

# 2 & 3 Brush Ford Generators

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# My Old Car Background

I'm a retired US Navy Chief with an electro-mechanical background. I've been an old car, truck and motorcycle guy all my life - having owned over 40 of them over the last 50 years. My first model A was a 1931 pickup purchased in 1988. Of all the cars & trucks I've owned, I missed that little truck the most. Finally, about three years ago I bought another one 😊 My garage currently holds it and a 1935 Ford Deluxe Fordor Touring car.



## My 6 Volt Generator Background

I started out learning about vintage Splitdorf 6 volt generators in 1990 when I was into antique motorcycles. These were used on many motorcycles of the 1920s. In time, I started restoring them for others. Over the years I've built spare generators for most of them.

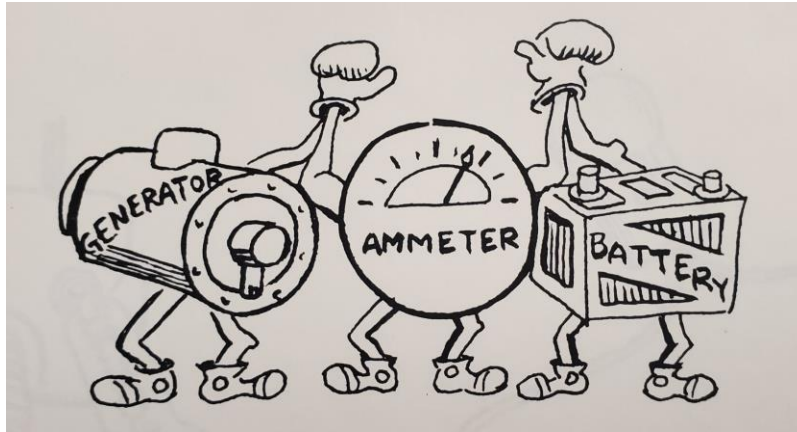


# What is a generator's purpose?

- Converts mechanical energy to electrical energy.
- Maintain battery voltage at 6.3-6.4 volts.
- Provide adequate current to meet vehicle demand without draining the battery.

This is a fine balance between vehicle electrical load, battery charge level and generator charging rate.

No free lunch here. Increased electrical output uses mechanical horsepower.



Adjusting current output was accomplished in two ways:

- A 3-brush generator - with an adjustable brush to regulate current output and a cutout. There is **NO** voltage regulation in a 3-brush generator.
- A 2-brush generator - with an external voltage regulator.



# Field Coil Operation

## 2 and 3 Brush



A small amount of current runs through the fields coils, magnetizing the pole shoes. The magnetic field between the pole shoes induces voltage in the armature. The amount of field current determines generator output.

# Armature Operation

## 2 and 3 Brush



The armature rotates within the magnetic field created by the field coils and poles shoes. This magnetic field induces AC voltage in the rotating armature windings that is transferred to the commutator. Here it is picked up by the carbon brushes and converted to DC.

**In the 1830s Michael Faraday discovered a way of producing an electrical current in a circuit by using only the force of a magnetic field. Known today as Faraday's Law of Electromagnetic Induction.**



