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ELECTRICAL SYSTEM DESCRIPTION

ALTERNATOR

A 12 volt, 500 watt alternator is utilized. The alternator charges the battery and supplies current to the electrical units of the car.

ENGINE STARTER

An 8/10 HP, solenoid-operated starter is utilized. The starter is controlled by the ignition/starter switch on the instrument panel.

BATTERY

The six-cell, 12 volt, 45 Ah battery is located within the luggage compartment under the front lid. The negative battery terminal is connected to the ground.

IGNITION SYSTEM

The ignition system is battery operated and includes a high tension coil as well as a distributor which is equipped with a centrifugal spark advance mechanism. The distributor is driven by a worm gear mounted on the crankshaft. The ignition current is switched on through the ignition switch on the instrument panel.

LIGHTING

The two headlamps are mounted in the front fenders and have high and low beams in each. Parking lights are accommodated in the front directional blinker housings. The parking lights and headlights are switched on through a switch on the instrument panel, next to the ignition switch. Instrument light brightness can be varied with the light switch knob by turning it to the desired position. Tail lights go on with headlights.

The headlights are dimmed with the blinker/dimmer/headlamp flasher switch located on the steering post below the steering wheel. A blue headlamp control light goes on in the tachometer dial when high beams are on.

The two tail lights are combined with stop lights and directional blinkers. Two small lamps illuminate the license plate in the back.

The stoplights are controlled through a switch mounted in the brake master cylinder and go on when the foot brake is depressed. The backup lights go on when reverse gear is engaged; the lamps are located in the tail lamp housing, the switch in the side of the transmission housing.

The interior lamps are located above the doors. The lamps can be turned on by tilting the entire lens. In the same manner, the lamps can be set for courtesy operating together with the opening doors.

The cigar lighter socket in the instrument panel can also be used for plugging in a hand lamp.

ELECTRICAL ACCESSORIES

The signal horns can be sounded through a horn button in the center of the steering wheel; the contact is made through a contact ring in the blinker/dimmer/flasher switch.

The directional blinkers and headlamp signal flasher can be actuated through switch lever in the steering post extension; the switch also controls the high and low headlamp beams. Operation of the directional blinkers is indicated by a green control light in the tachometer dial as well as through an audible ticking noise in unison with the flasher.

The windshield wipers and washers are actuated through a combination wiper/washer switch on the steering post. The fuses for the various accessories are located in the left part of the luggage compartment and are covered with a plastic top.

INSTRUMENTS

The speedometer and odometer are driven by a gear in the transmission by means of a cable drive. The tachometer is transistorized; electrical pulses emanating from the ignition system pass through a transistorized converter and are fed into an electric counter in the tachometer unit.

The fuel level is indicated by means of a fuel gauge which is connected to an electrical sending unit in the fuel tank. In addition, the gauge has a low fuel warning light.

The oil temperature gauge and, in Type 911 S, the pressure gauge as well are electrically connected to their sending units in the crankcase.

Type 911 S also has an oil level gauge in the instrument panel.

NOTE

Repairs in the electrical system normally are confined to the replacement of worn or defective parts and the repair of the wiring system. In general, damaged wiring removed from the system should be replaced wire of same cross-section as shown in the wiring diagram. BOSCH components should be repaired by BOSCH service whenever possible.

CAUTION

To avoid shorting the circuit and minimize fire hazards due to electrical sparks, the battery ground strap should be removed from the battery prior to the initiation of any work in the electrical system.

