TECH TALK

Editors Note – Pete Yuen has written an excellent technical article (one of several) related to the restoration of his grandson's 1951 Studebaker. He lists it under the title of "Eddy Tor's Shop Talk and Car Care". I have reproduced his latest article for your reading pleasure.

Reason To Rewire Your Car . . .

Deterioration of the insulation mostly due to heat and age leaving spots where the wire core which is the electrical conductor exposed. Abrasion and chafing will also wear out the insulation. Should a bare spot on the wire carrying current be in contact with anything that will ground the circuit, then there is a complete (closed) circuit. This is a "Short Circuit." The power has not and will not reach the equipment that it was destined for. If the circuit is protected by a fuse, it will burn out to break the circuit. A breaker is at times used in place of a fuse. It may be described as a thermal switch which allows power to flow through it. Excessive power draw through the breaker will cause the contacts to open to break the circuit. When the breaker such as used in a car cools again, it will allow current flow through it again.

Picture:
Break in the insulation of the wire is indicated by the frayed wire covering.
Breaks in the insulation on the middle wire. Tape is used for insulation on the left side of the wire.
Bottom wire has insulation broken off and missing on the right side of picture.

It is my belief that insulation on a wire does not enhance or inhibit the flow of electricity through it. A bare wire will transmit power as well as an insulated one. While bare wires can be use for trolley buses and high voltage power transmission lines for great distances, bare wire has limited applications in a car with the exception of the ground straps as used in older model cars. Ground straps on modern cars are insulated. The model "A" Ford from 1928- 1931 used uninsulated copper or brass straps from the distributor to the spark plugs with excellent results.

Cable on left is used for ground strap on 6 volt equipped Studebakers. *Cable on the right is insulated*

The purpose of the insulation on the wire is to keep the current within the wire by insulating it from direct contact with other wires so that it may flow to wherever it was designated to go, whether it be to the headlights, ignition system, tail lights, solenoids, relays, electric motors such as used on heaters, windshield wipers, etc. Other destinations for power are horns, gauges, engine heat sending units and gas gauge sending units. Modern cars have added power windows, seats, sunroof, locks, mirrors and computers. Wiring a car is an adventure and not many car owners get a chance to experience it and what it entails to get the system operative. In rewiring a car, a person does not need much skill or knowledge. It does require time and patience and the wiring schematics for the specific car for reference. In the days of the early Model "T" Fords, there was only the wiring from the magneto to the coil box, wire to the commutator (distributor), spark plug wires and wire to the ignition switch. Later Model "T"s had a starter, generator and electric head and tail lights so the amount of wire used was on the increase, possibly to be near 100 feet. A modern car may have 700 feet of wire in it.

As the new cars have 12 volt systems, smaller wires are used than that of the older cars with 6 volt systems. It is the voltage/amperes ratio stuff that allows it.

Ideally, use the largest cable that can be purchased to supply power from the battery to the starter on the 6 volt system. The 6 volt starters need all the help that they can get. A small battery cable will impede the flow of current. The result will be less than optimum output of the starter.

Regardless of whether the car is wired with a positive or negative ground, it is imperative that the system be well grounded for each and every application. The ground completes the electrical circuit. Without good ground, the circuit will either be non-functional or at best, partially functional.

There are many circuits within the wiring system of a car. Some circuits are individually grounded and others may be grounded from several points such as the dome light on the '51 Studebaker. The door switches and the pillar switch serve to ground the circuit for the light.

Fuses and breakers are used to protect the wiring and equipment on their circuits. Unintentional grounding of a circuit could cause an overload on that circuit and wiring. When a fuse blows out or a breaker trips, the ground or the power supply will be interrupted. What it effectively does, is it leaves an air gap where there had been continuity as a complete circuit. The fuse is a metallic link through which current will flow. It is rated and marked as to how much current it will carry without burning out and leaving an air gap. The breaker is a thermal switch. It too is rated to be able to carry a certain power load rated in amperes (amps). Excessive current draw will cause the element within the breaker to flex. As it does, the contacts that were carrying electricity will pull away from each other creating a break in the circuit.

Relays and solenoids are magnetic switches. A solenoid is used on the starter circuit of a car. Solenoids are designed for short periods of use whereas the relays are designed so that they are able to withstand being energized for an extended time period. Relays are used on horn and light circuits. Both are used to minimize the load on the switches which are also rated for the amount of power that they can safely transmit.

Automotive wiring incorporates the usage of the powered circuit, grounded circuit and the resistance circuit. The gas and heat gauges are connected to units that emit a current resistance value.

