



# BRIGHT LIGHTS 1

## THE GOOD EARTH

A poor return circuit is probably the most common cause of lighting problems and dim lights in older cars. This aspect of the electrical system is also an occasional cause of problems in newer cars.

The difficulties arise from using the body panels and general framework of the vehicle as an earth (or ground) return circuit. The principle goes back at least as far as the early days of telegraphy and radio or wireless telegraphy (telegraphie sans fils or la TSF as the French have it). At that time it was appreciated that great savings in expensive wiring could be made by connecting one side of the circuit to the earth itself. In rural areas one often sees electric power going through a single elevated wire on poles - the SWER system (single wire earth return). The earth, because of its huge cross-section and moisture in the soil etc, is a reasonably good conductor (and certainly cheap!). Of course the circuit must make good electrical contact with the earth - e.g. by clamping onto a buried metal water pipe or by using a network of buried wires around the base of a radio mast. The symbol for this earth connection is  or . You will appreciate its stylistic derivation.

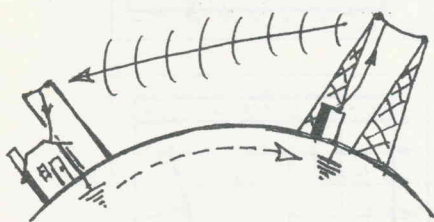
The idea of using the earth return then carried over into vehicles (cars, ships, planes etc) for internal or on-board circuits, even though the return was no longer really through the earth as such (extremely difficult with a plane in particular!). Rather it was through the conducting metal body panels and chassis etc. Sometimes in a wiring diagram, the earth return connection as above may be shown, or alternatively, it may be implied with

only the outgoing or live/active ("above earth") parts of the circuit being shown. The use of the body as one side of the circuit means that it is easier to develop "short-circuits" - i.e. if the insulation of any active wire chafes through, the wire itself may contact "earth" (the body), and produce troublesome or dangerous side-effects - operational failure, wiring burnout, fire. Care and protection of the wiring from damage, and use of fuses in the circuits minimize these problems.

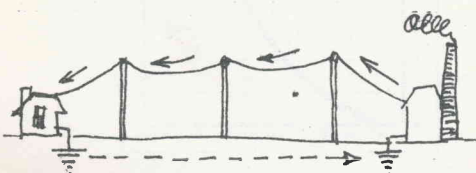
The older vehicles are particularly prone to earth return problems, especially for components such as headlights, tail lights, side lights which are not mounted on the main hull or body work. In these cases, the earth return path can involve many metal-to-metal junctions and at each of those junctions, high resistance to electrical current can be caused by layers of metal oxide (especially rust), dirt or paint. For the headlamps, the components in series could include: bulb base, reflector, headlamp shell, mounting bracket, mudguard, splash-panel, hull, battery earthstrap, battery terminal.

The contact between each of these components can cause trouble. Even exposed items on the main hull may develop earthing problems e.g. trafficators. Perhaps your magnificent paint job is the problem - layers of primer, undercoat, enamel - all very good insulators.

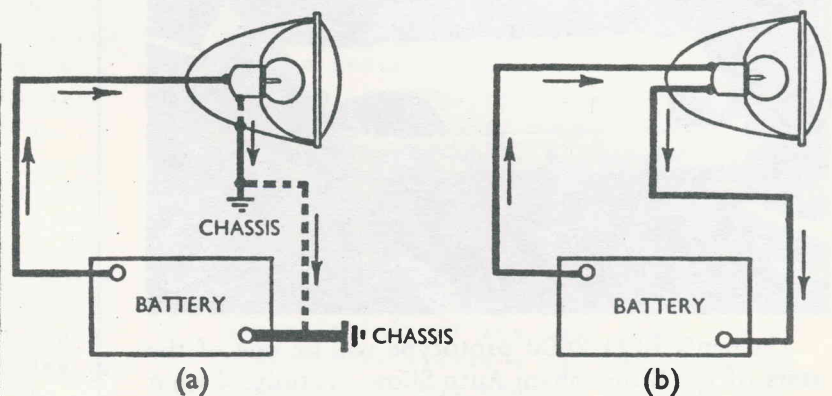
Various answers **are** available. Scrape off small areas of paint or oxide at the points where the components join up e.g. under assembly bolts, and prevent these surfaces from re-oxidizing by spraying the



Radio transmission with earth return



Electrical transmission with earth return (SWER system)