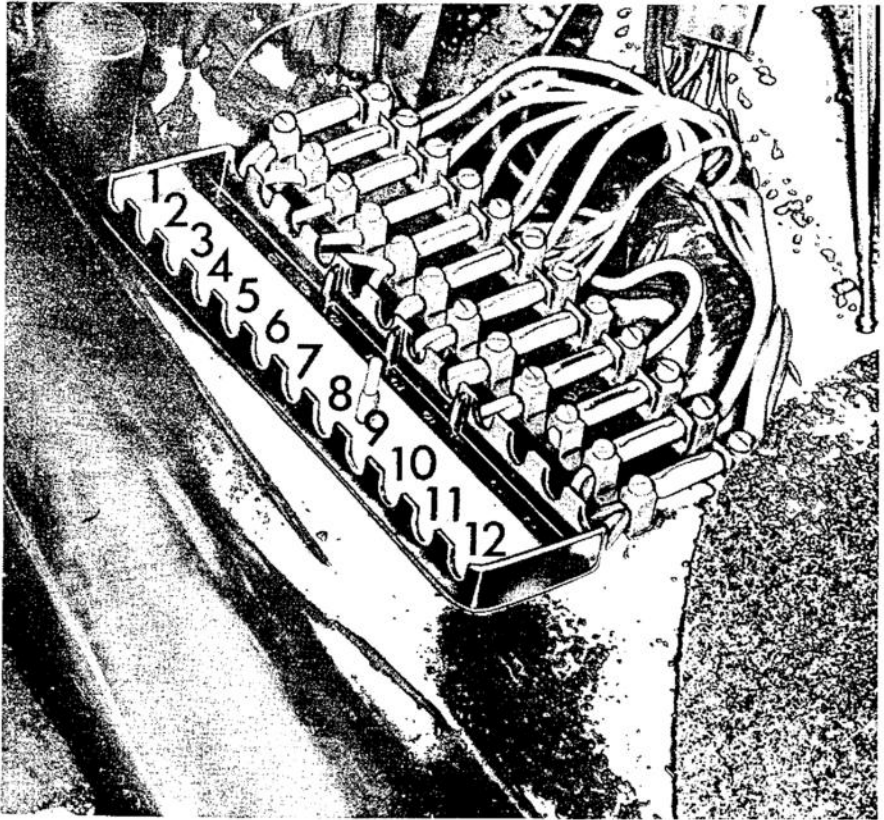


Fig. 1

- | | |
|-----------------------|---|
| 1 High beam, left | 7 License plate lamp and luggage compartment lamp |
| 2 High beam, right | 8 Fog lamps |
| High beam indicator | 9 Windshield wipers and washer |
| 3 Low beam, left | 10 Auxiliary combustion heater |
| 4 Low beam, right | 11 Interior light, cigar lighter, electric clock |
| 5 Parking lamp, left | 12 Stop lights, blinkers, backup light |
| 6 Parking lamp, right | |

BULB CHART

All bulbs 12 volts

Qty	Nomenclature	Wattage
2	Twin filament headlamp bulbs	45/40 W
2	Sealed beam inserts (US made)	50/40 W
4	Cartridge bulbs for parking and license plate lamps	4 W
2	Cartridge bulbs for parking lamps (Italy)	3 W
4	Single filament bulbs for directional blinkers	18 W
4	Single filament bulbs for directional blinkers (Italy)	15 W
(6)	Single filament bulbs for directional blinkers and backup lights (USA)	32 cp
(2)	Twin filament bulbs for stop and tail lights (USA)	32/4 cp
2	Twin filament bulbs for stop and tail lights	18/5 W
2	Single filament bulbs for backup lights	25 W
2	Cartridge bulbs for interior lights	10 W
1	Single filament bulb for luggage compartment light	5 W
16	Bulbs for instrument illumination and control lamps	2 W
(2)	Single filament bulbs for parking lights (USA)	2 cp

General

The steadily growing application of electric power in motor vehicles required the use of generators of steadily growing capacity. This trend led to the development of automotive AC generators, or alternators, which offer the following advantages: greater reliability, reduced maintenance, extended life, and improved efficiency due to power output over greater rpm ranges, including idling, which is advantageous in congested traffic environments.

Characteristics

The alternator in question is a 12-pole synchronous AC generator with an external field exciting source. The alternator has stationary windings and a rotating DC field coil. The rotating field coil receives the exciting voltage from a rectifier (Terminal D+ / 61) via the regulator and two brushes riding on slip rings. The stationary winding is directly connected to silicone rectifiers in a 3-phase circuit, while the DC voltage terminal B+ of the silicone rectifier is connected directly to the battery.

Owing to this arrangement, the charging current no longer flows through the regulator and its connections but directly to the battery. The connection between the alternator and regulator is by means of a three-fold wire loom so that the wires cannot be connected to the wrong terminals. The two-contact regulator limits the alternator voltage to 14 V. It is not necessary to limit the current since the current output curve rises to its maximum level and then stays flat up to the maximum rpm. The direction of rotation of the alternator depends on the type of impeller used. The alternator may be operated only when the battery and regulator are connected since otherwise the rectifier and regulator may become damaged. The respective regulator must be ordered separately when ordering parts. Terminal D+ / 61 may be connected only to loads imposed by the regulator and generator charge indicator lamp.

The Diode

The diode is a semiconductor. Semiconductors allow electrons to flow in one direction only, blocking the flow in the other direction.