# Model A Generators

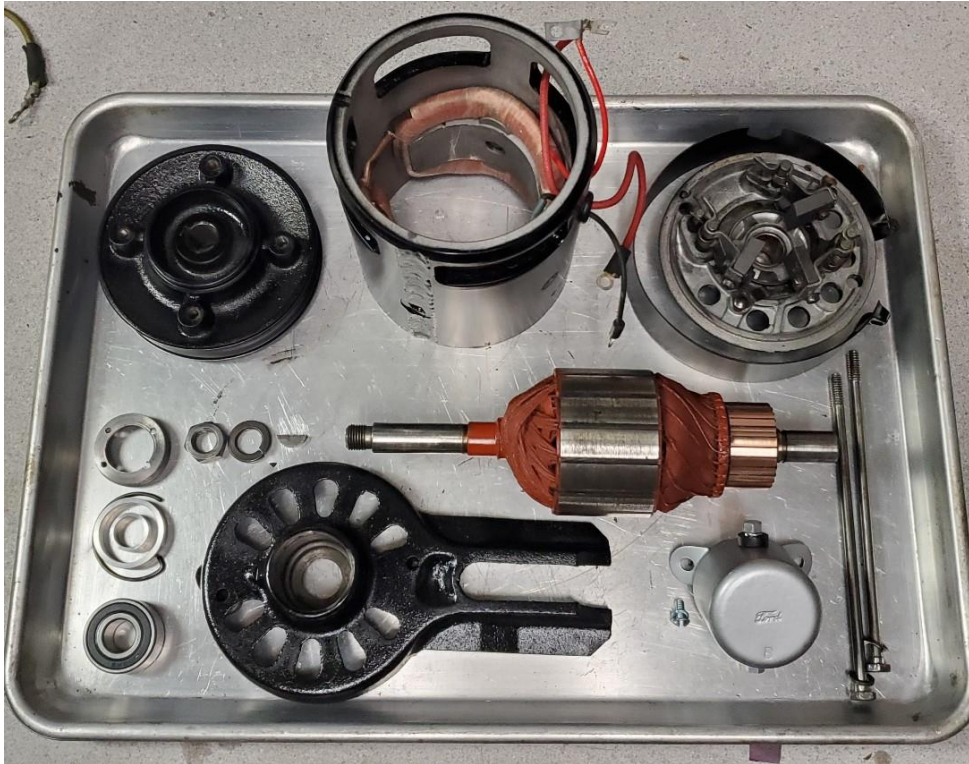
1928-1931



The Powerhouse 5 and 3 brush versions were used from the start up to July 1929.  
Oct 1928 - March 1930 cylindrical generators used ball bearings at both ends.  
After that, a bushing was used in the brush plate.

# Components of a 3-Brush Generator

1932-1936 style



A lot of parts in a 3-brush, and a complex double-row front bearing needed to carry the load and thrust of the pulley mounted fan.



# 1932 - 1936 3-Brush Generator Thrust Bearings



Complex, 8-part double-row, angular contact thrust bearings were originally used to carry the load and thrust of the pulley mounted fan.

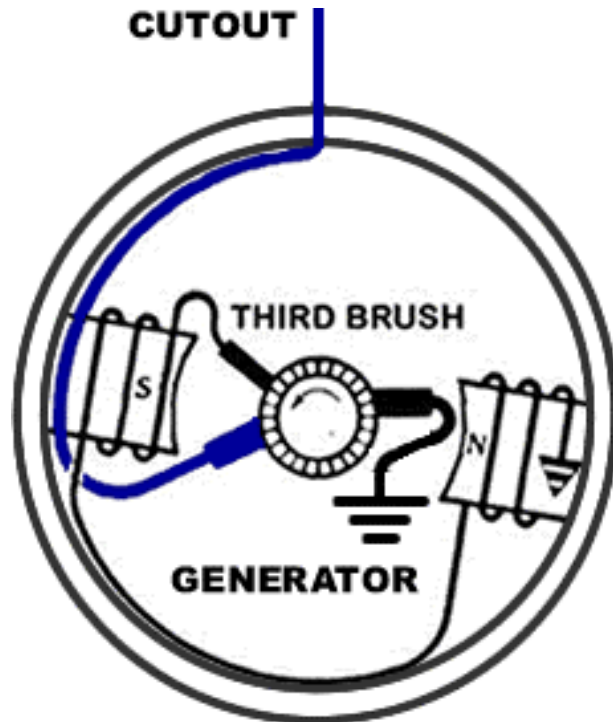


I replace these with a modern sealed, double row, angular bearing. Spacer rings are machined to match the original bearing stack height.



A fragile, threaded pot metal bearing retainer holds the bearings in place. These are often damaged. I've had new retainers machined from steel.

# Typical 3-Brush Generator Operation



Moving the third brush in the direction of rotation increases field strength and pole shoe magnetism. This increases current output of the generator.

