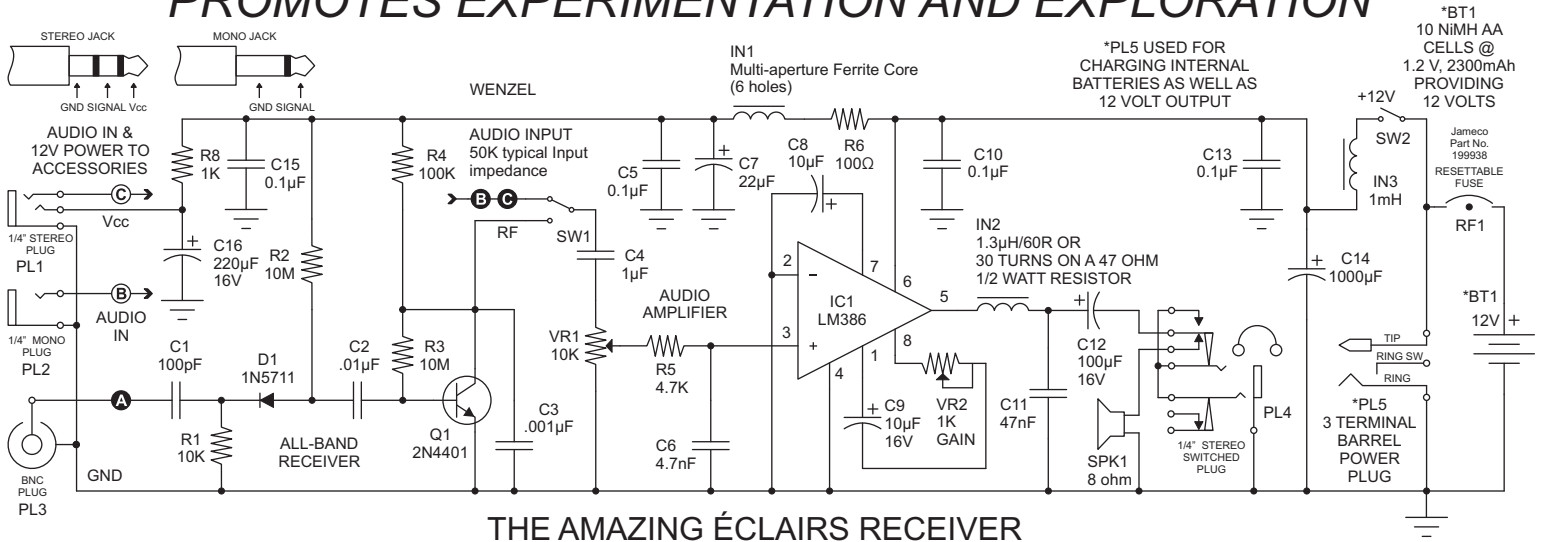


# THE AMAZING ÉCLAIRS RECEIVER

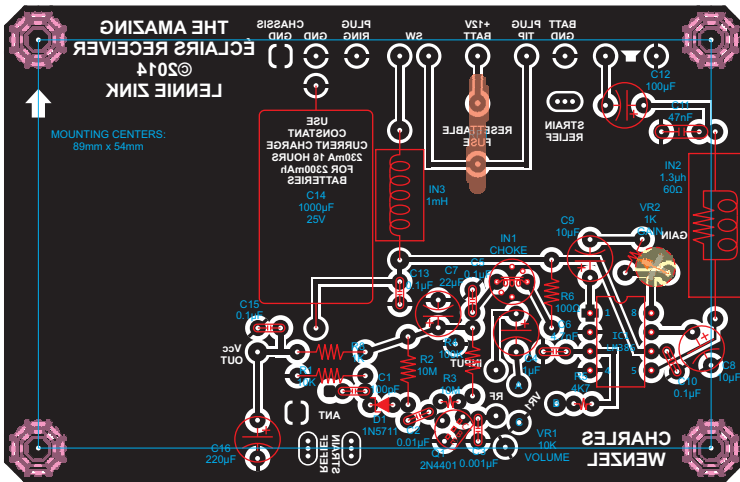


(EMF/Charge/Light/Audio/Induction/RF/Sferics)

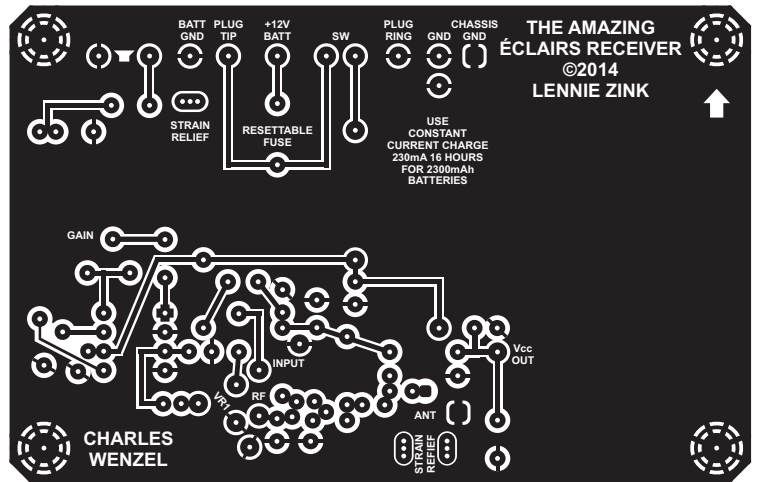
PROMOTES EXPERIMENTATION AND EXPLORATION



