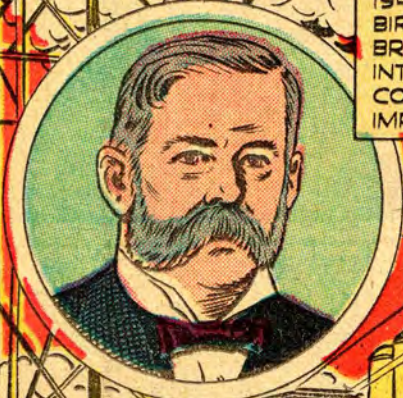


# GEORGE WESTINGHOUSE

1946 MARKS THE 100TH ANNIVERSARY OF THE BIRTH OF GEORGE WESTINGHOUSE, WHOSE BRILLIANT ACHIEVEMENTS DURING A PERIOD OF INTENSE NATIONAL GROWTH HAVE FOREVER COUPLED HIS NAME WITH PROGRESS AND IMPROVED LIVING.



INCLUDING 7 PAGES OF  
**Fun in Science**  
FOR BOYS AND GIRLS

GEORGE WESTINGHOUSE WAS BORN IN CENTRAL BRIDGE, N.Y., ON OCTOBER 6, 1846. AS A BOY IN HIS FATHER'S MACHINE SHOP...

YOUR SON IS A MIGHTY SMART YOUNG FELLOW, MR. WESTINGHOUSE.

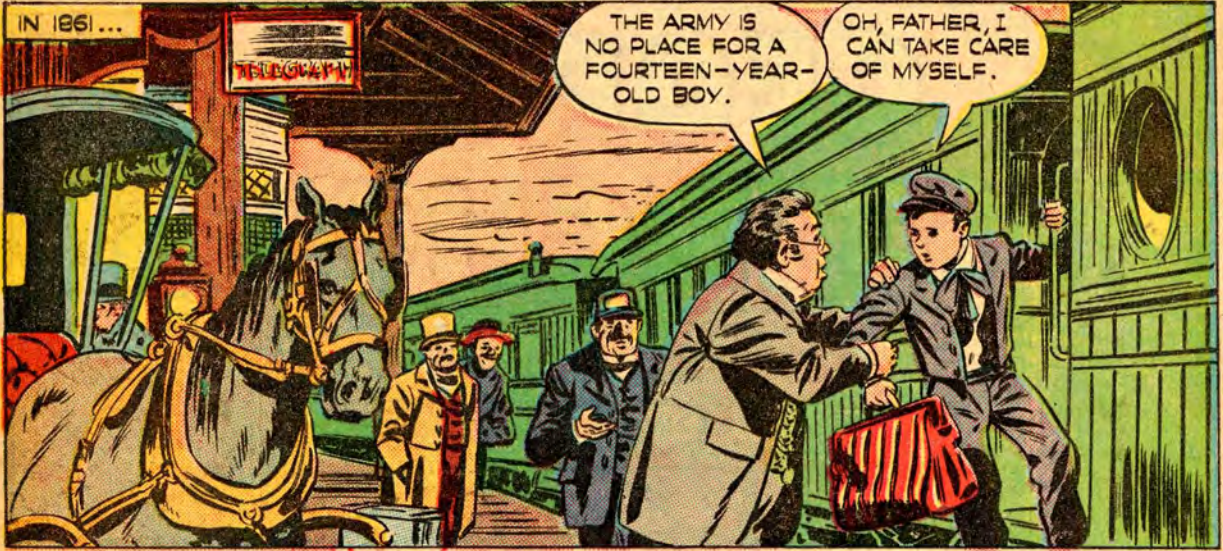
PERHAPS. BUT I TOLD HIM TO CUT A SHIPMENT OF PIPES INTO EQUAL LENGTHS - AND THERE HE IS, WASTING HIS TIME DOING SOMETHING ELSE.



BUT, FATHER, THE JOB IS DONE! I RIGGED UP A POWER TOOL AND CUT THE PIPE AUTOMATICALLY IN A FEW HOURS.

WHAT? I EXPECTED THAT TASK TO TAKE THE REST OF THE WEEK!





IN 1861...

THE ARMY IS NO PLACE FOR A FOURTEEN-YEAR-OLD BOY.

OH, FATHER, I CAN TAKE CARE OF MYSELF.



BUT A FEW YEARS LATER, HE WAS IN THE NAVY.

WELL I'LL BE A LANDLUBBER! A LATHE!

SURE, IN MY SPARE TIME I TURN OUT MECHANICAL GADGETS.

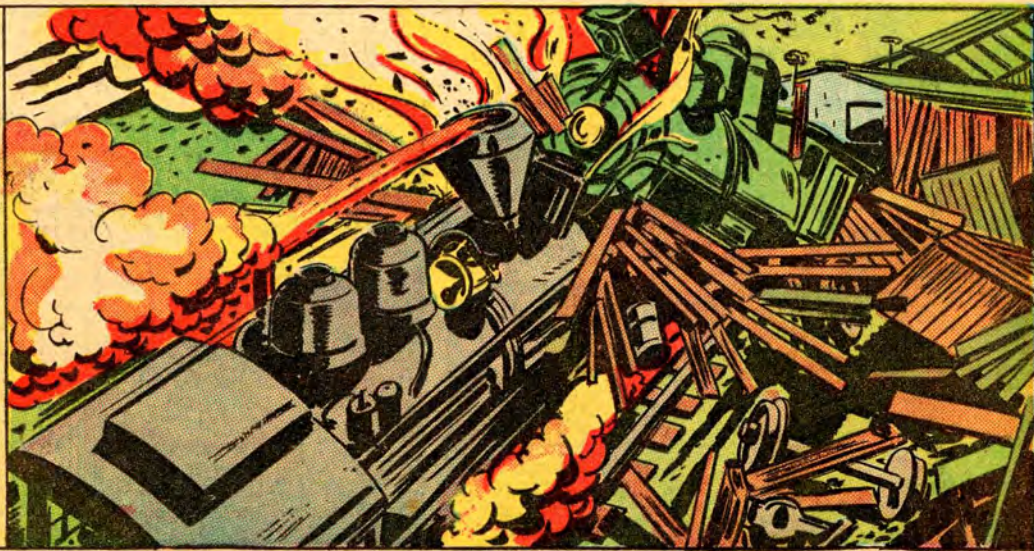


AFTER THE WAR, GEORGE RETURNED TO HIS FATHER'S SHOP. SOON ...

I'VE GOT IT! THE PATENT ON MY ROTARY ENGINE!

YOUR FIRST PATENT AT NINETEEN! KEEP UP THE GOOD WORK, SON!

THEN, IN 1866, AN EVENT TOOK PLACE WHICH WAS DESTINED TO BE THE TURNING POINT IN HIS CAREER.



A FEW MINUTES LATER, ANOTHER TRAIN ARRIVED ON THE SCENE : AMONG THE PASSENGERS WAS GEORGE WESTINGHOUSE .

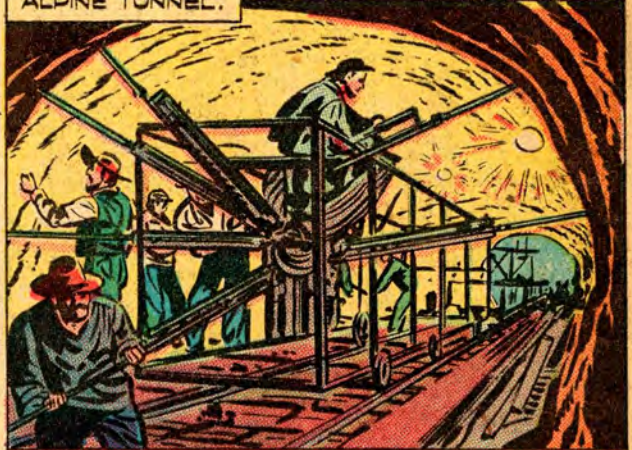
IF THE TRAIN COULD ONLY HAVE STOPPED A MOMENT SOONER ...