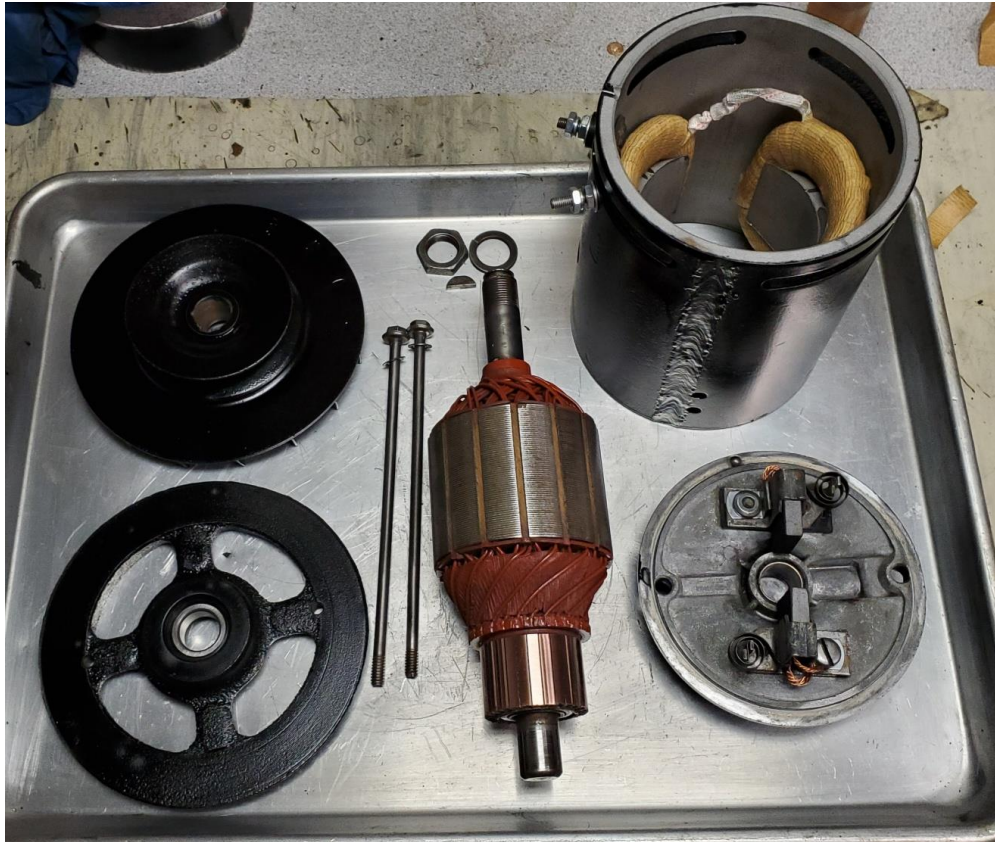
Video link:

<https://youtu.be/PL94VX3Glq8?si=f2cJee-YmHjTkTCx>



# Components of a 2-Brush Generator

1947-1953 style



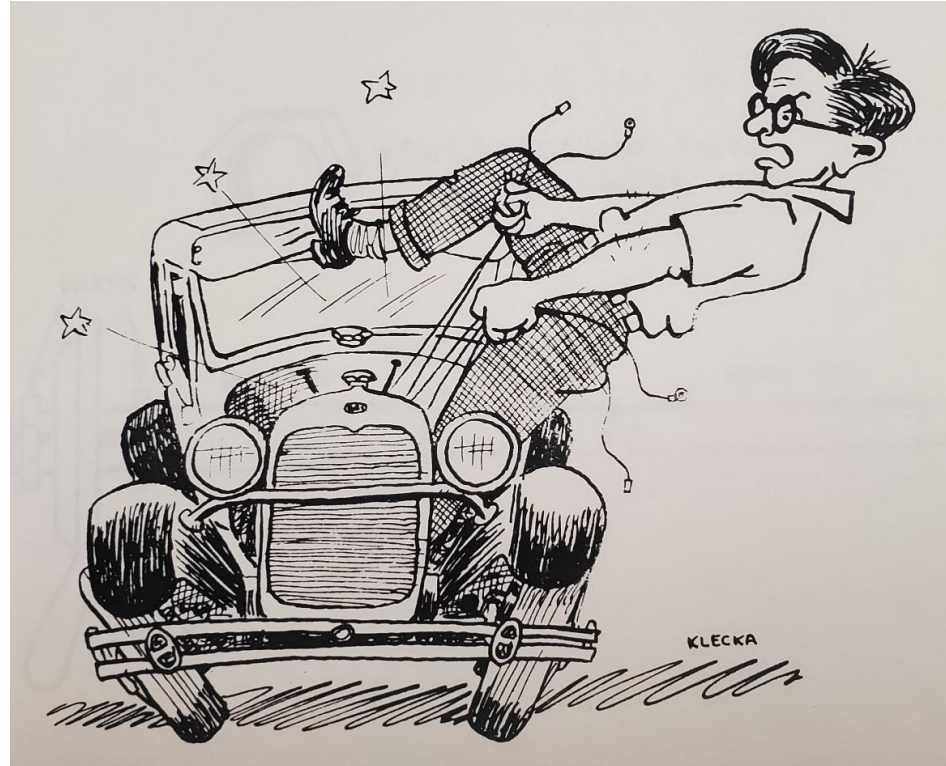
A 2-brush generator is simpler, more robust, has higher output and uses external voltage regulator.



# Typical 2-Brush Generator Operation



In a 2-brush generator, field strength is controlled by an external voltage regulator.



Maintenance  
Let's get to work!

# Generator Maintenance

## 3<sup>rd</sup> brush adjustment:

- Adjust to provide a slight (4 - 5 amps) positive charge under usual driving conditions.
- I run all LED lights. With these the 3<sup>rd</sup> brush is adjusted down nearly to its lowest setting.

## Lubrication:

- Rebuilt generators almost always used sealed bearings at the pulley end. No lube required.
- At the brush plate, just a couple drops of 30wt oil every 1000 miles. No more - too much oil and work its way to the commutator.

## Brushes:

- Inspect the brushes. The brush spring should not bottom out on the brush holder.
- If worn, replace them. While not required, new brushes should be sanded in, matching the shape of the commutator.
- Blow out carbon dust.

## Belt:

- Don't overtighten the belt. An overtightened belt is hard on the bearings. Have at least  $\frac{3}{4}$ " belt deflection.





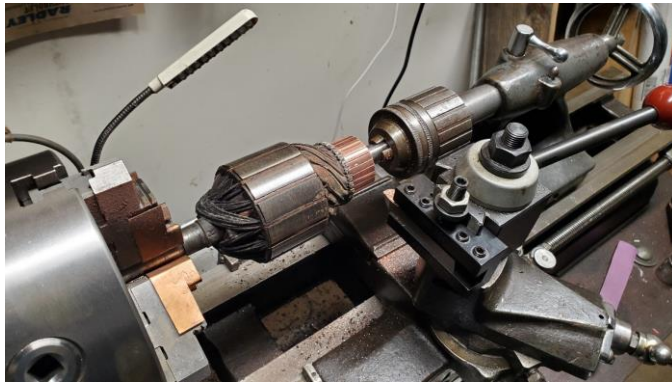
# Armature Testing & Service

The armature is the heart of the generator. My armature servicing process includes:

- Clean the commutator, then test on the growler for opens, shorts and grounds.

<https://youtu.be/QZ6Px1HryBU?si=l88yEgGuKFt407ms>

- If it passes the growler tests, I put it in the lathe and true and/or polish the commutator. Then clean up the laminated core with 220gr sandpaper.



- If needed, the mica between the copper bars is undercut about .030”.



# Polarizing a generator

Polarizing a generator does two things:

- Sets residual magnetism in the pole shoes. This is needed to start the generator charging.
- Causes the armature to rotate like a motor, showing that the generator is electrically sound.