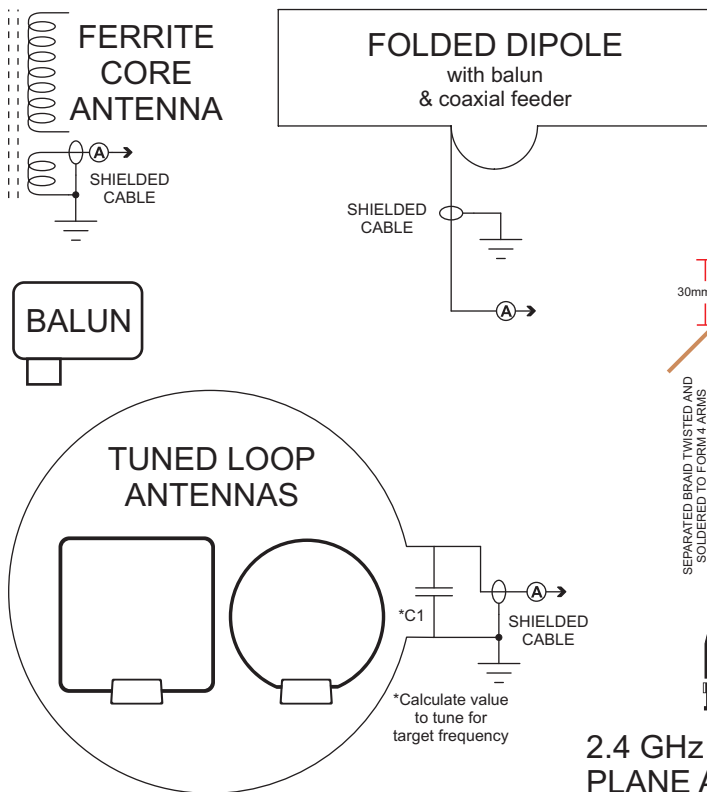
THE AMAZING ÉCLAIRS RECEIVER



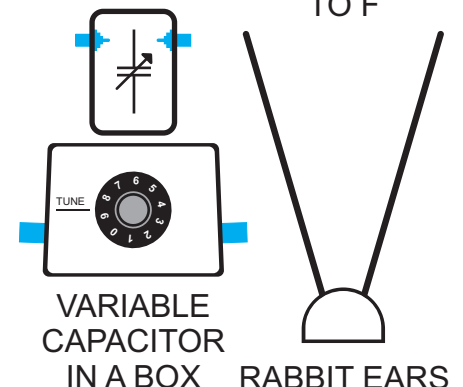
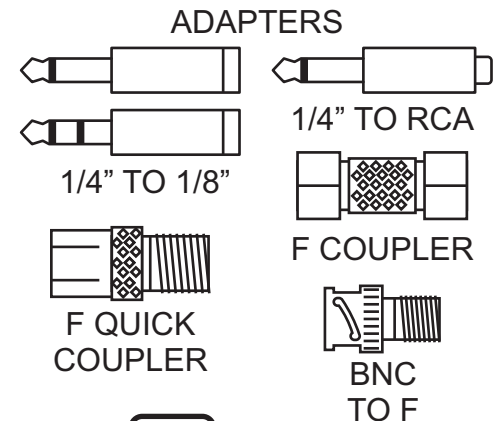
COMPONENT LAYOUT