HAND BRAKES DON'T STOP A HEAVY TRAIN QUICKLY ENOUGH .



GEORGE SAW THE NEED FOR A BRAKE THAT WOULD STOP A TRAIN INSTANTLY, AND...

THEN HE GOT AN INSPIRATION FROM THE FIRST SUCCESSFUL USE OF COMPRESSED AIR TO OPERATE ROCK DRILLS IN THE MONT CENIS ALPINE TUNNEL .

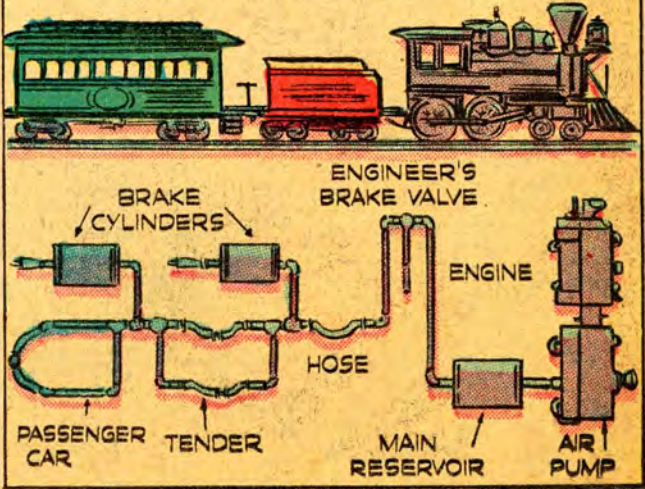


FINALLY...

AT LAST! MY COMPRESSED AIR BRAKE WORKS!



THE WESTINGHOUSE ATMOSPHERIC BRAKE



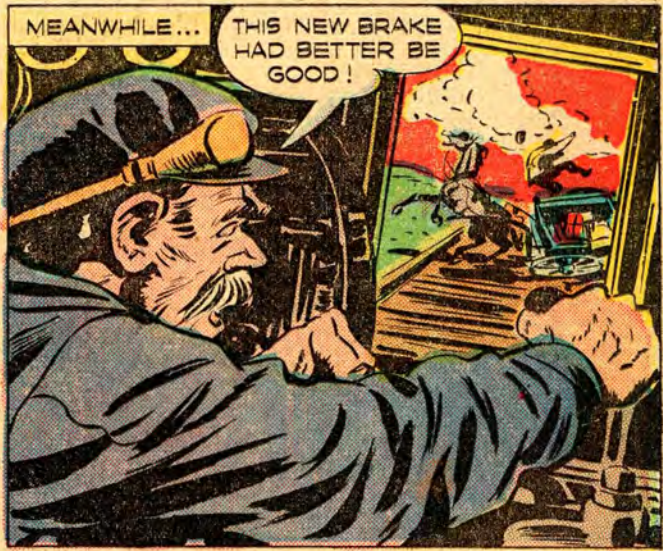
BUT THE YOUNG INVENTOR COULD NOT CONVINCE THE RAILROADS UNTIL, FINALLY, IN APRIL, 1869...

I HOPE YOUR INVENTION IS SUCCESSFUL, YOUNG MAN - FOR THE PANHANDLE RAILROAD'S SAKE, AS WELL AS YOUR OWN.

DON'T WORRY, SIR. IT WILL WORK.

MEANWHILE...

THIS NEW BRAKE HAD BETTER BE GOOD!



INSIDE...

WHAT HAPPENED?

I WOULD LISTEN TO THAT YOUNG FOOL!



I HAD TO APPLY THE NEW AIR BRAKE IN A HURRY, SIR! BUT IT WORKED PERFECTLY AND SAVED THIS MAN'S LIFE!

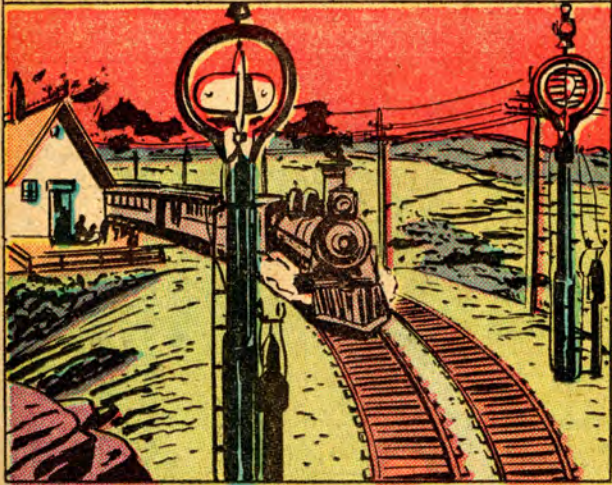


AT TWENTY-TWO, WESTINGHOUSE WAS IN BUSINESS - BUILDING AND IMPROVING AN AIR BRAKE. BY 1881, HE DEVELOPED THE FIRST AUTOMATIC ELECTRIC BLOCK SIGNAL.

GENTLEMEN, THIS NEW SIGNAL SYSTEM WILL AVERT WRECKS, SAVE LIVES, AND SPEED TRAFFIC.

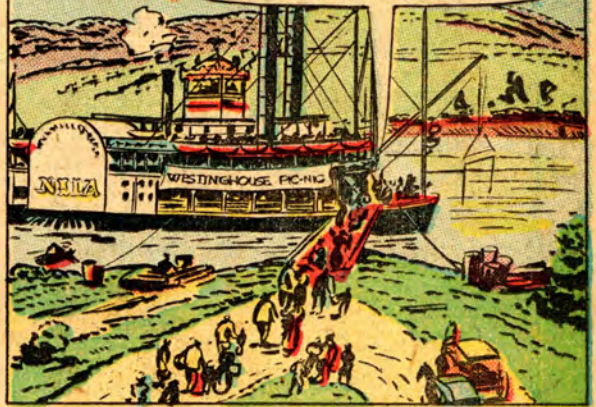


SOON, THE WESTINGHOUSE AUTOMATIC SIGNAL WAS IN USE THROUGHOUT THE COUNTRY.



WESTINGHOUSE PROVED TO BE A CONSIDERATE EMPLOYER.

IT SURE IS NICE TO GET EVERY SATURDAY AFTERNOON OFF FOR PICNICS AND BALL GAMES!



IN 1885, ELECTRICITY SHOWED GREAT PROMISE AS A SOURCE OF POWER. BUT DIRECT CURRENT, WHICH WAS THEN USED, COULD NOT TRANSMIT CURRENT VERY FAR, SERIOUSLY LIMITING INCREASED USE OF ELECTRICITY. THEN...



ALTERNATING CURRENT, NOT DIRECT, IS THE ANSWER!

YES, AND I'M BUYING RIGHTS TO THIS TRANSFORMER. WITH IMPROVEMENTS, IT WILL BE THE KEY TO THE ALTERNATING-CURRENT SYSTEM.

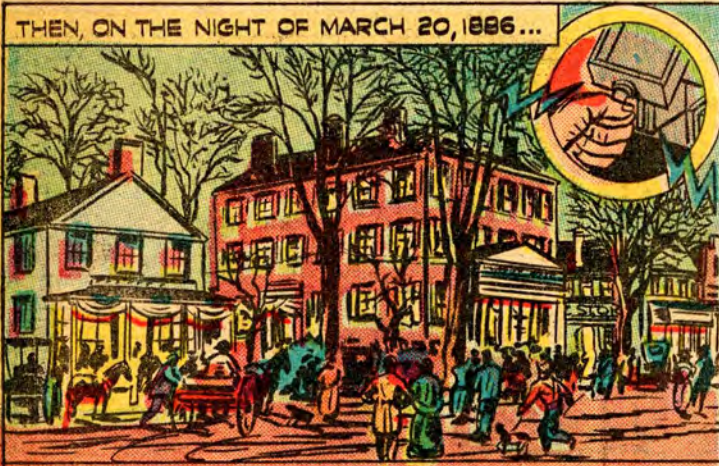
SOON, THE TRANSFORMER WAS READY FOR A FINAL TEST. WESTINGHOUSE SENT HIS ASSOCIATE, WILL STANLEY, TO GREAT BARRINGTON, MASS., AND...