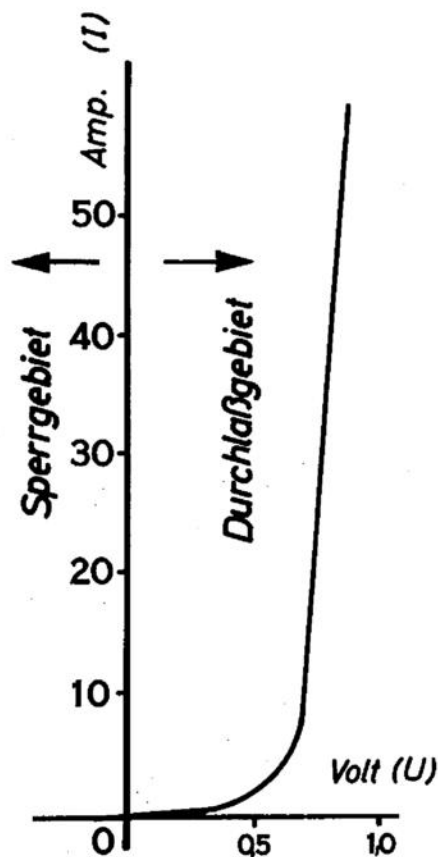


Fig. 2

This characteristic can be better understood when the atomic structure of germanium (Ge) can be grasped.

Germanium is an element of the 4th group in the periodic law. When purified, germanium is in the polycrystalline form. Each germanium atom is bonded to four neighboring atoms. Each germanium atom has 32 electrons; the four outer electrons reinforce the crystal lattice and, in pure germanium, can conduct electricity only when subjected to considerable electrical pressure.

By adding a small amount of impurities from an element in the 5th group of the periodic law, electrical conductivity is considerably increased.

In a five-electron atom, four electrons are grouped closely together within the lattice while the fifth remains free and assumes the role of a current carrier. Since the electrons are negatively charged, the conductor is called a negative conductor, or n-type.

If the germanium receives impurities from an element in the 3rd group, the lattice will have a deficiency of one electron. A free electron from nearby can, however, easily fill this free space but by so doing creates an electron deficiency or "hole" elsewhere. This occurrence can be taken as an eternally transferring "hole". In such way, though, we have a positive conductor, or p-type.

A silicone germanium rectifier consists, in most part, of n and p atoms with a pn junction. This gives it alternating current rectifying characteristics. In this process, surplus electrons from the formerly neutral n-type germanium move into the neutral p-type germanium, so charging it negatively. Also, "holes" move from the p-type germanium into the n-type germanium. However, this diffusion ceases as soon as the n-type has a positive charge, and the p-type a negative charge. At this time, a space charge forms at the pn junction.

When the p-type germanium is given a positive charge and the n-type a negative charge, the space charge weakens and the diode functions as a conductor. When the diode polarity is reversed, it acts as an efficient resistor, having such strong space charge that the energy carriers are unable to pass through.

Single - Element Voltage Regulator

Characteristic Features: Two-contact, single field regulator without a switch. The functions of the reverse current switch are carried out by diodes in the alternator. The regulator base has two mounting ears with holes for attachment bolts. The field coil end is connected to the negative brush. It is of constant voltage characteristics without a current limiter. Radio suppressors are built into the regulator. Radio suppression extends from FM to LW. It is equipped with three tab terminals of 6.3 mm width each (DF, D+, D-). The dust cover is rectangular.

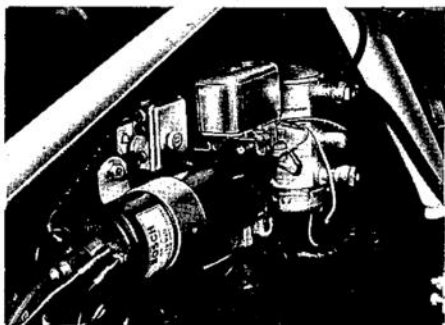


Fig. 3

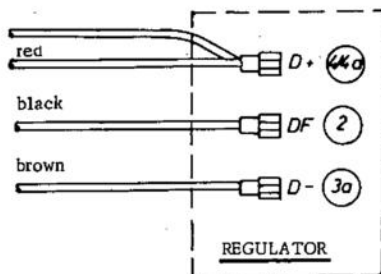


Fig. 4

Maintenance Requirements

The alternator is service free. However, the ball bearings and contact brushes should be checked and the ball bearings repacked with new grease in conjunction with engine overhauls, or at least once each year, whichever should first occur, using BOSCH ball bearing grease FT 1 v 33.

