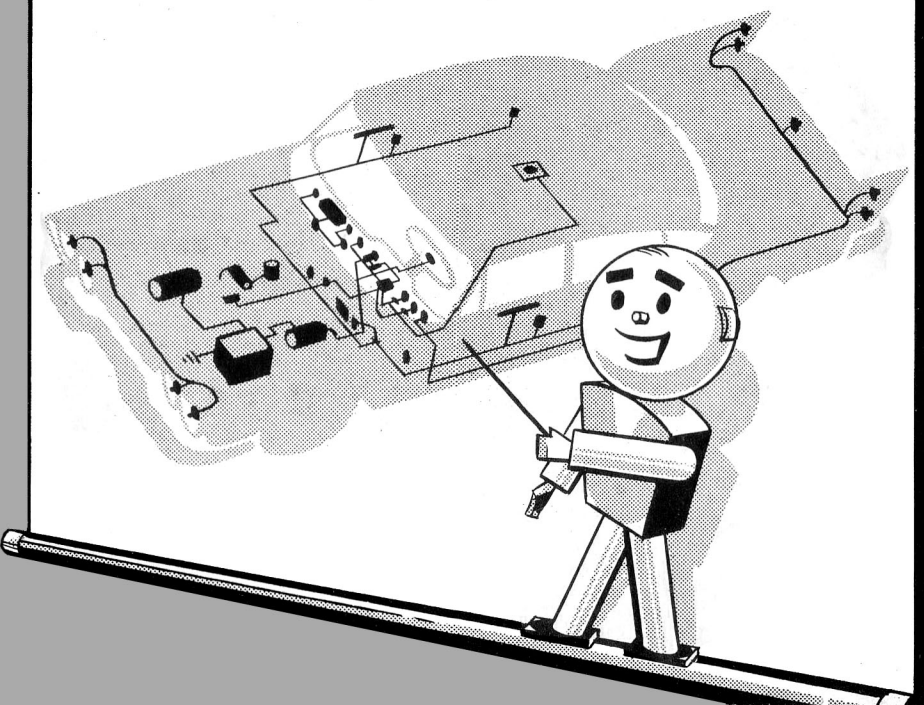
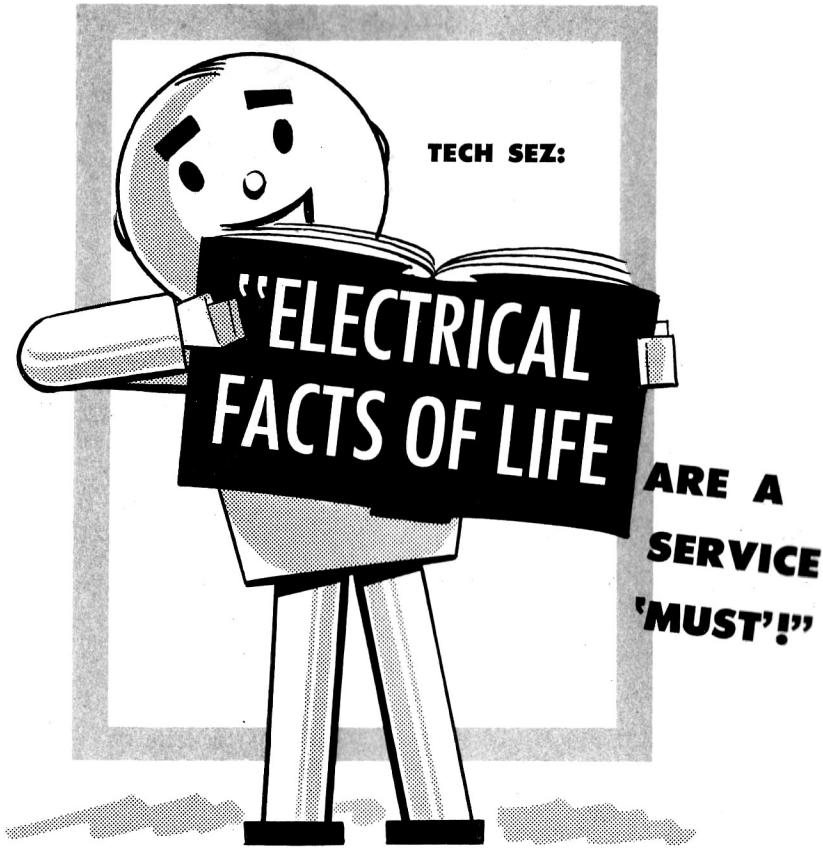
SERVICE REFERENCE BOOK NO. 118