BOTTOM VIEW

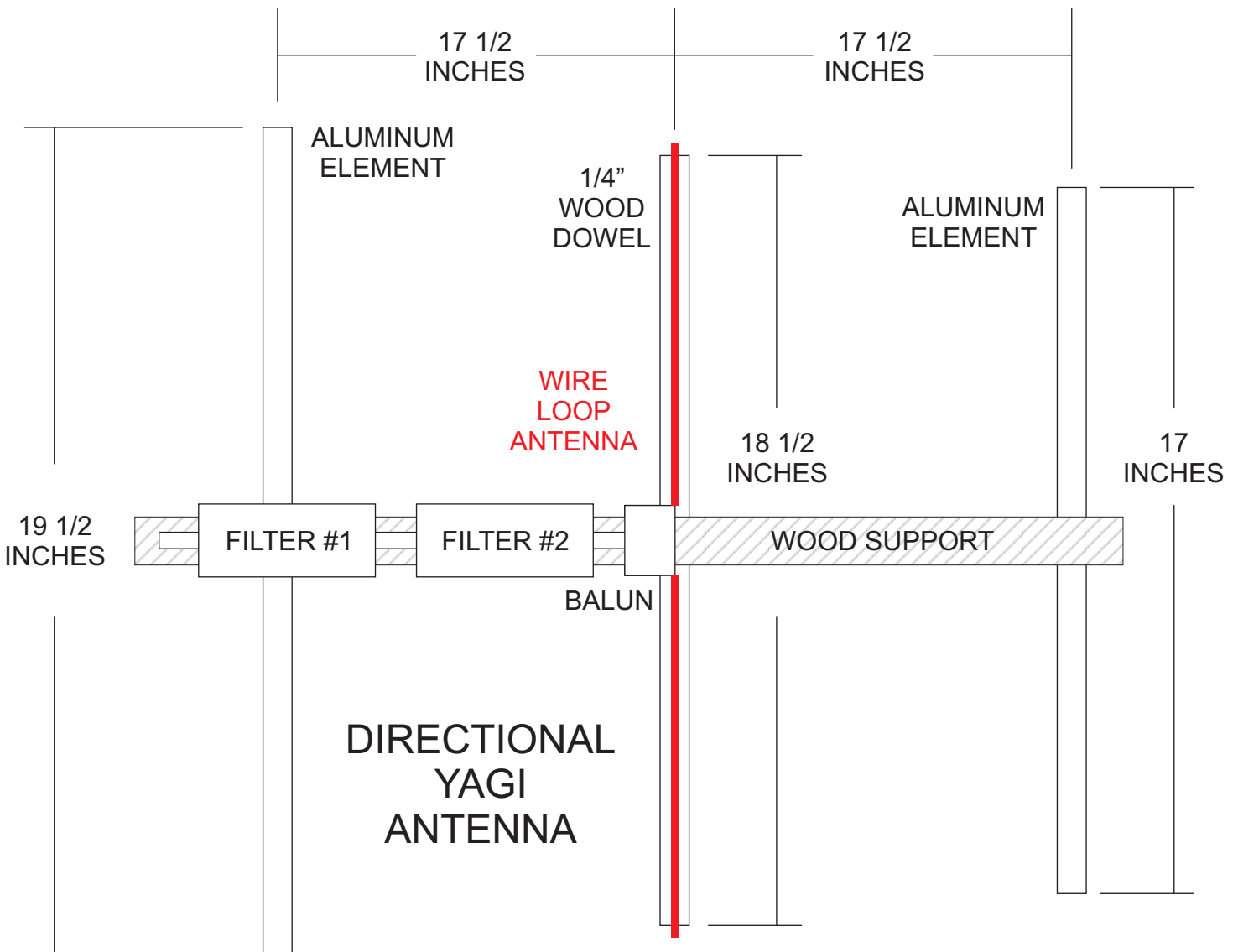
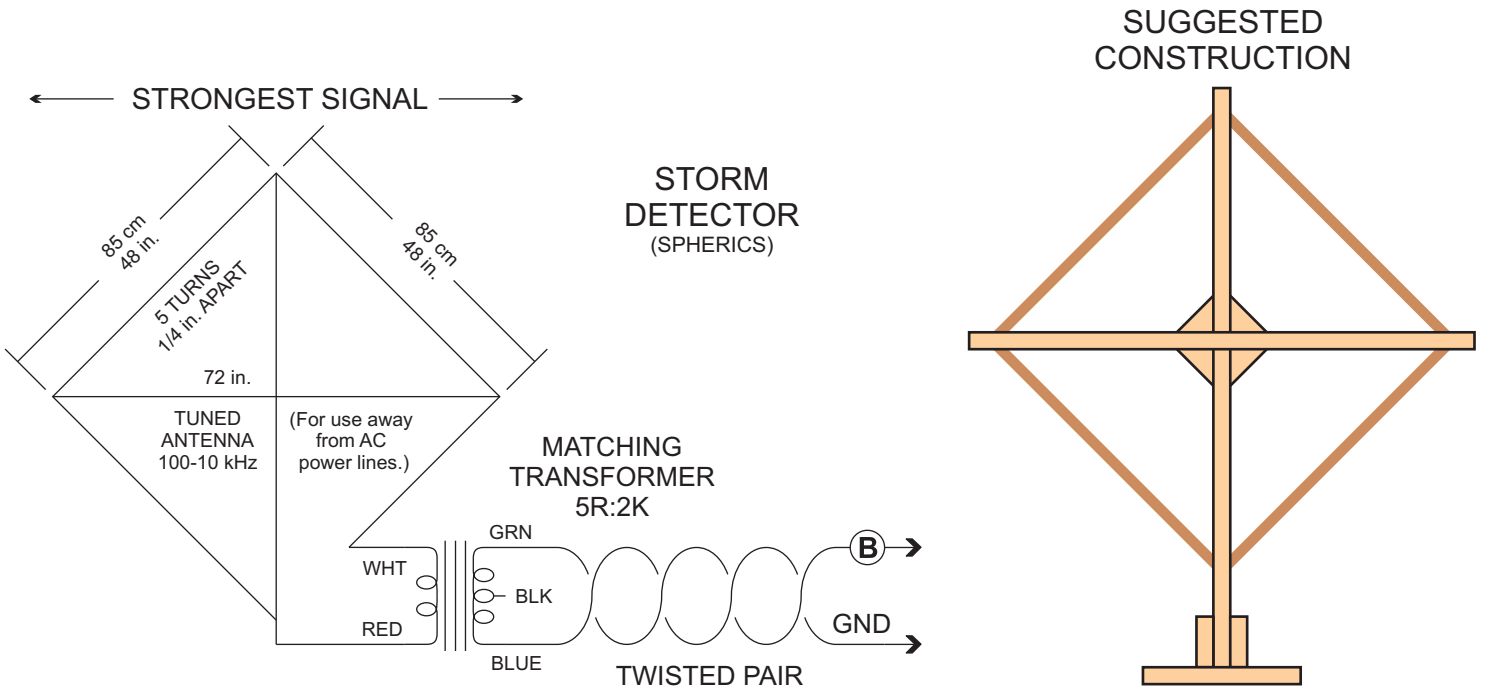