LOOK AT THE MAN, MAMA!

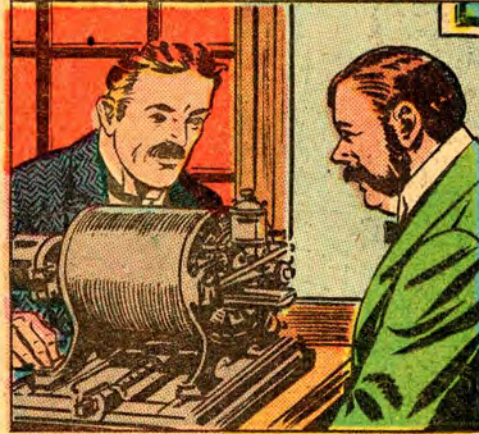
LAND'S SAKES! GROWN MEN CLIMBING TREES!

THEN, ON THE NIGHT OF MARCH 20, 1886...



AND WITHIN TWO YEARS, APPROXIMATELY ONE HUNDRED ALTERNATING-CURRENT PLANTS WERE IN OPERATION.

NEXT, WESTINGHOUSE, WITH THE AID OF A YOUNG ENGINEER, NIKOLA TESLA, PERFECTED THE FIRST PRACTICAL INDUCTION MOTOR.



AGAINST STRONG OPPOSITION, WESTINGHOUSE WON THE CONTRACT TO LIGHT THE GREAT COLUMBIAN EXPOSITION TO BE HELD IN CHICAGO IN 1893.

RIVAL INTERESTS HOLD THE PATENT ON THE ONLY PRACTICAL LAMP AVAILABLE! WE'LL HAVE TO DEVELOP A NON-INFRINGING LAMP - AND DO IT QUICKLY!



IN AN INCREDIBLY SHORT TIME, WESTINGHOUSE PERFECTED THE "STOPPER" LAMP AND...

YOUR DEMONSTRATION HAS PROVED THAT ALTERNATING CURRENT IS COMPLETELY PRACTICAL.



AND THIS DEMONSTRATION HELPED WESTINGHOUSE WIN A CONTRACT FOR HARNESSING THE VAST POWER OF NIAGARA FALLS.

WE HAVE A TREMENDOUS JOB AHEAD OF US, GENTLEMEN. THIS WILL BE THE BIGGEST ELECTRICAL PLANT IN THE WORLD.



BY NOVEMBER, 1895, THREE MAMMOTH GENERATORS HAD BEEN INSTALLED.

THIS WILL SET THE PACE FOR POWER DEVELOPMENTS ALL OVER THE WORLD!

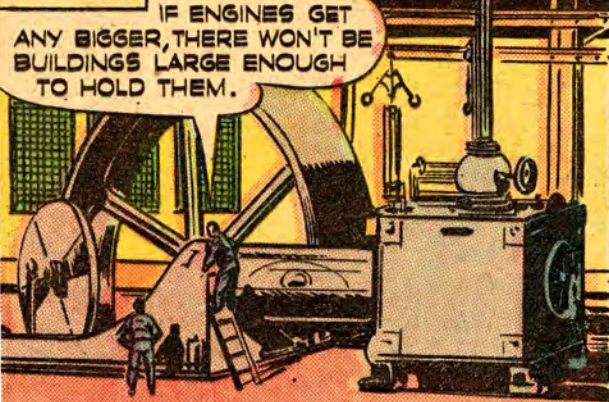


THEN, ON NOVEMBER 6, 1896, IN BUFFALO...



SHORTLY AFTERWARDS, AT A GENERATING PLANT...

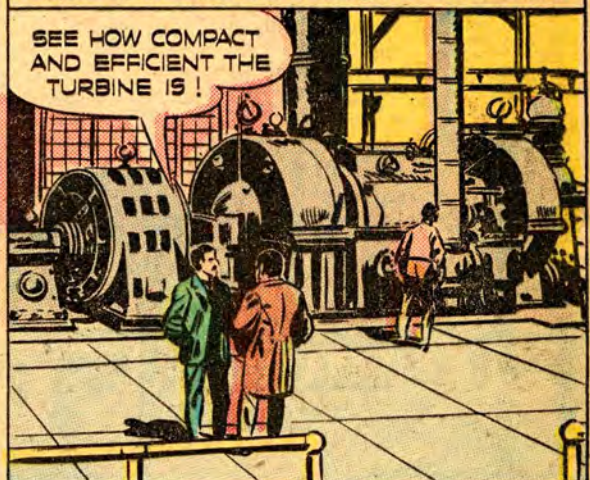
IF ENGINES GET ANY BIGGER, THERE WON'T BE BUILDINGS LARGE ENOUGH TO HOLD THEM.



BUT WESTINGHOUSE WAS PERFECTING THE PARSONS' ROTARY STEAM TURBINE.

AND, IN 1900, WESTINGHOUSE INSTALLED THE FIRST CENTRAL STATION TURBINE GENERATOR.

SEE HOW COMPACT AND EFFICIENT THE TURBINE IS!



IN PITTSBURGH, ON MAY 16, 1905, RETURNING TO RAILROAD PROBLEMS...

MR. WESTINGHOUSE, I'M CONVINCED YOUR NEW ALTERNATING-CURRENT ELECTRIC LOCOMOTIVE WILL SOON BE IN USE ON MAIN LINES THROUGHOUT THE COUNTRY.



AND THEN, TURNING HIS ATTENTION TO SHIPS' ENGINES.

McALPINE AND I HAVE WORKED OUT THIS SCHEME FOR A REDUCTION GEAR DRIVE WHICH WILL MAKE IT POSSIBLE TO DRIVE SHIPS WITH TURBINES.

THAT'S WONDERFUL, MELVILLE.