Prepared by CHRYSLER CORPORATION

Plymouth · Dodge · De Soto · Chrysler · Imperial

AUTOMOTIVE ELECTRICITY





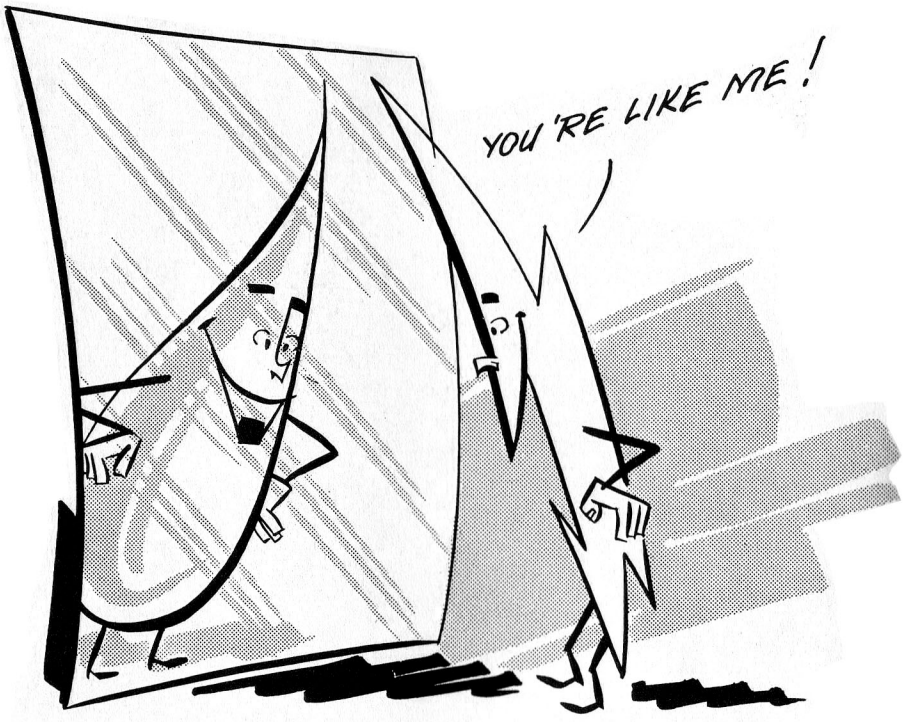
Easier driving and more automatic operation appear to be what owners go for. So, every year our cars add more and more electrical units. Since our customers rapidly get used to the greater convenience electrical accessories afford, they hate to be without the driving ease they provide.

Once more, then, it falls to us to sharpen up our knowledge of how to service the new electrical circuits. This reference book outlines useful tips on automotive electricity, plus suggestions on how to locate difficulty in any of the circuits.

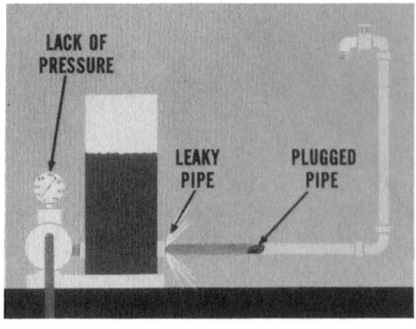
You'll find this important information arranged as follows:

WATER AND ELECTRICITY ARE RELATED

There's no need to break out in a cold sweat when you're asked to do an electrical service job. Actually, electrical repair is as easy as simple plumbing. And this is true even though you can *see* water, while electricity is invisible.

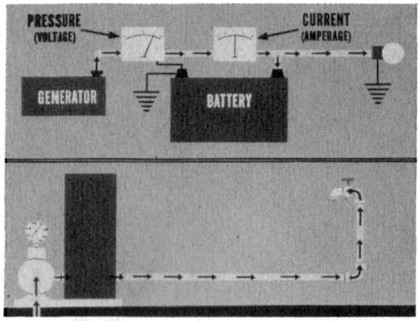


You see . . . water and electricity are quite a bit alike. They both need some means of carrying them from where they're produced to the place in which they're used. In a water system, pipes do the carrying. In an electrical system, wires take over the carrying job.

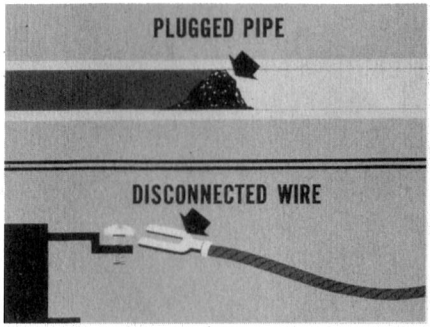


As an example, in your home water system only three things usually keep water from getting to its destination: a lack of pressure . . . a plugged pipe . . . or a pipe that leaks.