2.4 GHz GROUND PLANE ANTENNA



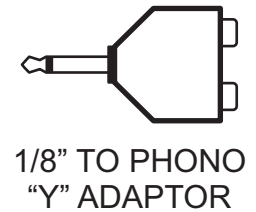
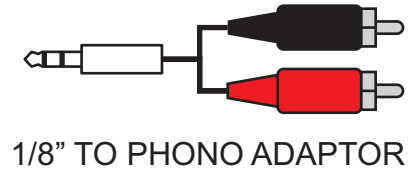
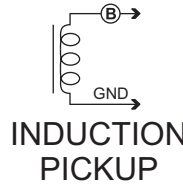
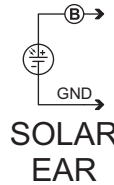
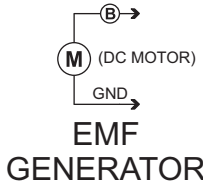
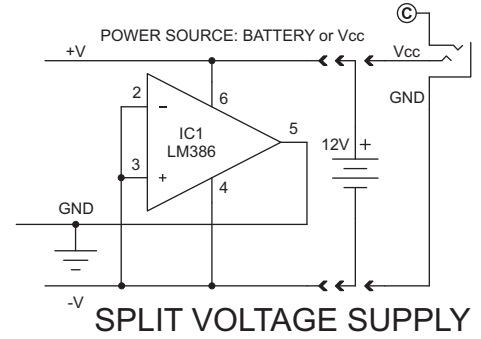
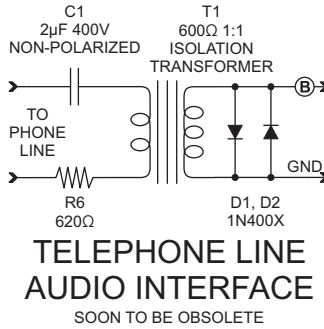
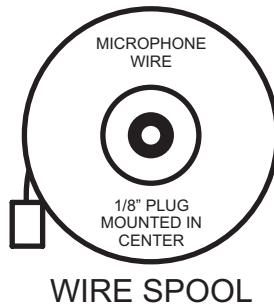
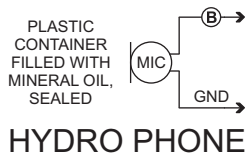
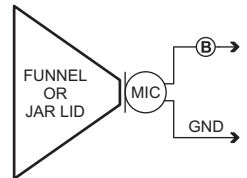
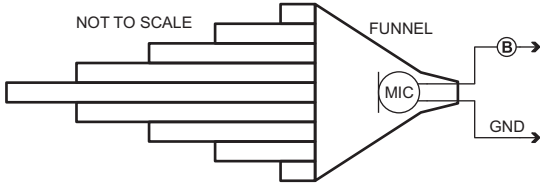
# THE AMAZING ÉCLAIRS RECEIVER

(EMF/Charge/Light/Audio/Induction/RF/Sferics)



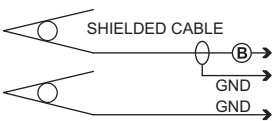
# THE AMAZING ÉCLAIRS RECEIVER

(EMF/Charge/Light/Audio/Induction/RF/Sferics)



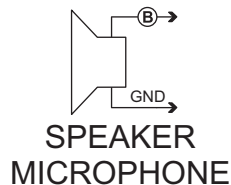
Lightning whistlers were first discovered by German scientist H. Barkhausen during World War I. To try to eavesdrop on Allied telephone conversations, he drove two metal stakes into the ground and connected them to the input of an audio amplifier. Instead of human voices, he heard lots of the atmospheric sounds. We don't know how far apart the metal ground pipes were, but trying to recreate Barkhausen's experience could be a great experiment in itself!

**ALLIGATOR TEST CLIPS**



A copper screen buried deep in the earth for an antenna will also work.

A "Rain Alert Microphone" consists of a speaker mounted midway inside a plastic bucket, mounted bottoms-up on the roof or just out in the yard. This project evolved from the Air Force's need for rain alerts during manned rocket sled tests in New Mexico during the 1950's! It works very well and also lets you hear all else going on in your neighborhood, whether you want to or not.

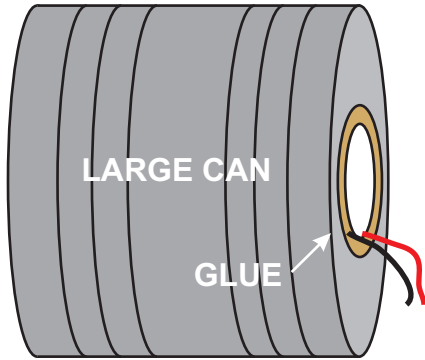


# THE AMAZING ÉCLAIRS RECEIVER

(EMF/Charge/Light/Audio/Induction/RF/Sferics)

## PIEZO EXPERIMENTS

If this piezo speaker is turned bottom down and the can filled with cleaning fluid, could it be used as an ultrasonic cleaner?