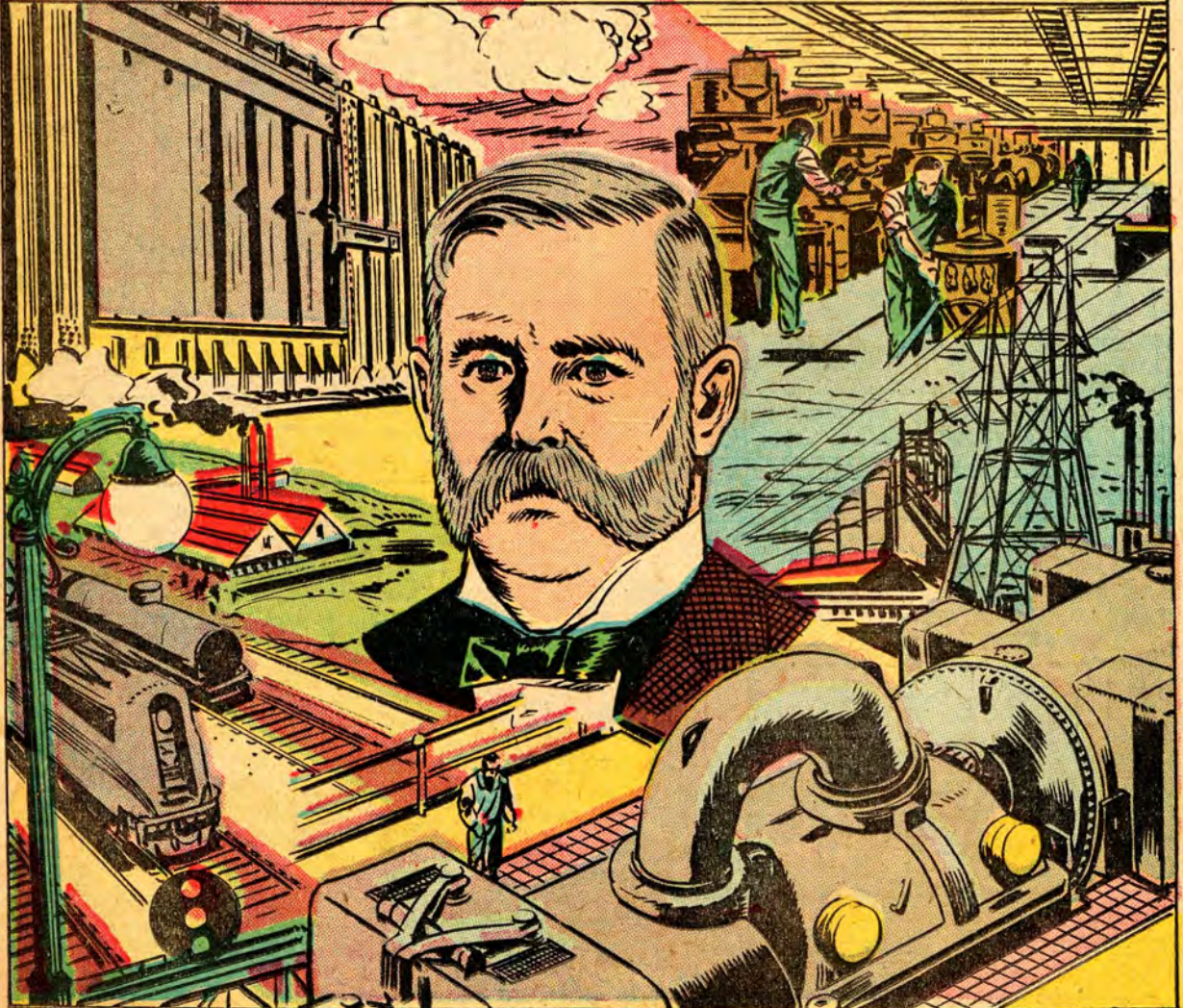


ON JANUARY 21, 1911...

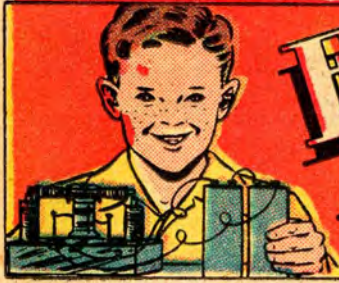
IT WON'T BE LONG BEFORE ALL SHIPS ARE POWERED BY MARINE TURBINES.



GEORGE WESTINGHOUSE DIED ON MARCH 12, 1914. HE LEFT THE WORLD A BETTER PLACE IN WHICH TO LIVE, AND HIS WORK GOES ON THROUGH THE GREAT INDUSTRIES HE CREATED.







# Fun in Science

## FOR BOYS AND GIRLS



### Stunts with Static Electricity

You produce static electricity every time you comb your hair . . . shine your shoes . . . or rub a cat's fur. The comb, shoes, and cat are charged *electrostatically* by friction—caused by rubbing. Here are some amusing stunts with static electricity which you can do to surprise your friends . . .

*Important Note: These stunts work best in dry weather. Don't be disappointed if they fail to work on very damp days.*

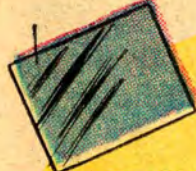
#### "MAGNETIZED" WATER

—Run a comb briskly through your hair and hold it near a fine stream of water. The water acts as though it were "magnetized"—because, with the *electrostatically* charged comb, you can pull the stream far over to one side . . . just as though it were a piece of string!



**"JUMPING BEANS"** — Drop some tiny bits of tissue paper on charged disc. They will stick to disc for a moment and then jump high in the air. You can keep them floating in air merely by holding disc under them.

#### PHOTO FILM



PIECE OF FUR

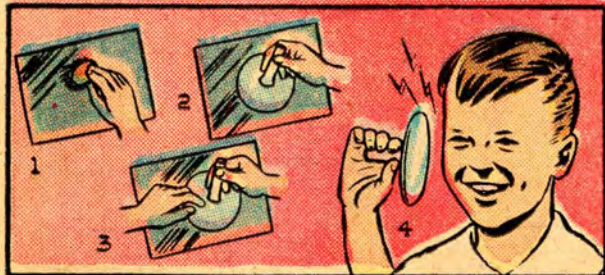
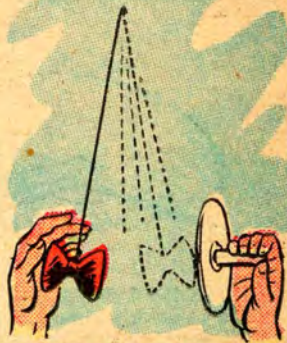


SEALING WAX  
TIN DISC

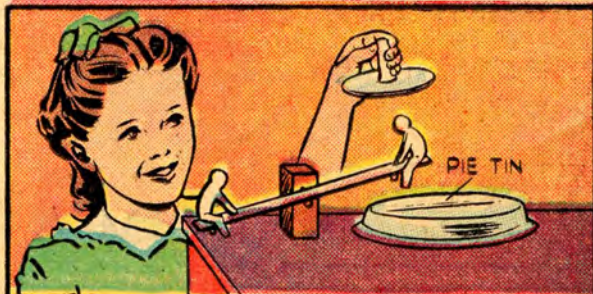


**AN ELECTROPHORUS** is a device for storing up a large charge of static electricity. All you need for building one is: a large photographic film . . . a tin disc (cover from quart paint can will do) . . . half a stick of sealing wax . . . and a bit of fur. Heat one end of sealing wax and attach it securely to center of tin disc—and your electrophorus is complete.

**FLY BUTTERFLY** — Make a small butterfly of tissue paper and support it with cotton thread—between your hand and charged disc—as shown. The butterfly will flutter back and forth until disc has lost its charge.

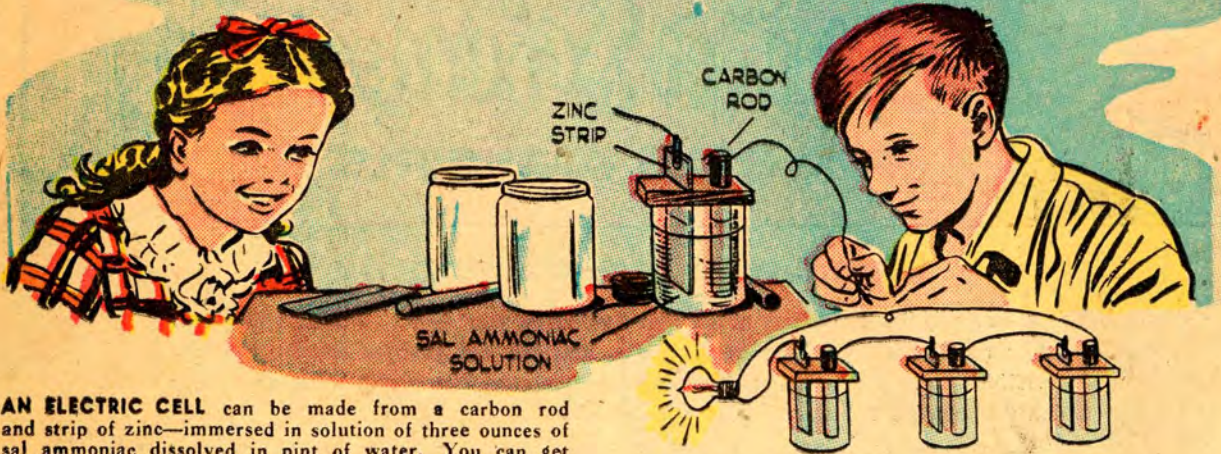


**TO CHARGE AN ELECTROPHORUS,** you first rub photographic negative briskly with fur. Then place disc on negative. Finally, touch your finger to disc as shown. To test static charge of disc, pick it up by sealing wax handle and hold it near your ear. You'll hear a "click" as a spark flies from disc to your body.