To me, the powered circuit is one that is powered through a switch. The grounded circuit is on that has power and requires a switch to complete the circuit to ground.

On re-wiring a Studebaker, new harnesses are available. For the '51 Studebaker that is being worked on, harnesses are available for the standard drive car. The main harness, tail light harness and the turn signal harness can be purchased. For the automatic drive car, the wiring harness was not available and had to be made up. The proper colored wires may not be available so there is a need to identify the wires in any way that is available to you. Electricians use numbered or lettered strips that have an adhesive backing. Each number or letter strip comes in 2 parts - one for attaching to the wire and the other is to be attached to where the wire is intended to go to.

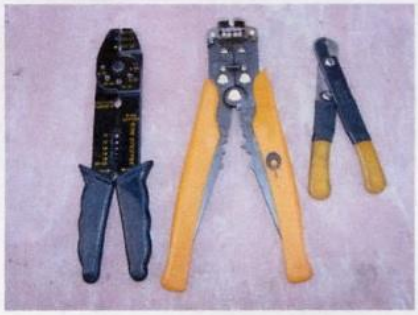
With the use of a digital camera, a person can easily take a picture of where the wires go in the event that you need to refresh your memory. Before you remove a harness, tag where the wires go to. When making up a new harness, copy the harness that has been removed then add a couple of inches to the length on each end. While the original harness was of adequate length to serve the purpose, they had a specific routing for the wires. In refitting the new harness, you may change the routing slightly if the wire length permits.

When wiring switches or plugs in house wiring, you simply strip enough of the insulation off from the wire and loop it around the screw on the plug or switch with the loop going in the same direction as the screw when you tighten it. Connections for wires are made with wire connectors inside boxes mounted on the wall. The boxes may be just for wire connections, for switches or plug receptacles. Boxes are not used in automotive wiring.

The automotive multi strand wires uses a variety of connectors and terminal ends. Common connections are made with bullet connectors that use a crimped- on bullet connector on the end of each wire to be connected to each other and a sleeve into which each end with a bullet connector will be pushed into. Switches may have screws for wires to attach to. They may also have provision for the bullet connector or in some cases, the spade connector. Gauges generally have studs which wires with loop or open slot ends are bolted on to. While soldered wire connections may be preferable, the car factories use crimped on connections probably for economic reasons. Soldered connections will be more time consuming and time is money.

Left: Switch using bullet type connector Center: Breaker with studs using wire terminals with loops. Right: Pillar switch with screws. Wire terminals used will be loops.

Needs For Wiring

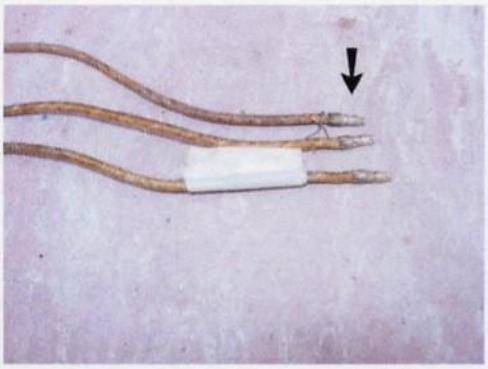


Wire Strippers: They all work
Center one preferred

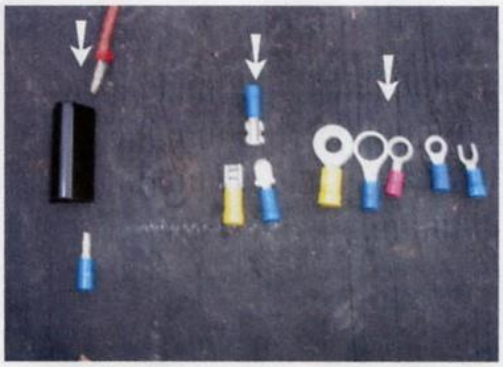
Crimpers: Top one- Industrial crimper preferred. Provides more leverage and better crimp.

Solder: Left roll is solder for wires.
Right roll is solder for plumbing.
Do not use solder with acid core

Heat Shrink Tubing: Used for insulation over the soldered connections. It is superior to electrical tape. Available in variety of colors, sizes and shrink values. Most will shrink to half size.



Bullet Connectors:
They were commonly used in older cars. Wires above have bullet connectors crimped to the wires. Cars came from the factory with these connectors.



Connectors: Left: Bullet connectors and sleeve. Center: Spade connectors
Right: Wire Terminals for attaching to switches, relays, gauges, solenoids, etc.