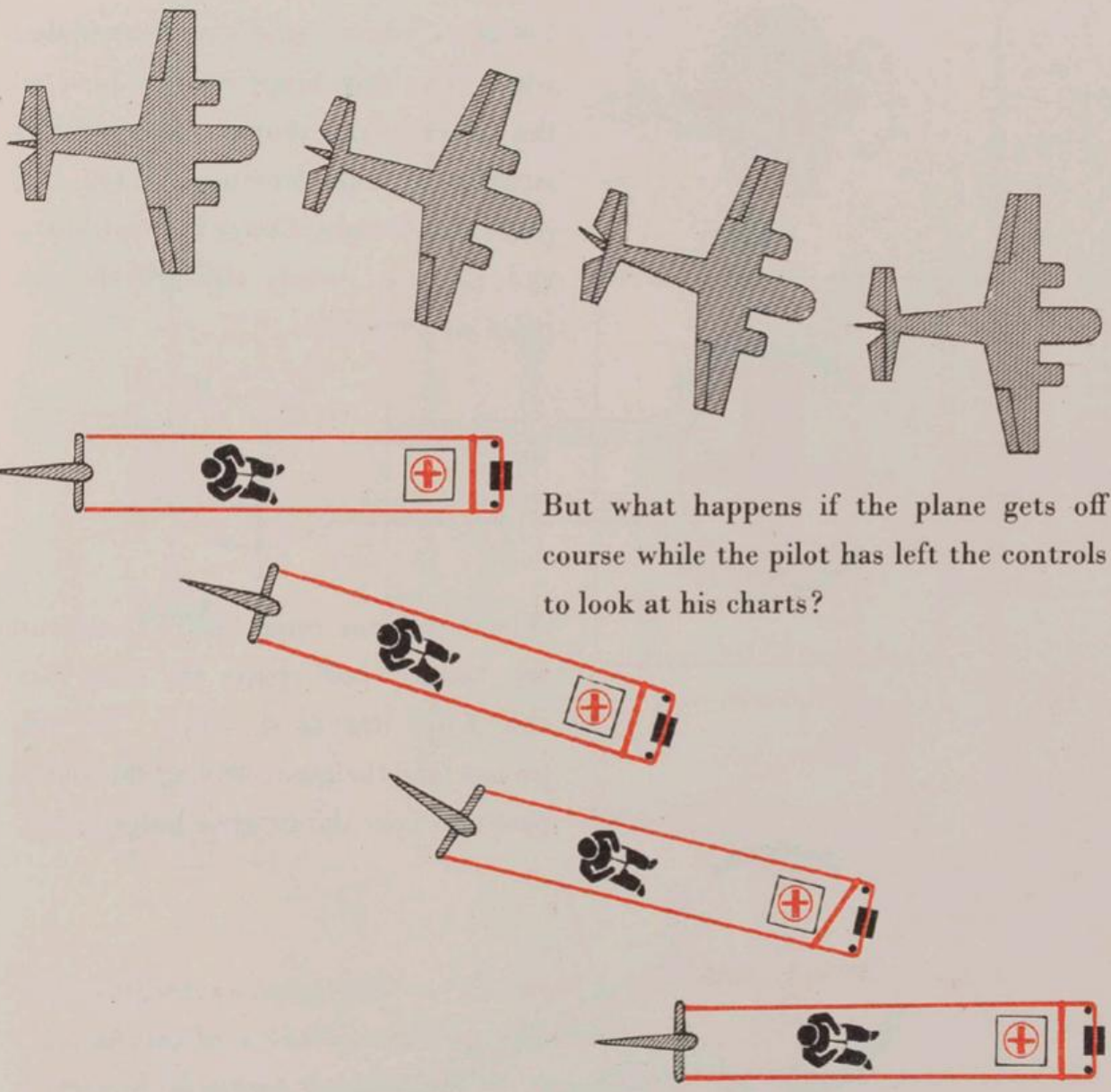
This electric kettle has almost boiled dry. If the current were still allowed to flow, the expensive heating element (shown yellow) would burn. But as the element becomes too hot, a pair of jaws made of two metals expand and release a spring. The spring pushes out the electric plug and the current is cut off.