How to polarize a 3-brush generator video:

[https://youtu.be/cvTico\\_p6K0?si=whT2bIUG9m3-6yyT](https://youtu.be/cvTico_p6K0?si=whT2bIUG9m3-6yyT)

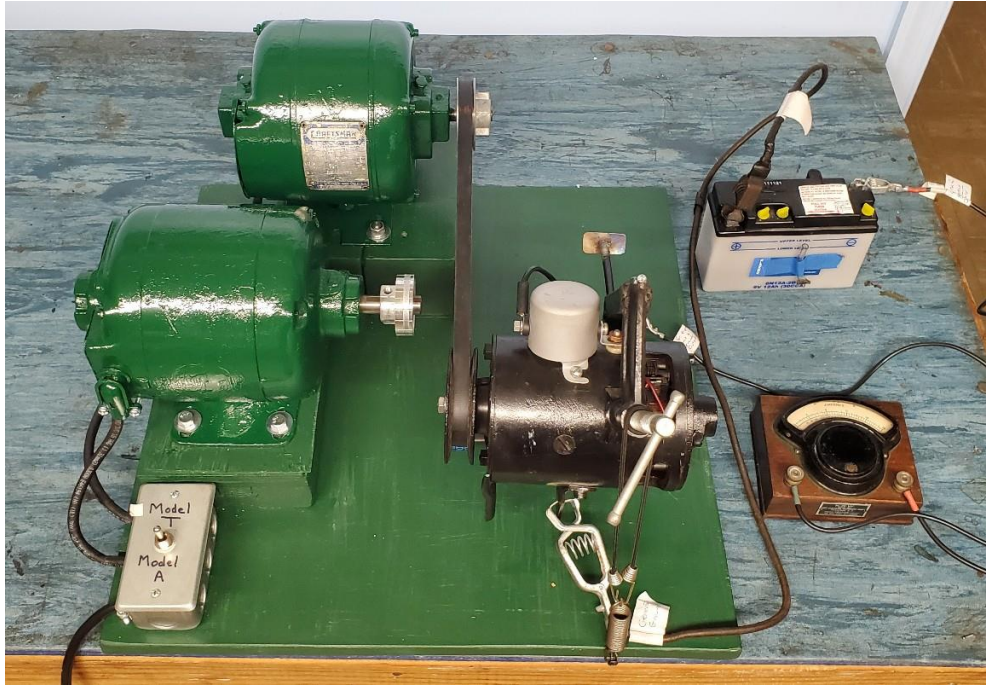
How to polarize a 2-brush generator video:

<https://youtu.be/RI9KY4wTHm0?si=RN56BUgQLEEr1LKR>

**Contrary to what you may read on the internet,  
there is no such thing as polarizing a regulator!**



# Last Step - Testing!



My shop-built model T and model A test bench.



Early 1930s Weidenhoff Generator Test Bench



# Looks Can Be Deceiving

Even crusty clunkers can often be restored



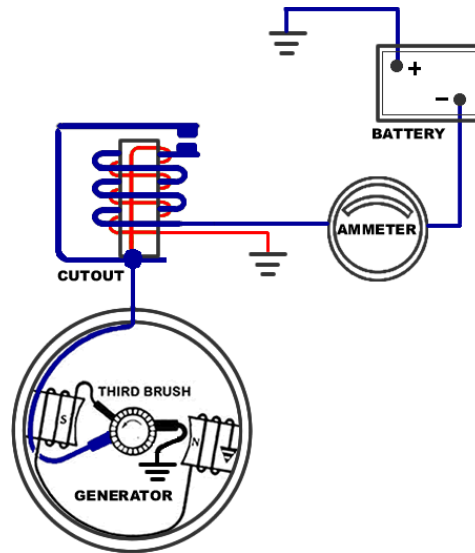
This generator was converted from 3-brush to a 2-brush with an Electronic Voltage Regulator (EVR).

