A Simple Experiment To Determine the Electromagnetic Polarity of the Earth

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Contents

From Tube to Planet

Inspired by the electron tube technology, specifically the pentode, I set out to determine the electromagnetic polarity of the Earth. How?

The pentode makes use of uni-pole magnetic grids to straighten the path of the electrons from the kathode to the anode. The kathode is negatively charged and the anode positive, meaning that the electrons try to establish a current from the kathode to the anode, from negative to positive. (Saying it's the other way around is schizophrenic.)

All signal amplifier tubes use grids to control the current. These grids are open connections in the form of meshes that have infinite impedance. The electrons can be pulled onto the grid or pulled off of it, but they can't flow through it.

For signal amplifiers, the kathode is wrapped in the control grid with an even higher negative charge. Lowering this magnetic charge opens up the connection. Raising the charge closes it down further. When the control grid's negative charge becomes as low as that of the kathode, the signal starts to distort, which you can hear as a crackling noise.

With the triode, this is the only grid used to control the current.

The tetrode wraps just one grid, the suppressor grid, around the control grid, before the electrons can get to the plates that function as an anode. It has to have a charge that's as positive or slightly more negative than the anode for the electrons to be able to proceed. If it's more positive than the plates, the electrons want to flow from the anode to this grid.

The tetrode as such has a negative, negative, positive, positive organization, which makes it one really long magnet. Some have hypothesized that you could hypothetically use the suppressor grid as a simple volume control. In practice I suspect it's finicky, but that's beyond the scope of this text on the Earth's polarity.

With a pentode, the screen grid wraps around the suppressor grid, meaning that between kathode and anode you have three grids. The screen grid typically gets the same negative charge as the kathode. This means that now you have a negative, negative, positive, negative, positive organization.

Take a look at the diode for a second. Fill it with a gas that lights up with electrons traveling through it, you can see they travel largely in a straight line, but there is also some minor diffusion with electron paths dispersing from the center line. This offers the roomy sound people like when it comes to tube amplifiers: diffuse delay, not compression.

For more accurate amplification with less diffusion, to straighten the electromagnetic field, the pentode puts four uni-pole magnets in sequence, emulating two bi-pole magnets.

This helps the electrons stay on track. The octode does this repetitively, also hooking up another control grid in between directly linked to the first control grid.

All of this not only inspires me to build my own tube amplifier, it made me question whether I could easily use this to demonstrate the electromagnetic polarity of the Earth.

The Experiment and its Results

The experiment I came up with is really easy to perform, also in class by students. All you need is sturdy electrical wire that you can coil, a battery, and a compass, some tape to hold it in place, and a screwdriver to coil the wire around.

Fig. 1 - The battery with coils attached to make a magnet

Fig. 2 - The experimental setup

I fully removed the plastic from the wire, but officially you don't have to. You cut two pieces off of the electrical wire and make sure that one end of each is exposed. You coil the other side twice around a screwdriver for both pieces of wire. Finally you tape the uncoiled end to either side of the battery for both wires. This should look like fig. 1.

Now you take your compass and you allow the magnetic needle to settle so it points north. Take your battery with the coils and place them over east and west. The compass will turn to accommodate the new magnetic field. This allows the students to figure out whether the North and South Pole of the Earth are positively charged or negatively.

Placing the battery with its two uni-pole magnetic coils over the compass shows that north points to the battery positive and south to the battery negative. This demonstrates that the North Pole is positively and the South Pole is negatively charged. The needle point that points to the North Pole as such itself is negatively charged and the other positively.

This is a really simple experiment that when introduced with electronics allows you to discuss and demonstrate also tube amplifier technology in high school. Students can build their own tube amplifiers, for instance with a simple 12 to 48 volts step up transformer and subminiature pentode tubes. A car battery is sufficient to power it as a street performer.

I still have to build mine, but you don't need capacitors: you only need three (two preamp and one power) subminiature tubes, the step up transformer, an output transformer, three 220Ω power resistors, one 20kΩ resistor, some potentiometers, connectors, a speaker, just really basic stuff. Physics: keeping it simple keeps it fun.

Literature

RCA radiotron manuals

Lee de Forest, "Space Telegraphy" (triode patent) - application no. 879,532 with the United States Patent Office.