Steering Straight Without the Pilot



A sudden sharp gust of wind meets this airplane and turns it off its course. How can it be brought back?

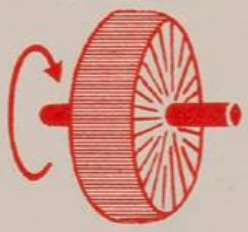
As the plane turns to the right, the pilot pushes his left foot against the rudder-control. A cable pulls the rudder over to the left and air presses against it, swinging the plane back on to its proper course.



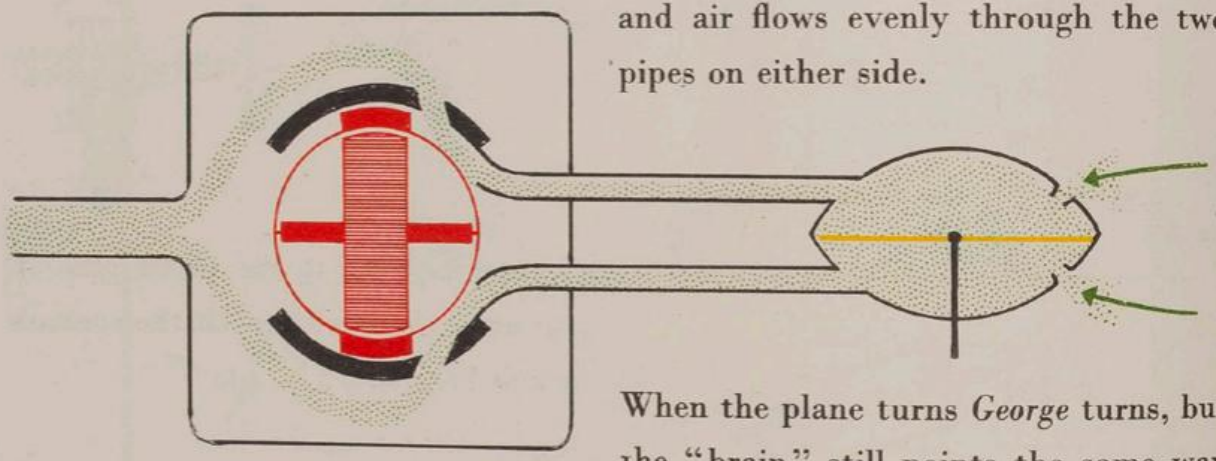
But what happens if the plane gets off course while the pilot has left the controls to look at his charts?

A very wonderful machine, which the pilot usually calls *George*, must think and act for him, pulling the rudder-cable the correct way at the correct moment. Turn over and you will see how *George* works.