# Cutouts & Regulators

The background features abstract, overlapping geometric shapes in various shades of green, ranging from light lime to dark forest green. These shapes are primarily located on the right side of the slide, creating a modern, layered effect. The text is centered on a white background.

## 3-Brush Generator Cutout (AKA Reverse Current Relay)

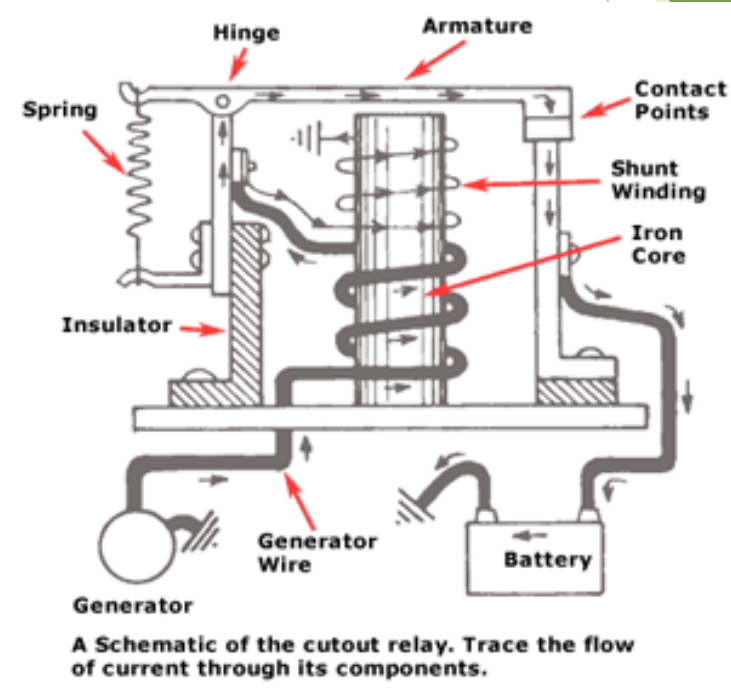
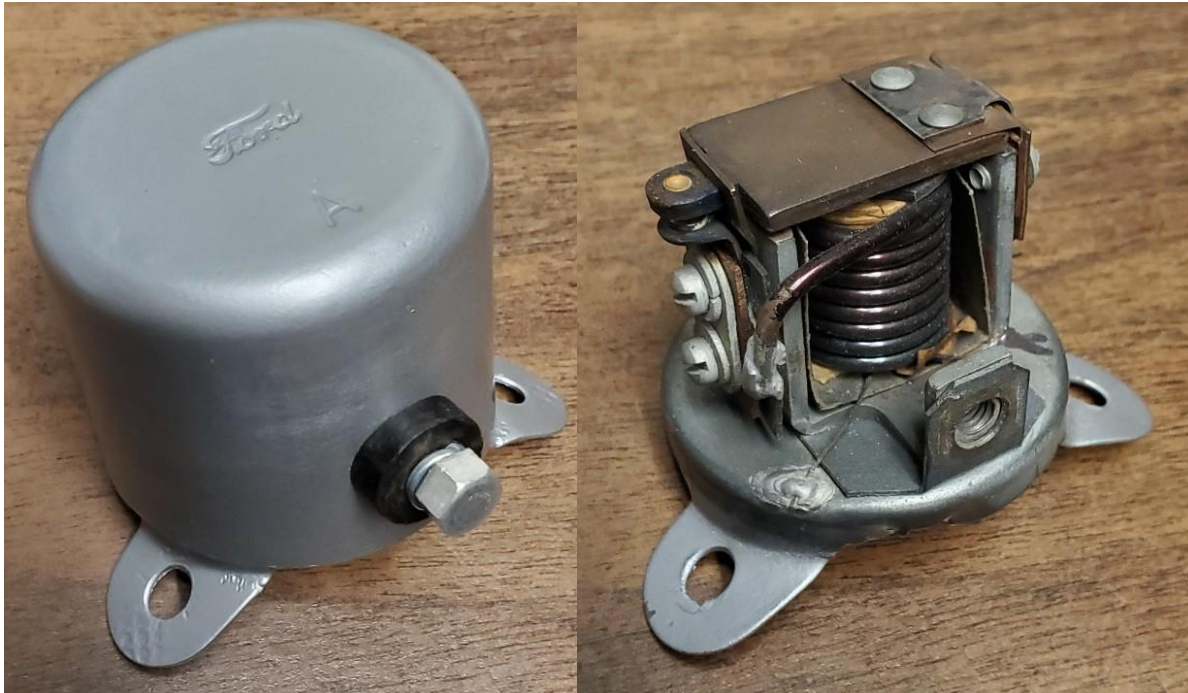
It lets current out of the generator as it spins up. With the car shut off, it prevents the battery from discharging back through the generator to ground.