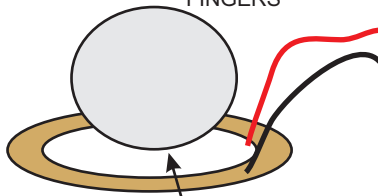
LARGE CAN

GLUE

PIEZO SPEAKER

SOUND EXPERIMENT

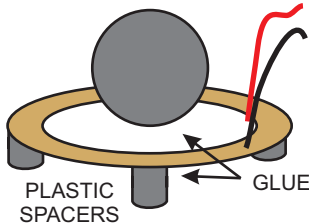
MESSAGE WITH FINGERS



GLUE TO COTTON BALL

VIBRATION EXPERIMENT

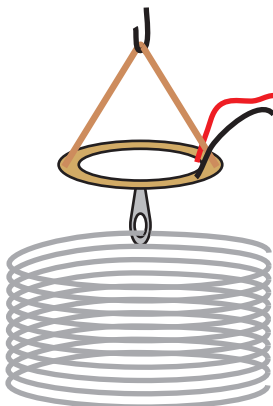
LEAD FISHING BALL



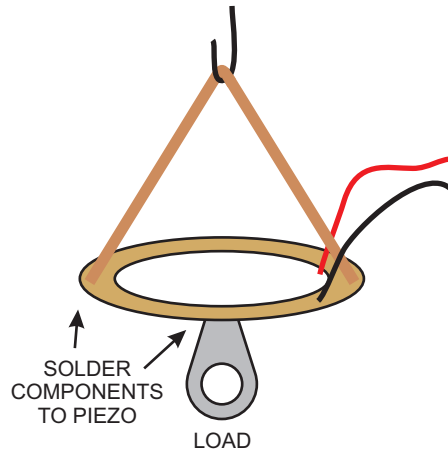
PLASTIC SPACERS

GLUE

SLINKY RECEIVER



FORCE SENSOR / ACCELEROMETER

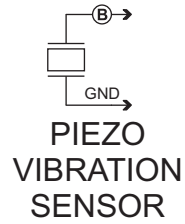


SOLDER COMPONENTS TO PIEZO

LOAD



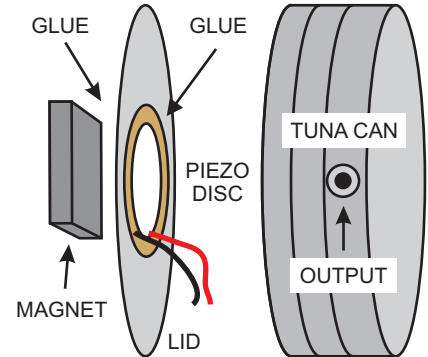
PIEZO TWEETER HORN



PIEZO VIBRATION SENSOR

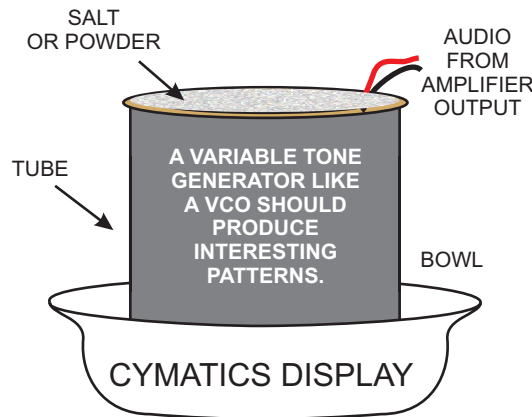


PIEZO HYDROPHONE



MAGNETIC VIBRATION SENSOR

Open a can of tuna with an edge-cutting opener. After a good washing, glue a magnet to the top of the lid. Glue a piezo disc to the inside of the lid. Attach a 1/8 inch connector through the side of the can and solder the piezo wires to it. Test the piezo by connecting it to the input of an audio amplifier. Seal the lid to the can. The magnet will hold the sensor to metal objects.



SALT OR POWDER

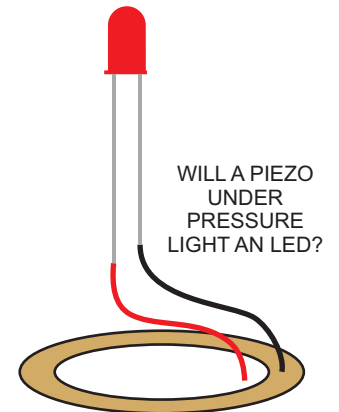
AUDIO FROM AMPLIFIER OUTPUT

TUBE

A VARIABLE TONE GENERATOR LIKE A VCO SHOULD PRODUCE INTERESTING PATTERNS.

BOWL

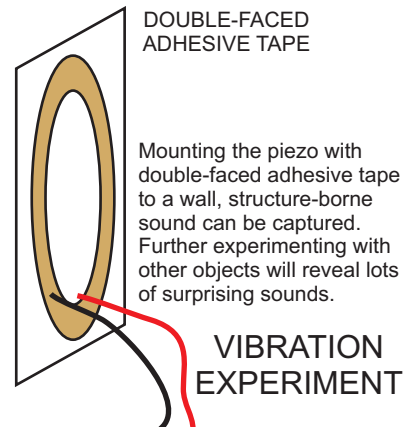
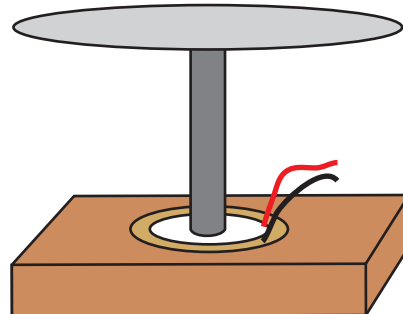
CYMATICS DISPLAY



WILL A PIEZO UNDER PRESSURE LIGHT AN LED?

LIGHT EXPERIMENT

INCREASED SURFACE AREA EXPERIMENT



DOUBLE-FACED ADHESIVE TAPE

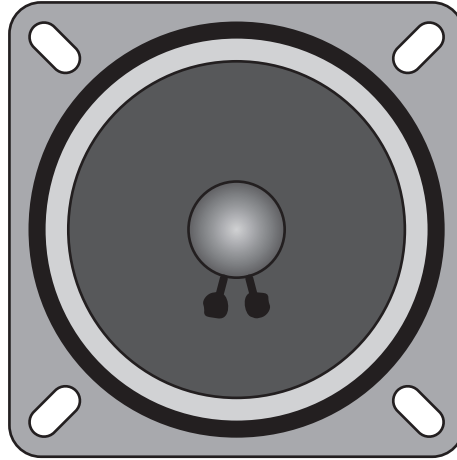
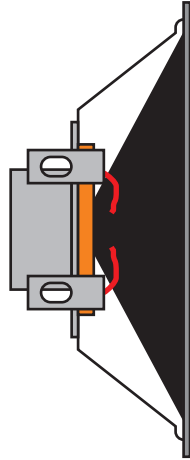
Mounting the piezo with double-faced adhesive tape to a wall, structure-borne sound can be captured. Further experimenting with other objects will reveal lots of surprising sounds.