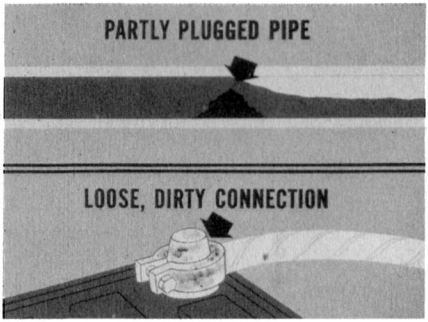
In an automotive electrical system, the battery and generator team up to supply electrical pressure. We call this pressure "voltage". The wires, which correspond to water pipes, carry the flow of current which we call "amperage". If you ever find that there is a lack of pressure (voltage), you'd normally suspect a low battery.

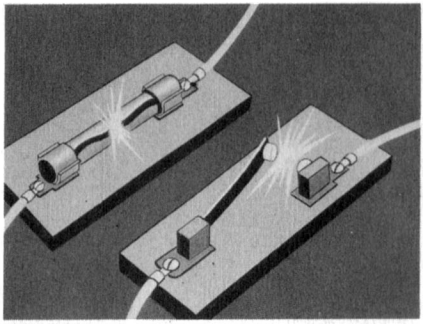


A plugged pipe would correspond to a broken or disconnected wire. Water, or current, wouldn't be able to get through.



You might also have a *partially* plugged pipe. You get the same effect in automotive electricity with a loose or dirty connection which reduces the flow of current. To correspond to a water leak, there's an electrical *short* . . . or an accidental *ground*. See the relationship?

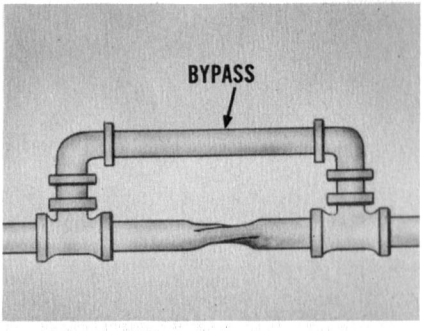




Now, *shorts* aren't too hard to locate. The wire heats up and insulation begins to burn on the shorted wire or unit. But before there's any serious damage, a fuse . . . or circuit breaker . . . disconnects the shorted-out section of the circuit from the source of supply to protect the entire system.

CHECKING ELECTRICAL CIRCUITS

For checking some ignition and generator conditions, test instruments are hard to beat. But for most of the garden variety of electrical jobs —such as finding an open or high-resistance circuit—a jumper wire will often tell you what you need to know.

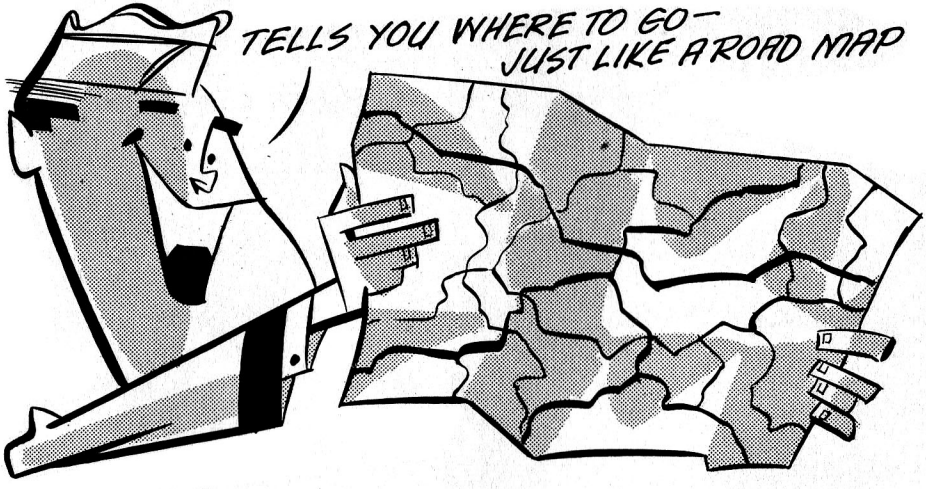


Just remember that you use a jumper to *bypass* parts of the circuit so you can close in on the section that may be at fault. It's a lot like using a pipe bypass in a water system.