System Check

1. Switch the ignition on: the control lamp must light up.
 - a. If the control lamp does not light up, then the bulb is defective or the wire connection broken,
 - b. If the control lamp stays on when the ignition is switched off, one or several diodes conducts current against the direction of flow.
Note: Disconnect the battery at once to prevent damage to the alternator and battery.

2. Start engine.
If the control light does not go off despite increased engine speed, or when it lights up in certain rpm ranges, then one or several diodes may be defective.

Note:

Do not operate the alternator without connecting it to the battery.

Testing Alternator in Vehicle

Testing Instruments: Voltmeter 0-20 V capacity
Ammeter 0-60 A capacity
Rheostat 500 W capacity

Testing Regulating Voltage

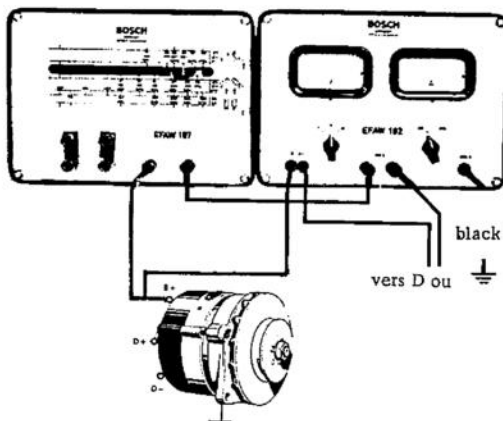


Fig. 5

Testing Procedure

Start engine and bring engine speed to 3000 rpm, keeping it steady. Adjust load current with rheostat and read voltage:

Load current: 28 - 30 Amps
Regulating voltage: 13,5 - 14,5 volts

Note:

The test cables should not be removed or the load excessively reduced during the testing procedure. Considerable load variations may damage the diodes. The control lamp should not go on at any time during the test.

The alternator may also be tested with an ignition oscillograph. The test should be accomplished according to instructions of the unit's manufacturer.

Alternators should be repaired by BOSCH service or auto-electric shops since these will have the necessary equipment on hand.

Removal

1. Remove air intake silencer.
2. Remove upper shroud attaching bolts.

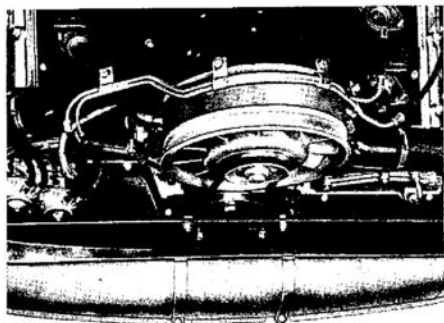


Fig. 6

3. Remove alternator pulley retaining nut (hold with special tool P 208) and take off the V-belt.

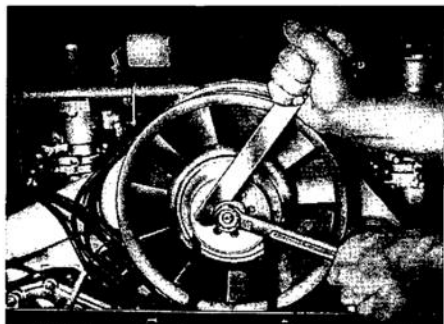


Fig. 7

4. Remove bolts from blower housing strap.

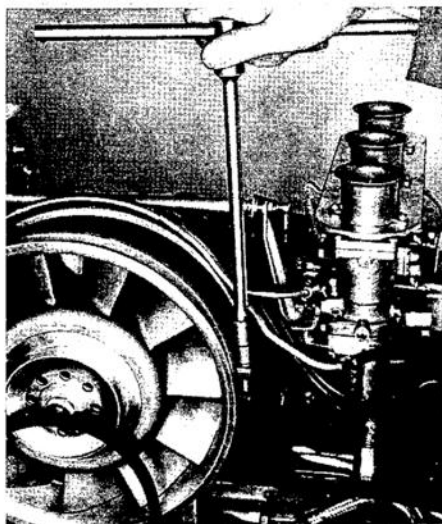


Fig. 8

5. Pull blower housing and alternator assembly towards the rear.
6. Detach wire connections from alternator.

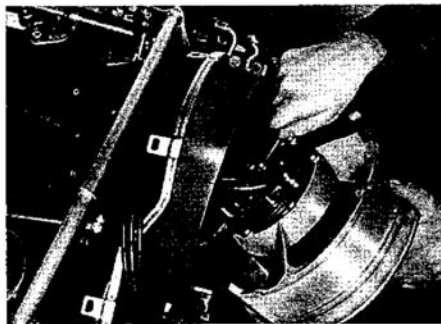


Fig. 9