VIBRATION EXPERIMENT

# THE AMAZING ÉCLAIRS RECEIVER

(EMF/Charge/Light/Audio/Induction/RF/Sferics)

## SPEAKER EXPERIMENTS



## CYMATICS DISPLAY

Carefully cut away the center dome attached to the speaker coil.  
Glue a piece of plastic in its place.

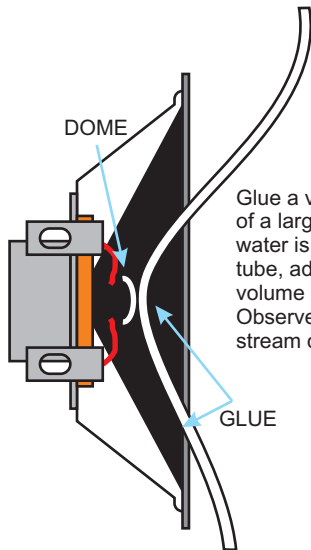
Face the speaker upwards.  
It is ready to hold powders or crystals like salt.

Place a layer of plastic wrap over the speaker and it will hold water.

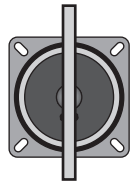
Connect the speaker to an audio amplifier with a sound producing source such as a tone generator. Slowly turn up the volume. Different tone frequencies will produce various patterns.

## POSSIBLE SPEAKER "CABINETS"

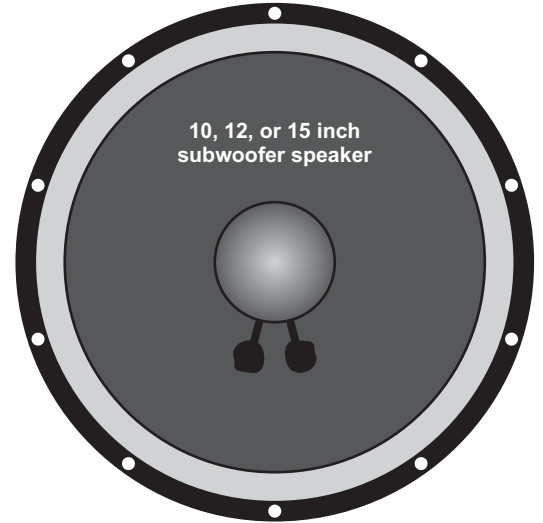
- Glass canning jars
- PVC pipe fittings
- 2 liter plastic bottle
- Tin can
- Foam cup
- CD/DVR case
- Watering can
- Coffee mugs of all types



Glue a vinyl tube to the cone of a large speaker. While water is running through the tube, adjust frequency and volume of amplified signal. Observe the changes in the stream of water.



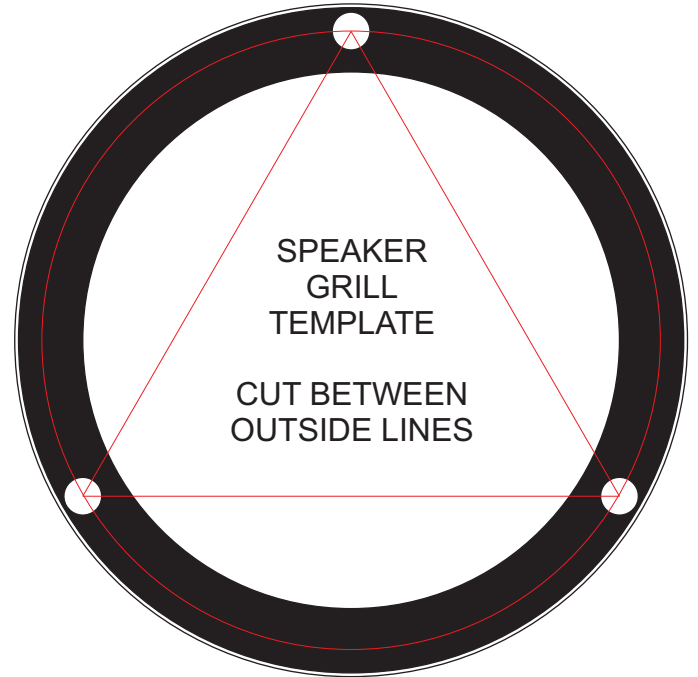
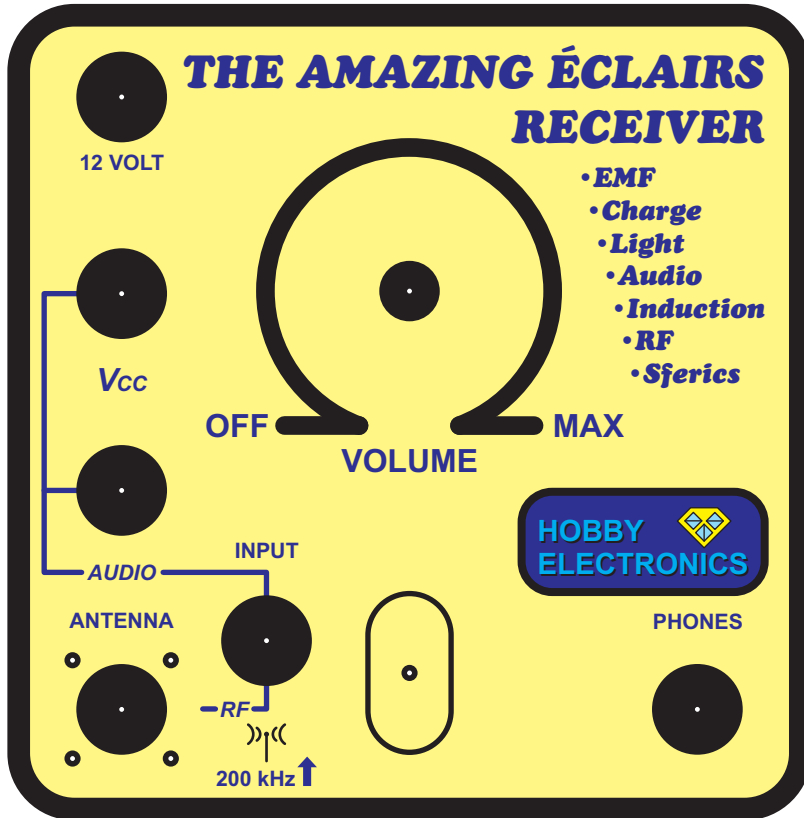
## THE STREAM OF WATER EXPERIMENT