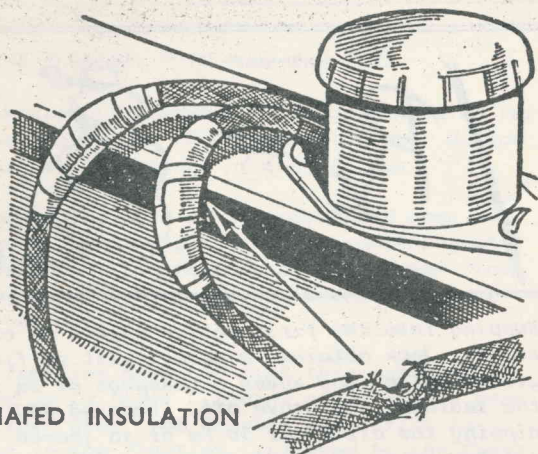


(a) Earth Return System

*One side of the bulb is connected internally to the lamp body, which in turn is connected to chassis.*

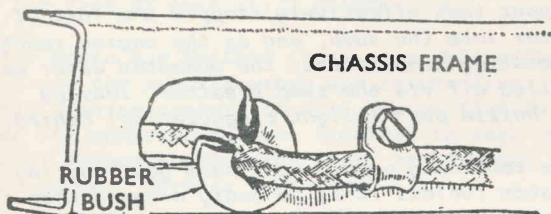
(b) Insulated Return System

*In this case, the path to and from the bulb is wired, the bulb carrying two contacts.*



CHAFED INSULATION

*A typical insulation fault due to chafing against some other part of the car. Insulation tape can be used to repair the defect.*



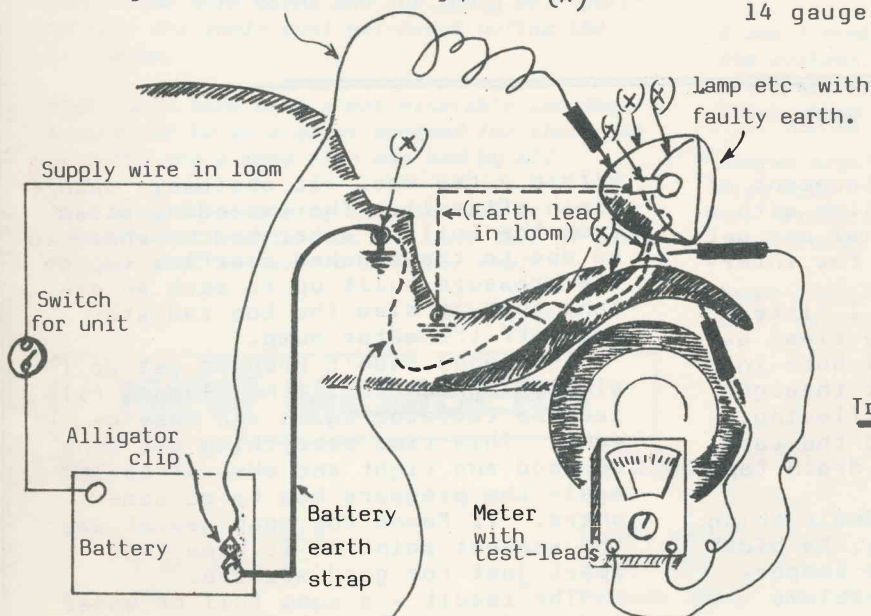
*In modern cars chafed insulation is practically abolished by such devices as this rubber bush and the bell-mouthed clip.*

area with a water repellent film - RP7, WD40 etc. Sometimes, the contact surfaces may be "tinned" with solder (gold as in computer electronics may be a bit much on the Traction, 2CV etc!). An ohmmeter (part of your multimeter or possibly in your car tune-up meter) can be used to isolate points of high resistance within the earth return for a given light etc. Alternatively, you can clip a piece of flex to a good earth on the main body and with the light etc switched on, make contact with components in turn along the earth path towards the light etc until full function is restored. You've then isolated the region of high resistance in the path and can proceed to treat it.

Another and perhaps the best way is to ignore the earth return and put in a separate return wire e.g. attach a return wire by soldering, bolting, etc to the lamp body, bulb holder etc and return it along with the other wires of the wiring loom and earth its other end to the hull or main body, via a spade lug (crimped or soldered), attached to a cleaned attachment point e.g. the mounting bolt of the regulator, earth strap etc. If you are making a new loom, it is worth putting in return wires for these more distant components. Modern cars (including later Tractions) do just that, relying on the body for earth return on the welded hull, but putting in separate return wires back to the hull for distant components. The earth wire should be as heavy as the feed wire for the component e.g. 28/0.3 mm or 14 gauge for head lights.

Bill Graham

Earthing test-lead with checking points (x)



Earth return through the components of the unit and the car body.

Voltmeter (power to unit on) will detect voltage drops between components in earth return circuit.

Ohmmeter (power off) will detect resistance between components in earth return circuit.

Tracking down an earth return problem.