**MAGIC SEE-SAW** — Make a cardboard see-saw . . . with paper figures as illustrated . . . and place pie tin under one figure. When disc is held over figure, see-saw will rock up and down many times with each charge.

## Build your own Electric Cell



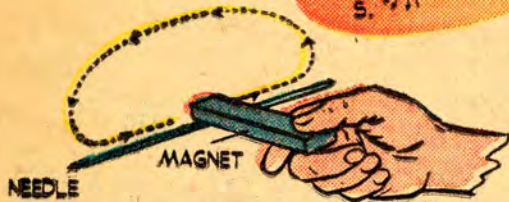
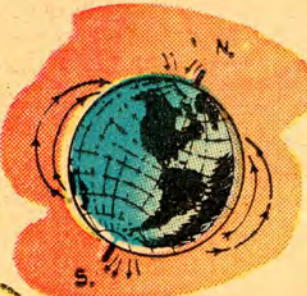
**AN ELECTRIC CELL** can be made from a carbon rod and strip of zinc—immersed in solution of three ounces of sal ammoniac dissolved in pint of water. You can get carbon rod and zinc strip by tearing apart an old electric dry cell. Sal ammoniac can be bought in any drug store.

Pictured above is correct method for connecting a number of electric cells in series to produce a *higher voltage* than you can obtain from a single cell. Each cell will produce about 1 volt—three cells about 3 volts.

## Playing with Permanent Magnets

### THE EARTH IS A MAGNET

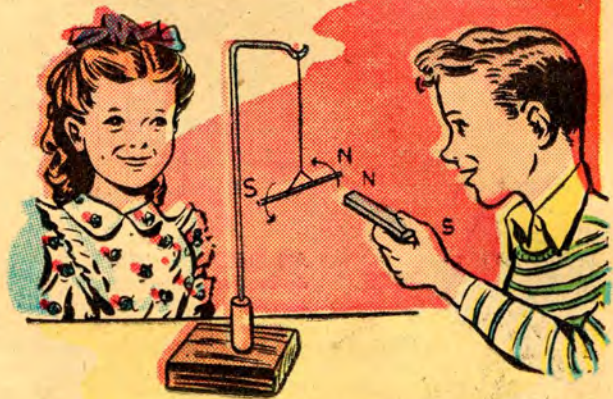
—A compass needle always points North because the earth itself is a huge magnet—with magnetic poles at the North and South and a magnetic field in the surrounding space.



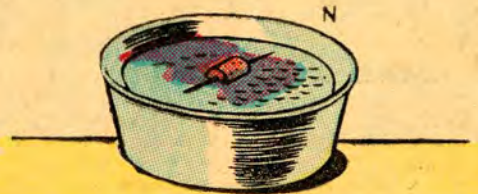
**MAGNETIZING A NEEDLE**—Lay large darning needle on table and stroke it with end of permanent magnet. Always stroke in one direction, lifting permanent magnet high on return stroke, as indicated by dotted lines.



**MAGNETIC FIELDS** — Break magnetized darning needle in half, place it under sheet of paper, and sprinkle iron filings on paper. Tap paper, and filings will form a pattern—showing arrangement of magnetic field around the needle.



**LAWS OF MAGNETISM**—Suspend magnetized needle, as shown, and hold North pole of *swinging* magnet near North pole of needle. Needle will *swing away* from magnet. Now reverse magnet and needle will be attracted to it. This demonstrates one of the laws of magnetism: *like-magnetic poles repel and unlike poles attract.*



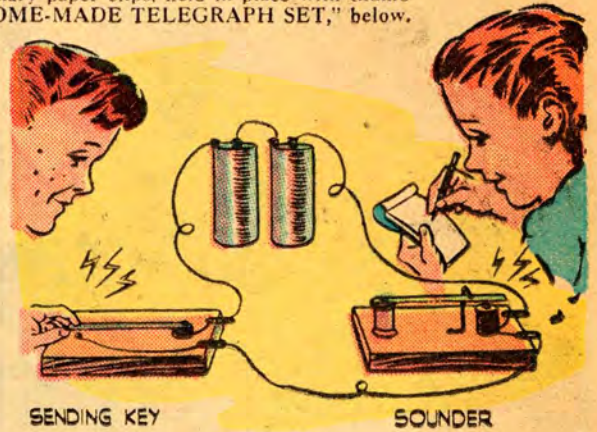
**A FLOATING COMPASS** is easily built by attaching magnetized needle to cork and placing cork in bowl of water. The earth's magnetism will turn needle until it points North.

# Fun with Electromagnetism

Home-made electric cells, shown on opposite page, become weak in a very short time. For experiments that will follow, we suggest that you use regular electric dry cells which you can buy in any hardware store. Incidentally, ordinary paper clips, held in place with thumb tacks, are excellent for connecting wires—see "HOME-MADE TELEGRAPH SET," below.



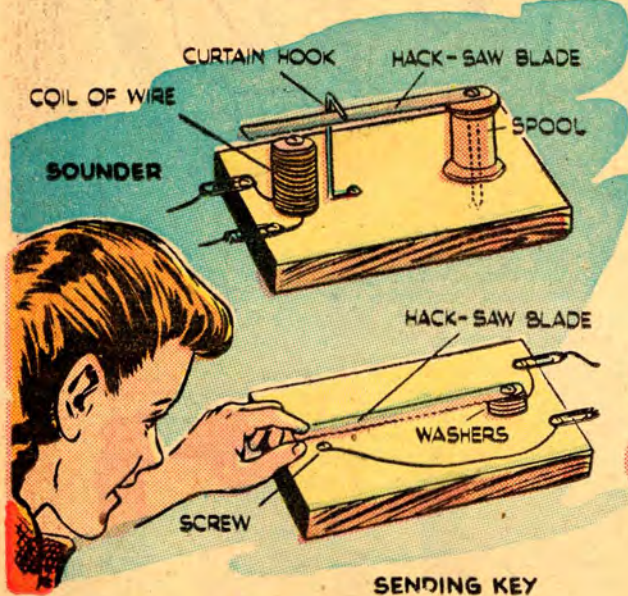
**SIMPLE ELECTROMAGNET**—Wind about 100 turns of ordinary bell wire around iron bolt and connect coil to dry cell. With this simple electromagnet, you can pick up nails or magnetize needles. Large electromagnets . . . that lift tons of steel . . . work on exactly the same principle.



**TELEGRAPH CIRCUIT**—Now you are ready to hook up your telegraph key and sounder—so that you can talk with your next door neighbor in telegraph code. Connect two instruments with bell wire, as illustrated above. Two dry cells will supply enough electric current to operate sounder over distance of several hundred feet.

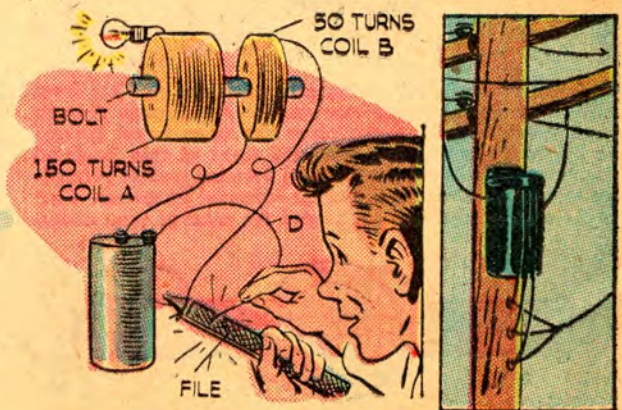
## LEARN TO SEND BY CODE

A	---	L	----	—In telegraph code, at left, "dots" are transmitted by giving key a <i>light tap</i> —"dashes" by holding key down a <i>little longer</i> . After a little practice, you will be surprised at how easy it is to send messages by International Morse Code!
B	----	M	---	
C	----	N	---	
D	---	O	----	
E	.	P	----	
F	----	Q	----	
G	----	R	----	
H	----	S	----	
I	----	T	---	
J	---	U	---	
K	---	V	----	
		W	---	
		X	----	
		Y	----	
		Z	----	



**HOME-MADE TELEGRAPH SET**—It's fun to build your own telegraph set and send code messages to your friends. To make *sending key*, break an old hack-saw blade in half and attach one piece to board by means of screw and half a dozen washers, as pictured above. Put another screw under loose end of blade and your sending key is ready to connect to your telegraph wires.