**When shutting off the engine, always glance at the ammeter to confirm it is back to 0.**

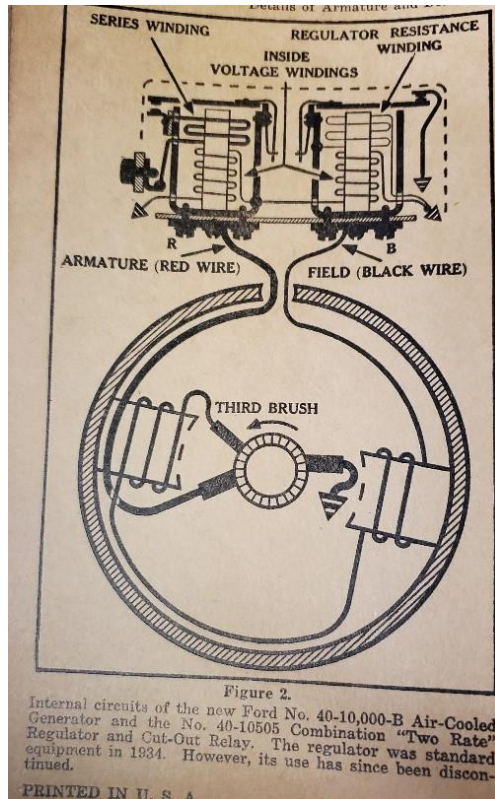


# 3-Brush Generator Cutout



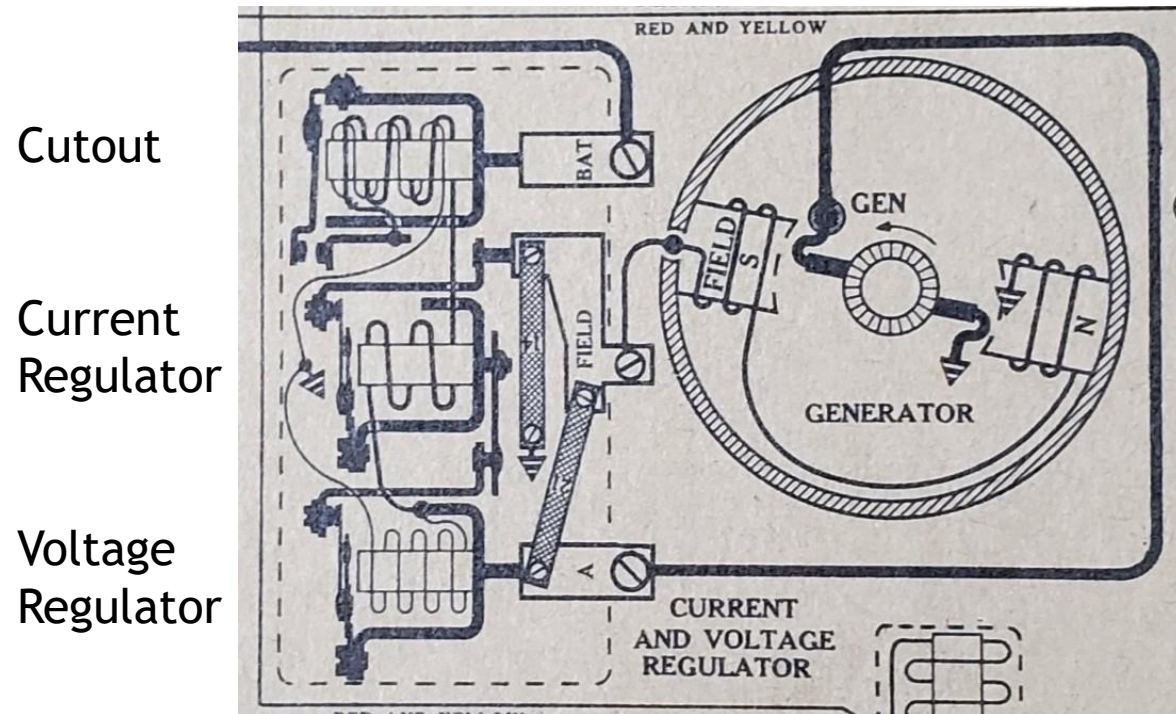
Just an electromagnetic switch to connect the generator to the electrical system.