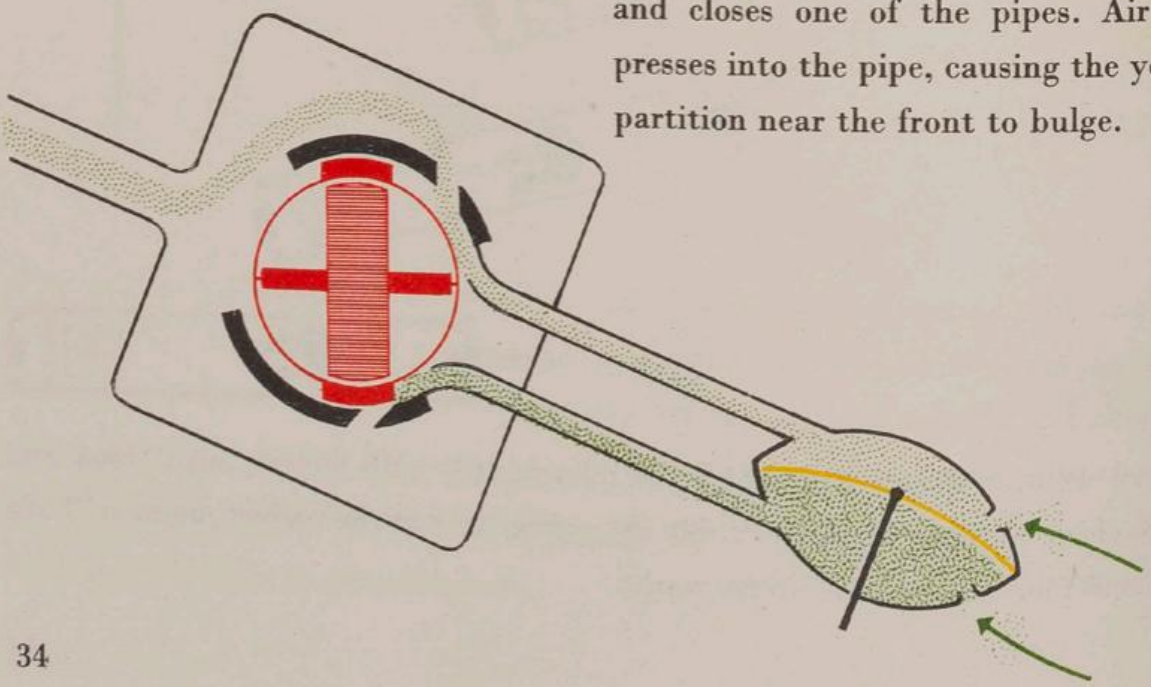
A Spinning Wheel Keeps the Plane Straight