## LOW FREQUENCY MICROPHONE

# THE AMAZING ÉCLAIRS RECEIVER

(EMF/Charge/Light/Audio/Induction/RF/Sferics)



## INTERNAL RECEIVER CIRCUITS:

- 200 kHz and higher All-Band Radio Frequency Receiver
- Audio Amplifier

## BASIC ACCESSORIES

- 2.4GHz Antennas
- Alligator Clips for experiments
- Directional Microphone
- EMF Generator
- Folded Dipole Antenna
- Hydro Phone
- Loopstick Antenna
- Rabbit Ears Antenna
- Sferics Detector
- Solar Ear
- Speaker Experiments
- Speaker Microphone
- Split Voltage Supply
- Stethoscope
- Telephone Line Interface
- Tuned Loop Antenna
- Variable Capacitor in a Box
- Vibration Sensor
- Yagi Antenna

# IMPORTANT DATES CONCERNING ELECTRICITY

- 600 B.C. Thales of Miletus writes about amber becoming charged by rubbing - he was describing what we now call static electricity.
- 1600 English scientist, William Gilbert first coined the term "electricity" from the Greek word for amber. Gilbert wrote about the electrification of many substances in his "De magnetibus, magneticisque corporibus". He also first used the terms electric force, magnetic pole, & electric attraction.
- 1660 Otto von Guericke invented a machine that produced static electricity.
- 1675 Robert Boyle discovered that electric force could be transmitted through a vacuum & observed attraction & repulsion.
- 1729 Stephen Gray's discovery of the conduction of electricity.
- 1733 Charles Francois du Fay discovered that electricity comes in two forms which he called resinous (-) & vitreous (+). Benjamin Franklin & Ebenezer Kinnersley later renamed the two forms as positive & negative.
- 1745 Georg Von Kleist discovered that electricity was controllable.  
Dutch physicist, Pieter van Musschenbroek invented the "Leyden Jar" the first electrical capacitor. Leyden jars store static electricity.
- 1747 Benjamin Franklin experiments with static charges in the air & theorized about the existence of an electrical fluid that could be composed of particles.  
William Watson discharged a Leyden jar through a circuit, that began the comprehension of current & circuit.  
Henry Cavendish started measuring the conductivity of different materials.
- 1752 Benjamin Franklin invented the lightning rod - he demonstrated lightning was electricity.
- 1767 Joseph Priestley discovered that electricity followed Newton's inverse-square law of gravity.
- 1786 Italian physician, Luigi Galvani demonstrated what we now understand to be the electrical basis of nerve impulses when he made frog muscles twitch by jolting them with a spark from an electrostatic machine.
- 1800 First electric battery invented by Alessandro Volta. Volta proved that electricity could travel over wires.
- 1816 First energy utility in US founded.
- 1820 Relationship of electricity & magnetism confirmed by Hans Christian Oersted who observed that electrical currents effected the needle on a compass & Marie Ampere, who discovered that a coil of wires acted like a magnet when a current is passed through it.  
D. F. Arago invented the electromagnet.
- 1821 First electric motor invented by Michael Faraday.
- 1826 Ohms Law written by Georg Simon Ohm states that "conduction law that relates potential, current, & circuit resistance."
- 1827 Joseph Henry's electromagnetic experiments lead to the concept of electrical inductance. Joseph Henry built one of the first electrical motors.
- 1831 Principles of electromagnetism induction, generation & transmission discovered by Michael Faraday.
- 1837 First industrial electric motors.
- 1839 First fuel cell invented by Sir William Robert Grove, a Welsh judge, inventor & physicist.
- 1841 J. P. Joule's law of electrical heating published.
- 1873 James Clerk Maxwell wrote equations that described the electromagnetic field, & predicted the existence of electromagnetic waves traveling with the speed of light.
- 1878 Edison Electric Light Co. (US) & American Electric & Illuminating (Canada) founded.
- 1879 First commercial power station opens in San Francisco, uses Charles Brush generator & arc lights.  
First commercial arc lighting system installed, Cleveland, Ohio.  
Thomas Edison demonstrates his incandescent lamp, Menlo Park, New Jersey.
- 1880 First power system isolated from Edison.  
In Grand Rapids Michigan: Charles Brush arc light dynamo driven by water turbine used to provide theater & storefront illumination.