# Early 2-Rate Regulator for 3-Brush Generators



Used in the mid-late 1930s, primarily on radio equipped cars.

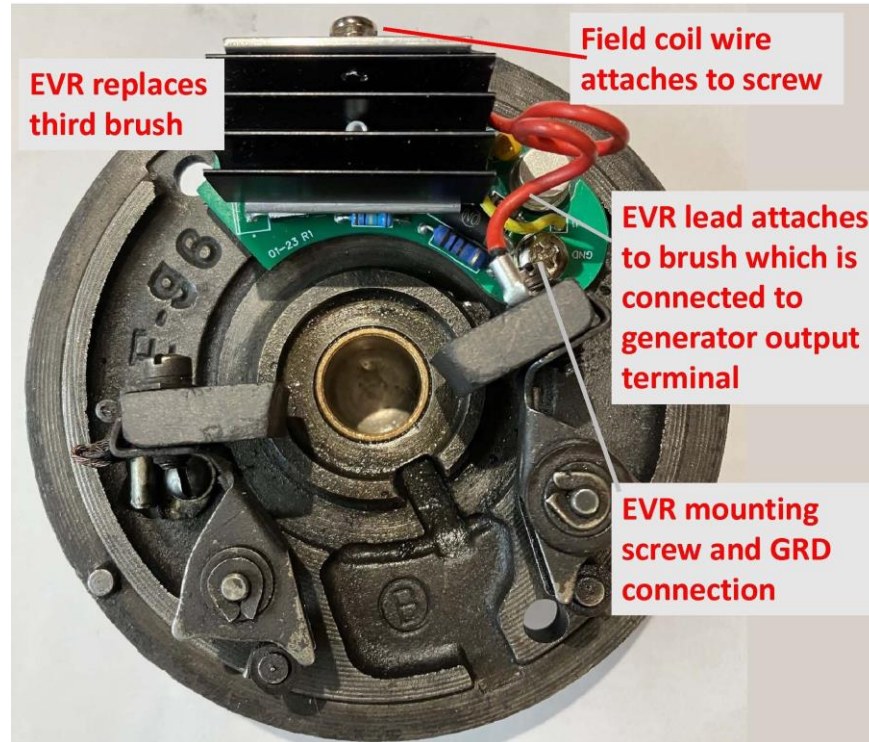
# Typical 2-Brush Regulator



The voltage regulator is actually three different devices; A cutout, a current regulator and a voltage regulator.



# Electronic Voltage Regulator For 3-Brush Generators



The adjustable 3<sup>rd</sup> brush assembly is removed and replaced by the EVR. The EVR senses battery voltage and electrical load. It adjusts field strength to meet demand.

# LED Lighting

LED headlights and taillights provide a significant safety and visibility improvement, comparable to modern cars.



**Plus** the generator can be set very low so it runs cooler which makes the generator very happy. There is no need for an ugly alternator.



A properly restored 6 volt electrical system works just fine and will provide many years of trouble-free service.



Happy Motoring!