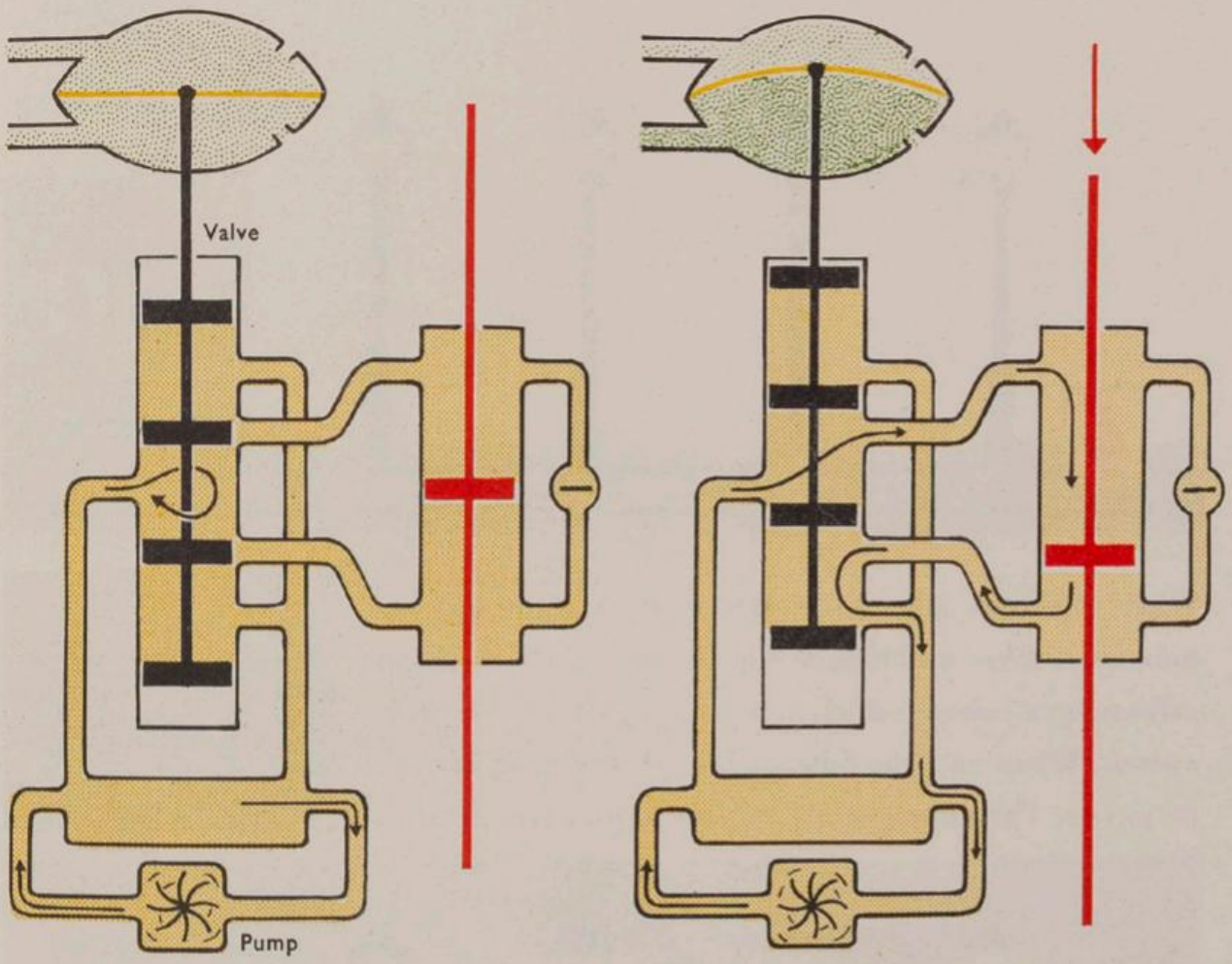


George's "brain" is a rapidly-spinning wheel. The spin keeps its axle (and all the other parts shown red) pointing steadily in one direction. While the plane flies straight, *George* keeps straight, and air flows evenly through the two pipes on either side.



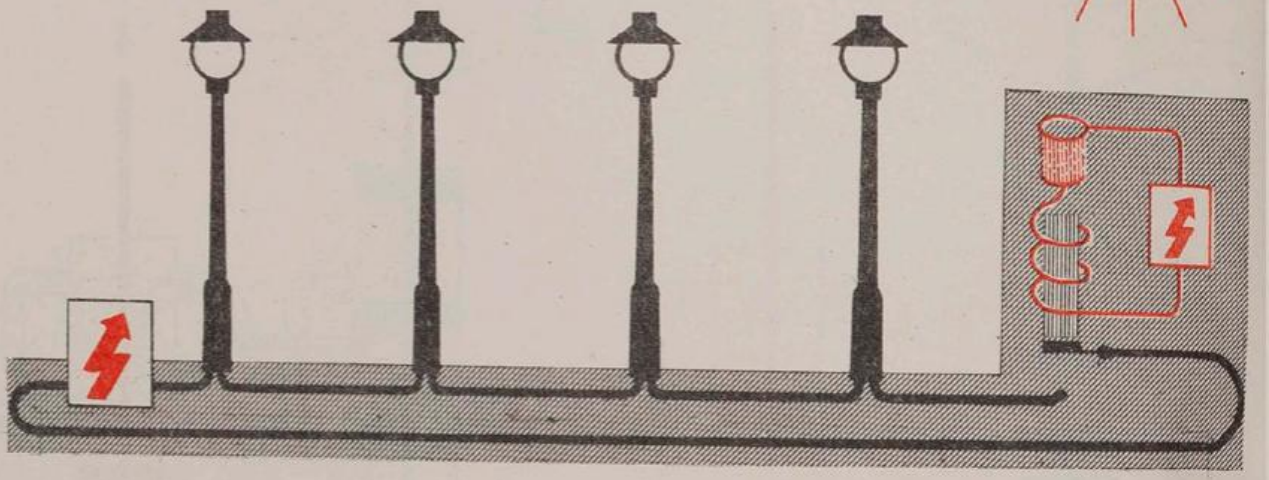
When the plane turns *George* turns, but the "brain" still points the same way and closes one of the pipes. Air still presses into the pipe, causing the yellow partition near the front to bulge.