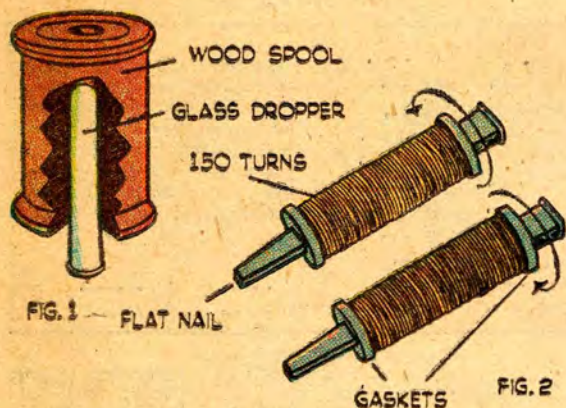
For *telegraph sounder*, attach the other half of hack-saw blade to wood spool on board, as shown. Wind about 50 turns of bell wire around small iron bolt and fasten it under opposite end of blade. Use curtain hook to control upward movement of blade.



**ELECTRIC TRANSFORMER**—Wrap 150 turns of bell wire around one end of large iron bolt and 50 turns around other end (coils A and B). Connect coil B to dry cell and rough file, as shown. Then connect flashlight bulb C to coil A. Now rub bared end of wire D rapidly across the file. The flashlight bulb will *glow brightly*—even though there is no direct connection between the two coils. Alternating-current transformers operate on much the same principle.



## How to make a Toy Electric Motor



To build a toy electric motor, seal small end of glass from straight medicine dropper over gas flame and insert glass in wood spool (Fig. 1). Next, place two water-faucet gaskets on  $2\frac{3}{4}$  inch flat nail and wind 150 turns of thin insulated copper wire (from old electric bell) between gaskets (Fig. 2). Be sure to wind wire in directions indicated by arrows. Two of these electromagnets are needed for rotor of your motor.

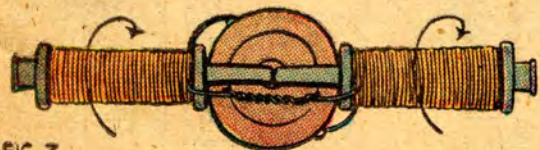
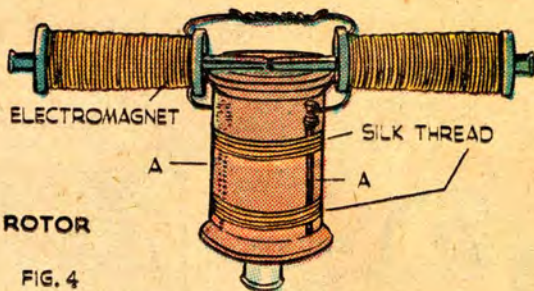


FIG. 3

Now glue long ends of flat nails to top of spool. Connect together *one* wire from each electromagnet across top of spool (Fig. 3), so that directions of windings are as shown by arrows. Attach two pieces of bared bell wire A to opposite sides of spool with silk thread—and connect *other two* wires from electromagnets to wires A, as shown (Fig. 4). This completes the rotor.



ROTOR

FIG. 4

File rough edges off point of 20-penny nail B and drive it, from underneath, through center of two-inch wood board (Fig. 6). Place rotor on nail B and see that it turns freely.

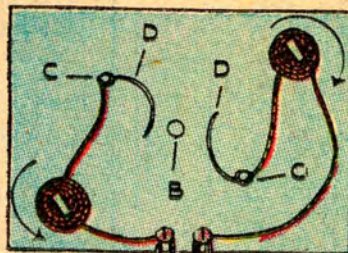


FIG. 5

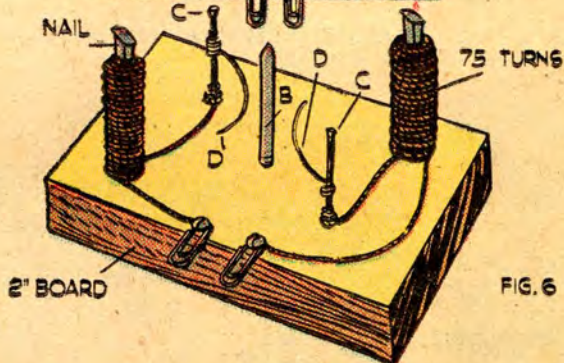


FIG. 6

Wind 75 turns of bell wire, in directions indicated by arrows in Fig. 5, around two flat nails and drive them into board so they clear electromagnets on rotor (see Figs. 6 & 7). Remove rotor. Then drive two small nails C in board and connect bared bell wires D to nails C, as illustrated. Finally, connect wires to various parts, as shown above.

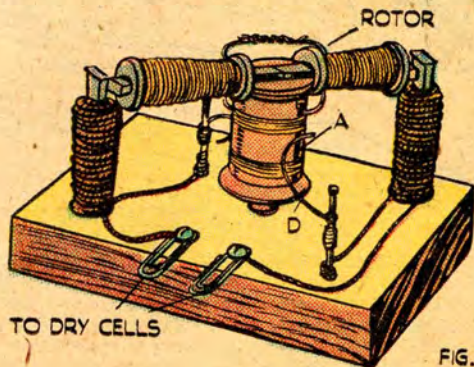
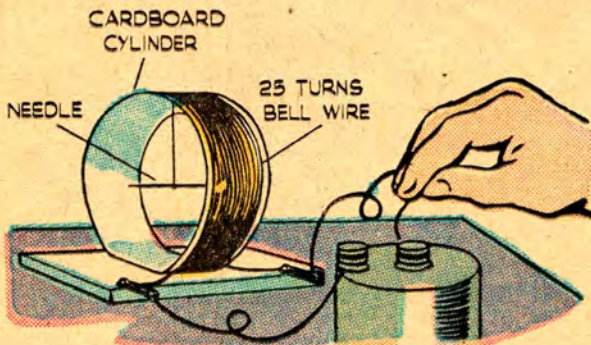


FIG. 7

Now replace rotor on nail B and bend wires D so they press firmly against wires A on spool (Fig. 7). Connect two dry cells to paper clips. Give rotor a quick turn and your motor is off to a running start!

## More Electrical Things You Can Build



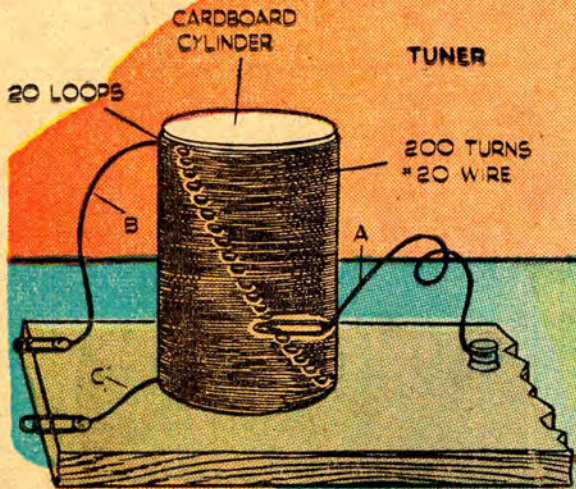
A **GALVANOMETER** is a handy thing to have around when you want to measure *feeble* electric currents. To build one, wrap 25 turns of bell wire around cardboard cylinder. Then suspend magnetized needle by thread—inside cylinder—with needle pointing toward cylinder walls. When you touch the coil wire to the pole of a dry cell, needle will swing around, indicating that an electric current is flowing.



