

# 2CV BATTERY CHARGING CIRCUIT

## Revision 5



Graeme Dennes

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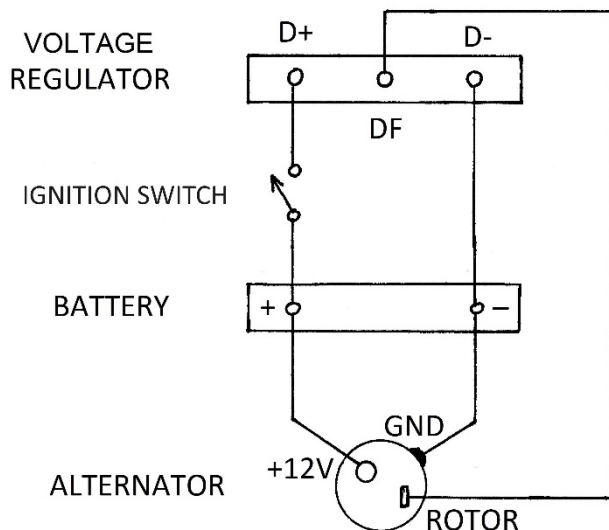
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This article describes the battery charging arrangements used in a 2CV fitted with an alternator.

The purpose of the alternator is to supply voltage to the vehicle's electrical system and to keep the battery fully charged. The 2CV charging system consists primarily of the battery, the alternator and the regulator. Maintaining the battery at its fully charged state maximises the battery life. Although charging circuits in general can sometimes be quite complex, the 2CV charging circuit is a very basic arrangement, as shown in Fig. 1 below.

### 2CV CHARGING CIRCUIT



The 2CV voltage regulator has three connection terminals: D+ (Dynamo+), DF (Dynamo Field) and D- (Dynamo-).

The battery has two connections: the positive (+) post and the negative (-) post.

The alternator has three connections: +12V (Battery +), Ground (Battery -) and Rotor (a.k.a. Exciter)

*Fig. 1*

With the ignition switch ON, the regulator's D+ terminal is connected to the battery + post via either a relay contact (if a relay is fitted) or via the ignition switch.

#### Voltage Regulator:

During vehicle operation, the purpose of the voltage regulator is to maintain the optimum voltage at the battery posts at all times, irrespective of engine speed, electrical system loading or the state of charge of the battery. If the battery is partially discharged, such as just after starting the engine, the regulator controls the battery voltage (through its control of the alternator), increasing the battery voltage slowly towards its fully charged point. Once the battery voltage reaches its fully charged point, the regulator then maintains that voltage at the battery posts. That voltage is equal to the regulator's voltage set point, which is a specification of the voltage regulator.

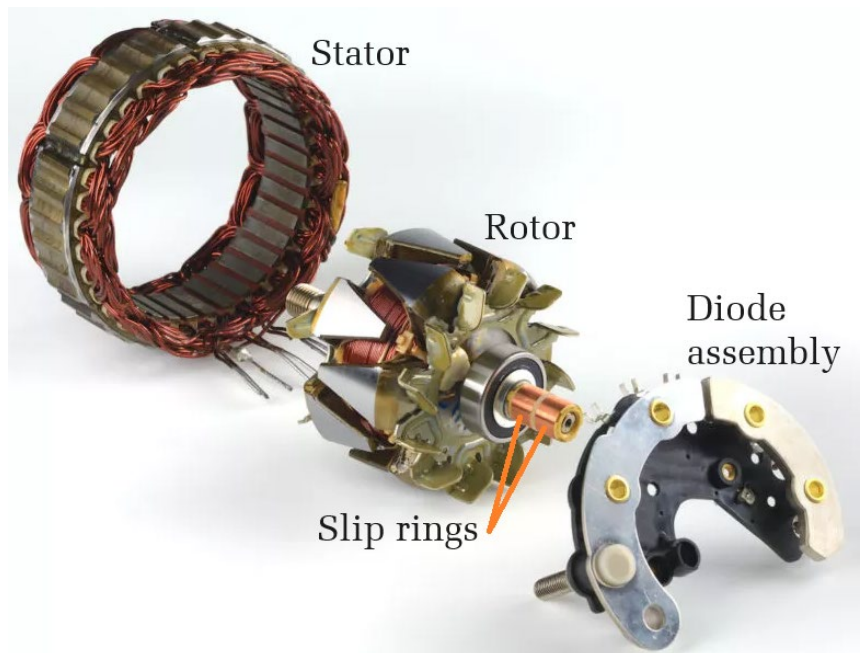
### Voltage Set Point:

The voltage set point of a voltage regulator is a fundamental design parameter. It is the voltage which the regulator aims to maintain across the battery posts. We'll consider the application of the Bosch RE57 voltage regulator as an example.

This regulator has a voltage set point of 14.2V, which is the optimum voltage to maintain at the battery posts of a standard lead-acid battery. (It is also the optimum voltage to minimise sulphation at the plates.) The job of the regulator is to enable the battery to be charged in a proper and controlled manner, and once charged, maintain that voltage across the battery posts at the set point voltage.



*Fig. 2 2CV Alternator*



*Fig. 3 Alternator internals*

### Circuit Operation:

In operation, the voltage across the battery is controlled by the alternator, the alternator voltage is controlled by the regulator, and the regulator is controlled by the battery voltage! It's an automatic level control function operating within a closed feedback loop.

During vehicle operation, the voltage regulator is continually sensing (monitoring) the battery voltage across its D+ and D- terminals and comparing it with its voltage set point. If the battery voltage is lower than the regulator's voltage set point, i.e., lower than 14.2V, which happens when, say, the headlights are turned on and the battery voltage drops a little due to the headlight current, the voltage regulator responds by increasing the control voltage at its DF terminal. This increases the voltage at the alternator rotor terminal, which causes the alternator's output voltage to rise, which increases the voltage across the battery posts and across the regulator's D+ and D- terminals, until the battery is (again) being charged at the optimum voltage (the voltage set point) of 14.2V as sensed by the regulator's D+ and D- terminals.

Conversely, if the battery voltage is higher than the regulator's voltage set point, i.e., higher than 14.2V, which happens when, say, the headlights are switched off and the battery voltage rises a little, the voltage regulator responds by decreasing the control voltage at its DF terminal.

This decreases the voltage at the alternator rotor terminal, which causes the alternator's output voltage to decrease, which decreases the voltage across the battery posts and across the regulator's D+ and D- terminals, until the battery is (once again) operating with optimum voltage (14.2V) at its posts, as sensed by the regulator's D+ and D- terminals.

This is the fundamental way the battery, the alternator and the voltage regulator interact to maintain the optimum voltage across the battery posts, which maximises the life of the battery and minimises battery sulphation.

If the battery is being undercharged, stored in an uncharged condition, or being overcharged, plate sulphation is promoted, causing the amount of charge able to be stored in the battery to be reduced, while also reducing the battery's life.

As a simple check, with a fully charged battery and the engine idling, the voltage measured across the battery posts should be around 13.5 to 13.7V. If the engine speed is increased to say 2000 (or higher) RPM, the battery post voltage should increase to the regulator's voltage set point, i.e., a voltage of 14.2V. *At no time should the battery voltage rise above the regulator's voltage set point of 14.2V, regardless of engine RPM.* If it does, something is very wrong.

Any failings within the wiring connections or any additional circuit resistances in the wiring at Fig. 1 *will* result in battery and battery charging problems, including an overcharged battery! Dead set! Refer to the writer's article, *2CV Battery Problems Solved* for further information on this issue and how to ensure the voltage across the battery posts never rises above the voltage set point of the regulator (14.2V for the Bosch RE57 regulator).

In summary, that's how the voltage regulator operates and exercises control over the alternator, so the battery is always being optimally charged and maintained at its optimum charge point. It's all accommodated automatically by the voltage regulator. It's also conditional upon the voltage regulator operating to its specifications and the integrity of the wiring and the wiring connections, including crimp connectors.

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