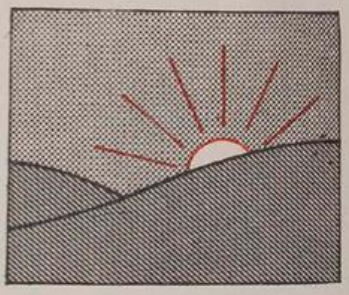


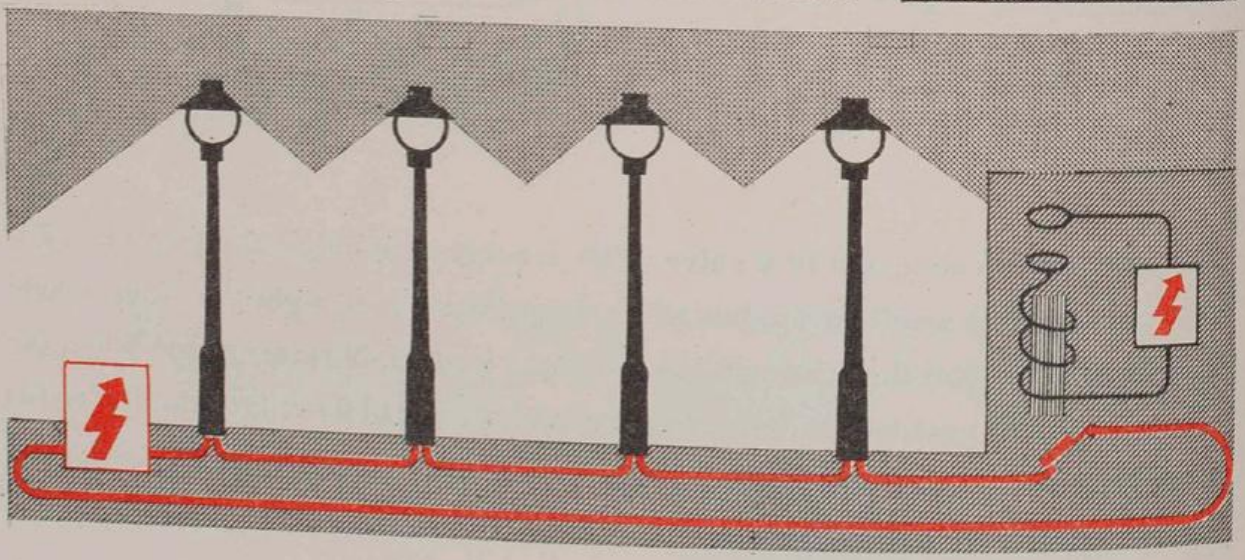
The partition is connected to a valve inside a network of oil-filled pipes. The oil is kept moving by a small pump, but while the partition is straight the valve is held down and oil cannot flow through the two pipes leading off to the right. When the plane turns, the partition bulges and raises the valve. Oil flows into the top right-hand pipe and pushes down the red disc with a rod fixed through it. As the rod moves it pulls the rudder-cable.

The Lamps which Darkness Lights



When darkness falls, these street lamps light up, yet nobody touches a switch. While the sun shines, a special cell carries a current which makes a magnet, holding up a switch. When no light falls on the cell the magnet loses its power. The switch drops and the main current flows.





BOOKS WHICH ARE LIKE THIS ONE

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Cutting the tunnels to take the trains – Signals worked by the trains themselves – The giant moving stairways – A station beneath a station – How air puts on the brakes.

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Rescue by ladder and line – When no one can pass down the stairs – The fire-boat fights a dockland fire – How water sounds the factory alarm – Planes and parachutes save a forest.

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A rocket which rises a hundred miles – How a steady jet drives the modern plane – Looking inside a great jet air-liner – A modern rocket races the sun – A plane without a pilot.

LET'S LOOK AT THE SKY

New worlds the telescope sees – How far are the stars? The planet where something grows – Red giants, white dwarfs – The star that follows the sun – A tiny speck in a vast universe.

A MESSAGE ROUND THE WORLD

Laying a cable deep on the sea-bed – The current that carries a voice – Sending a message without wires – How radio waves can carry a picture – Sending thirty pictures every second.

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Getting away from the pull of the Earth – Flying too fast to fall – When a man will weigh nothing at all – Stepping out into empty space – Strange worlds which men may one day see.

BY MARIE NEURATH



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