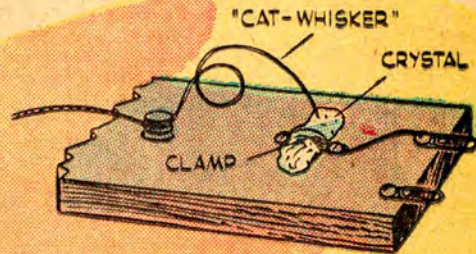
AN **ELECTRIC GENERATOR** is easy to make. Simply wind 100 turns of bell wire around cardboard tube and connect to galvanometer, described at left. Then move a permanent magnet up and down inside coil. Each movement of magnet generates a *weak electric current*, causing magnetized needle in galvanometer to *flicker*. Huge electric generators operate on the same principle!

## Build your own Radio Receiver

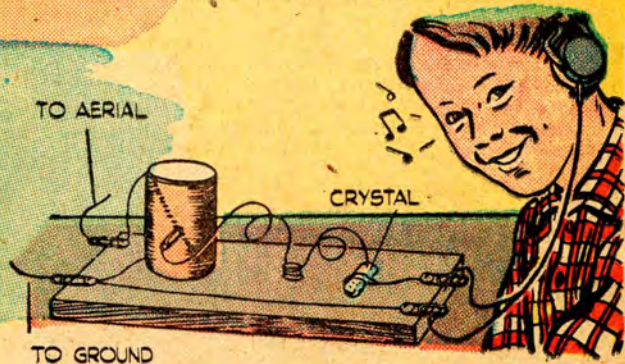
Here's a simple crystal radio receiver that you can build—which will pick up local broadcasting programs.



**TUNER**—A very simple tuner for your radio receiver is illustrated above. Around a large cardboard cylinder (the kind you buy ice cream in will do very nicely), wind a single layer—200 turns #20 insulated copper wire. Twist a small loop *after each ten turns* as you wind wire around cylinder—until you have *twenty loops*—running diagonally from top to bottom. Now carefully scrape the insulation off each loop. Mount cylinder on board, leaving room for crystal detector. Provide loose wire A, to end of which is attached an ordinary paper clip. (This wire will be used to “tune” your receiver, as described later.) Also attach wires B for aerial and C for ground connection.



**CRYSTAL DETECTOR**—For this you need a *galena* or *silicon* crystal (which you can buy for a small sum in many radio stores) and a “cat-whisker” (a piece of fine, stiff brass wire). Fasten crystal securely to board and attach “cat-whisker” so that the end presses firmly on crystal.

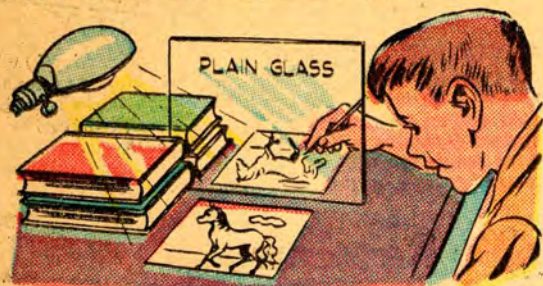


**HOW TO USE RECEIVER**—Hook up crystal detector, tuner, and ear phones to aerial and ground wires, as shown above. Now put the phones to your ears and attach paper clip to various loops on tuner—meanwhile shifting “cat-whisker” about face of crystal until you hear a radio program. Finally, move “cat-whisker” wire over crystal until you find the most sensitive spot where program comes in loudest. To tune in different programs, simply attach paper clip to various loops of tuner.

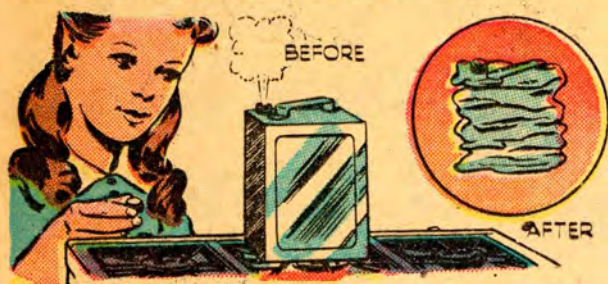
# Tricks with Light, Air, and Steam



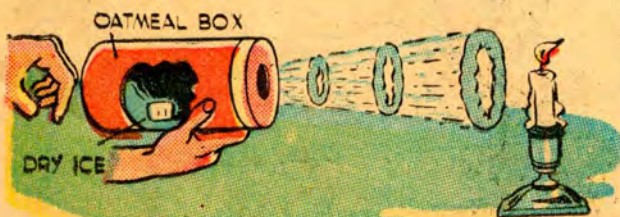
**MAGIC LIGHT BOX**—Place sheet of plain glass in box about 15 inches square, as shown in Figure 1. Put *tomato can* in one corner of box and *ripe tomato* in opposite corner. Now flash a light on tomato can (Figure 2) and then on tomato, through hole in top of box (Figure 3). The tomato will appear to have moved right *inside* tomato can!



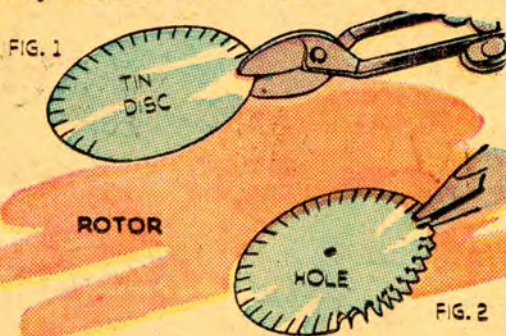
**DRAWING MADE EASY**—Place piece of plain glass on table between some books, as shown, and put a picture on table in front of glass. Under strong light, picture will be reflected in glass so that you can trace it *perfectly* on a sheet of blank paper, placed on other side of glass.



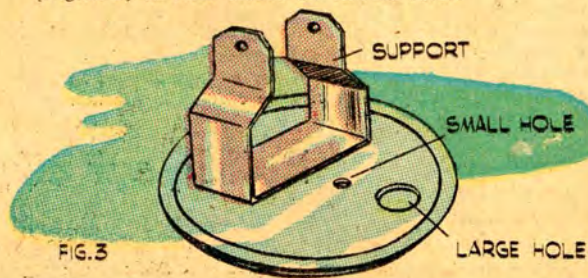
**THE POWER OF ATMOSPHERIC PRESSURE** will amaze you. To prove it, remove cover from a square tin can and pour in about one inch of water. Place can on stove and boil water violently for a few minutes. Then remove can and screw cover on *tight*. As steam in can condenses to water, atmospheric pressure will *crush can out of shape!*



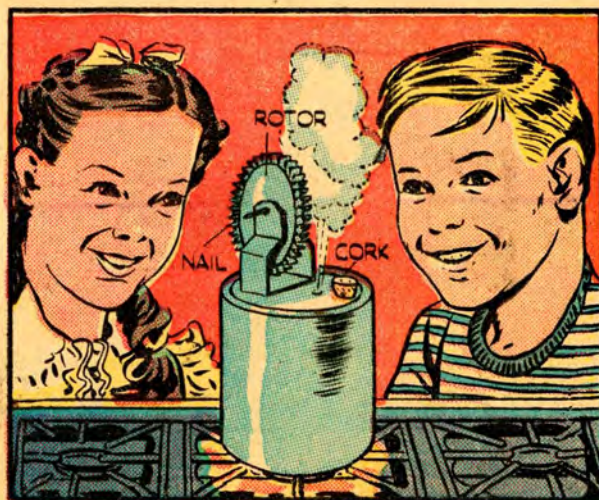
**"SMOKE" RINGS**—Cut a one-inch hole in cover of large cylindrical oatmeal box and insert a piece of "dry-ice" (used to pack around ice cream). Replace cover, tap opposite end of box and a perfect "smoke" ring will rush out of hole. You can use it to extinguish a candle, placed close by! (*Caution; do not touch dry ice with bare hands.*)



**A STEAM TURBINE THAT RUNS**—Get a tin disc (the kind you cut from a can with a modern can opener) and snip slits around rim, about  $\frac{1}{4}$  inch apart (Figure 1). Punch hole in center of disc for thin finishing nail which will form axle for your turbine. Then twist each segment around (Figure 2) to form blades for turbine rotor.