# IMPORTANT DATES CONCERNING ELECTRICITY

- 1881 Niagra Falls, New York; Charles Brush dynamo, connected to turbine in Quigley's flour mill lights city street lamps.
- 1882 Edison Company opens Pearl Street power station.  
The first hydroelectric power station opens in Wisconsin.
- 1883 The electric transformer is invented.  
Thomas Edison introduces the "three-wire" transmission system.
- 1884 Steam turbine invented by Charles Parsons.
- 1886 William Stanley develops transformer & Alternating Current electric system.  
Frank Sprague builds first American transformer & demonstrates use of step up & step down transformers for long distance AC power transmission in Great Barrington, Massachusetts.  
The Westinghouse Electric Company is organized. 40 to 50 water powered electric plants reported on line or under construction in the U.S. & Canada.
- 1887 In San Bernadino, California, the High Grove Station, first hydroelectric plant in the West is opened.
- 1888 Rotating field AC alternator invented by Nikola Tesla.
- 1889 Oregon City Oregon, Willamette Falls station, first AC hydroelectric plant.  
Single phase power transmitted 13 miles to Portland at 4,000 volts, stepped down to 50 volts for distribution.
- 1891 60 cycle AC system introduced in U.S.
- 1892 General Electric Company formed by the merger of Thomson-Houston & Edison General Electric.
- 1893 Westinghouse demonstrates "universal system" of generation & distribution at Chicago exposition.  
In Austin, Texas, the first dam designed specifically for hydroelectric power built across Colorado River is completed.
- 1897 Electron discovered by J. J. Thomson.
- 1900 Highest voltage transmission line 60 Kilovolt.
- 1902 5-Megawatt turbine for Fisk St. Station (Chicago).
- 1903 First successful gas turbine (France). World's first all turbine station (Chicago). Shawinigan Water & Power installs world's largest generator (5,000 Watts) & world's largest & highest voltage line—136 Km & 50 Kilovolts (to Montreal).  
Electric vacuum cleaner. Electric washing machine.
- 1904 John Ambrose Fleming invented the diode rectifier vacuum tube.
- 1905 In Sault Ste. Marie, Michigan the first low head hydro plant with direct connected vertical shaft turbines & generators is opened.
- 1906 In Ilchester, Maryland, a fully submerged hydroelectric plant is built inside Ambursen Dam.
- 1907 Lee De Forest invented the electric amplifier.
- 1909 The first pumped storage plant is opened in Switzerland.
- 1910 Ernest R. Rutherford measured the distribution of an electric charge within the atom.
- 1911 Willis Haviland Carrier disclosed his basic Rational Psychrometric Formulae to the American Society of Mechanical Engineers. The formula still stands today as the basis in all fundamental calculations for the air conditioning industry.  
R. D. Johnson invents the differential surge tank & Johnson invents hydrostatic penstock valve.
- 1913 Electric refrigerator is invented.  
Robert Millikan measured the electric charge on a single electron.
- 1917 Hydracone draft tube patented by W. M. White.
- 1920 First U.S. station to only burn pulverized coal is opened.  
Federal Power Commission (FPC) is established.
- 1922 Connecticut Valley Power Exchange (CONVEX) starts, pioneering interconnection between utilities.
- 1928 Construction of Boulder Dam begins.  
Federal Trade Commission begins investigation of holding companies.
- 1933 Tennessee Valley Authority (TVA) established.
- 1935 The Public Utility Holding Company Act is passed. The Federal Power Act is passed. The Securities & Exchange Commission is established. The Bonneville Power Administration is established.  
The first night baseball game in major leagues is played made possible by electric lighting.



# IMPORTANT DATES CONCERNING ELECTRICITY

- 1936 Highest steam temperature reaches 900 degrees Fahrenheit vs. 600 degrees Fahrenheit in early 1920s.  
287 Kilovolt line runs 266 miles to Boulder (Hoover) Dam.  
The Rural Electrification Act is passed.
- 1947 The transistor is invented.
- 1953 The first 345 Kilovolt transmission line is laid.  
The first nuclear power station ordered.
- 1954 The first high voltage direct current (HVDC) line (20 megawatts/1900 Kilovolts, 96 Km).  
The Atomic Energy Act of 1954 allows private ownership of nuclear reactors.
- 1963 The Clean Air Act is passed.
- 1965 The Northeast Blackout occurs.
- 1968 The North American Electric Reliability Council (NERC) is formed.
- 1969 The National Environmental Policy Act of 1969 is passed.
- 1970 The Environmental Protection Agency (EPA) is formed.  
The Water & Environmental Quality Act is passed.  
The Clean Air Act of 1970 is passed.
- 1972 The Clean Water Act of 1972 is passed.
- 1975 Brown's Ferry nuclear accident occurs.
- 1977 The New York City blackout occurs.  
The Department of Energy (DOE) is formed.
- 1978 The Public Utilities Regulatory Policies Act (PURPA) is passed, & ends utility monopoly over generation.  
The Power Plant & Industrial Fuel Use Act limits the use of natural gas in electric generation (repealed 1987).
- 1979 The Three Mile Island nuclear accident occurs.
- 1980 The first U.S. windfarm is opened.  
The Pacific Northwest Electric Power Planning & Conservation Act establishes regional regulation & planning.
- 1981 PURPA ruled unconstitutional by Federal judge.
- 1982 U.S. Supreme Court upholds legality of PURPA in FERC v. Mississippi (456 US 742).
- 1984 Annapolis, N.S., tidal power plant—first of its kind in North America (Canada) opened.
- 1985 Citizens Power, first power marketer, goes into business.
- 1986 Chernobyl nuclear accident (USSR) occurs.
- 1990 Clean Air Act amendments mandate additional pollution controls.
- 1992 The National Energy Policy Act is passed.
- 1997 ISO New England begins operation (first ISO). New England Electric sells power plants (first major plant divestiture).
- 1998 California opens market & ISO. Scottish Power (UK) to buy Pacificorp, first foreign takeover of US utility. National (UK) Grid then announces purchase of New England Electric System.
- 1999 Electricity marketed on Internet.  
FERC issues Order 2000, promoting regional transmission.