Next, make metal support and punch small hole in each side (the same size as in turbine rotor), see Figure 3. Attach support to cover of tight coffee can—using metallic "liquid solder" which you can get in any hardware store. Punch large hole in cover, as pictured above.



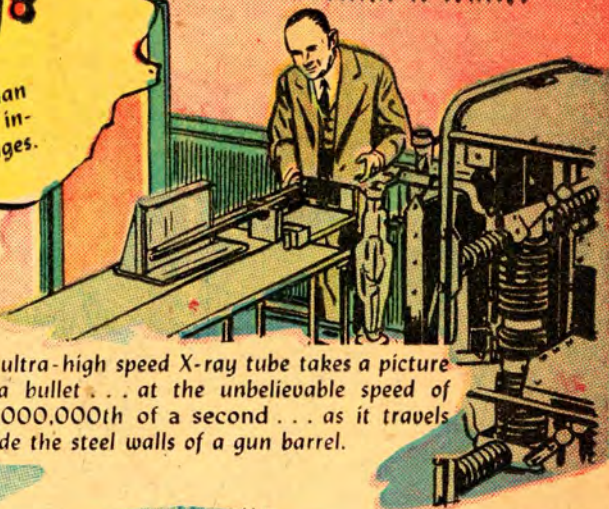
Mount rotor on thin finishing nail and fasten it to nail with "liquid solder." Insert nail in two holes in support, as shown above. Punch a tiny hole in *under side* of cover, *directly* under turbine blades. Then press cover *tightly* in can. Finally, fill can about half-full of water through large hole, cork hole tightly, and place can on stove. Soon, heat will make the water boil, a fine jet of steam will rush from hole, hitting turbine blades and turning rotor at high speed!

*Assistance from Science Service for many of the experiments in this book is gratefully acknowledged.*

# IT'S THE TRUTH!

In many ways, truth is indeed stranger than fiction. Here are a few examples of the ingenuity of the men of science through the ages.

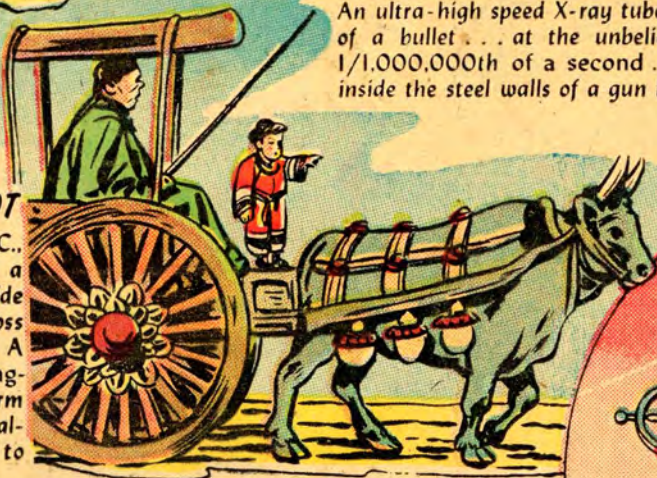
14,285 TIMES QUICKER  
THAN A WINK!



An ultra-high speed X-ray tube takes a picture of a bullet . . . at the unbelievable speed of 1/1,000,000th of a second . . . as it travels inside the steel walls of a gun barrel.

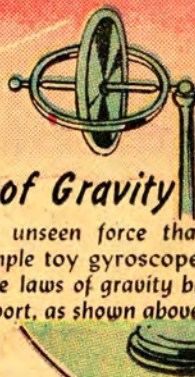
## COMPASS CHARIOT

Back as early as 2637 B.C., Hoang-ti constructed a compass chariot to guide a Chinese caravan across the trackless deserts. A natural permanent magnet, in the extended arm of a movable figure, always pointed South to show them the way.



## "Defying" the Laws of Gravity

As everyone knows, gravity is the unseen force that attracts bodies to the earth. Yet a simple toy gyroscope, invented many years ago, "defies" the laws of gravity by holding itself straight out from a support, as shown above.



## HOW NAVY BOMBERS SANK INVISIBLE JAP WARSHIPS!



One of the amazing stories to come out of World War II was the precision bombing of invisible Jap warships through dense cloud formations. Guided entirely by radar, U. S. bombers sank scores of unseen enemy vessels off the Philippine Islands and Japan.

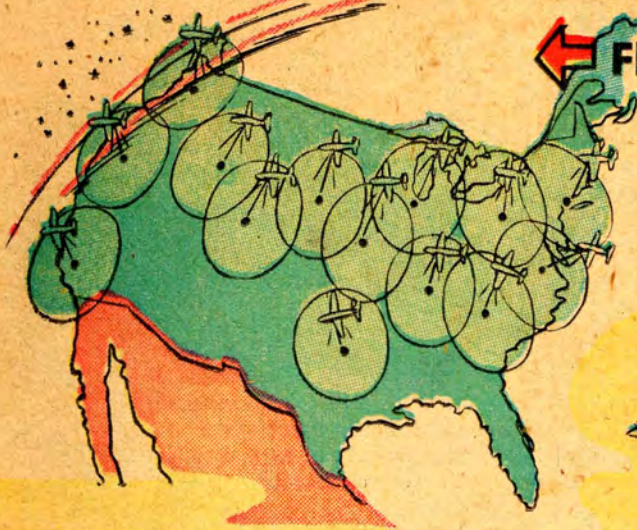


## 20 Times Hotter than Boiling Water!

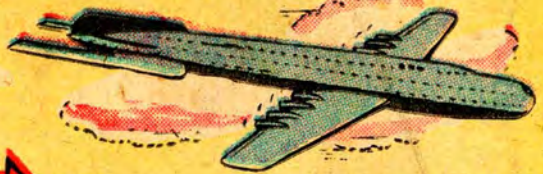
When burning, the temperature of the filament in an ordinary 60 Watt lamp is over 4300° F—twenty times hotter than the 212° F of boiling water.

# A Look Into the Future

## Flying Broadcasting Stations

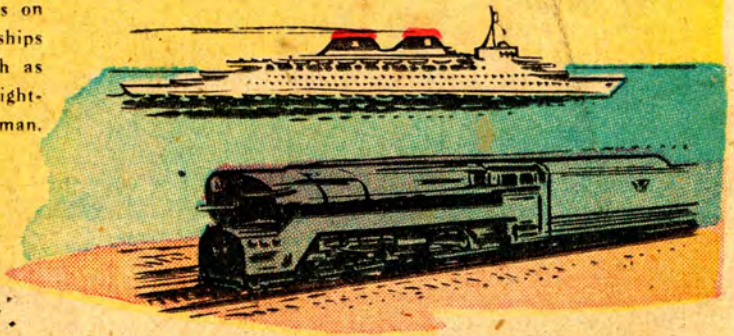


Before very long, giant airplanes will be circling constantly overhead—six miles high in the stratosphere above clouds and storms. They will be broadcasting television and FM programs over wide areas, for the first time bringing these forms of entertainment on a coast-to-coast hookup.



## Gas Turbines

The gas turbine, a brand new type of power unit, is on the way and may power our planes and trains and ships of the future. With an interior temperature as high as 1300° F., the gas turbine is one of the simplest, lightest, and most compact power units ever devised by man.



## Atomic Power

Energy locked within the nuclei of atoms staggers the imagination. This energy is released by the sun . . . as much every second as could be obtained by burning the world's total supply of coal . . . 8,000,000,000 tons. Man has already harnessed nuclear energy in uranium piles and the atomic bomb.



**Westinghouse**  
PLANTS IN 25 CITIES OFFICES EVERYWHERE