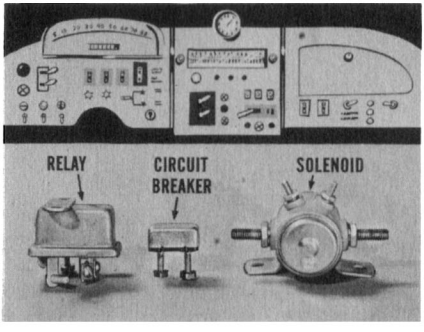
NOTE: Be sure to use a good set of jumpers with insulated clips so there won't be any accidental shorts. After all, the 12-volt system packs a lot more poke than the 6-volt system.

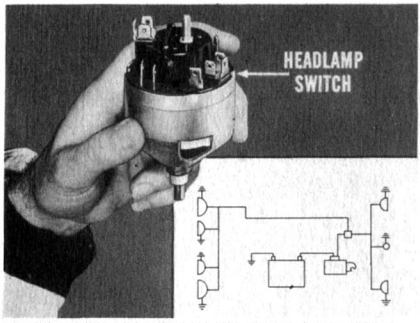
CAUTION: Never use a screwdriver. You'll not only ruin a useful tool, but you can damage the entire system as well!

Another tip . . . learn to use wiring diagrams. They tell you what units are in the circuits, and how they're hooked up. In order to check a circuit successfully, you should know exactly what each unit does, and how it does it. For example, suppose we talk about control units.

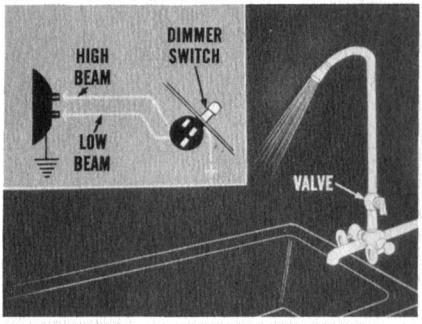


A manually operated switch is the simplest way to control electrical flow. It's like using a valve to stop and start the flow of water. But you know you can't use manually operated switches all over the car. There'd be too many levers to flip. You'd have to know which ones to push, and when. Instead, relays, circuit breakers, and solenoids are used. In other words, relays, circuit breakers, and solenoids work a lot like switches. They perform the same basic function. And while each one operates differently, starting and stopping the flow of electricity is their basic job.



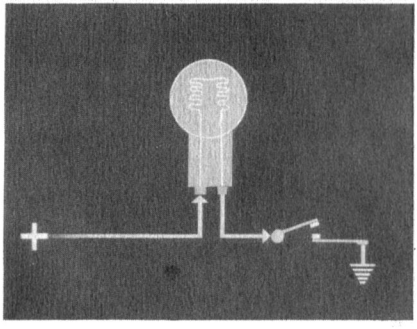


Headlamp Switch. The headlamp switch, for instance, is a good example of a manually operated switch. On a wiring diagram, you'll notice that there are ground symbols at the headlamps and at other external lamps. When the headlamp is grounded, a simple switch in the hot wire leading to the lamp turns it on or off.



Foot Dimmer Switch. Another example. The foot-operated dimmer switch channels current to either the high beam, or low beam filament. It works more like a valve that sends water to the shower-head instead of down to the faucet into the bathtub.

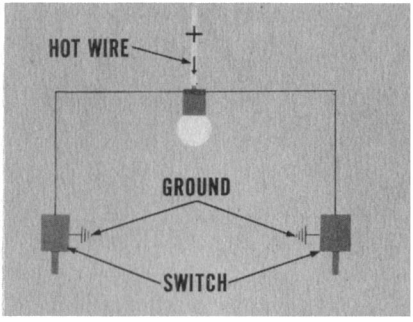
Dome Light, Map Light, Indicator Lights. The dome light, map light, and hand brake indicator lights are not *permanently* grounded.



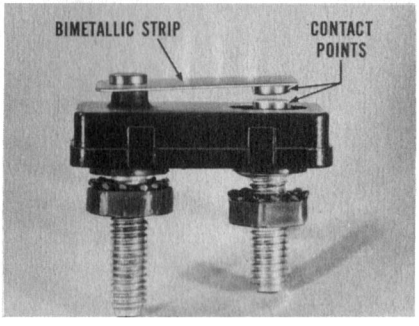
They use a simple switch connected into the ground side of the circuit. When this switch closes, it completes the circuit to ground. This type of circuit is used so the dome light, for instance, will light automatically when one of the car doors is opened. It's a lot like the light in your home

refrigerator. This type of circuit is often used when you want to control a unit from more than one location.

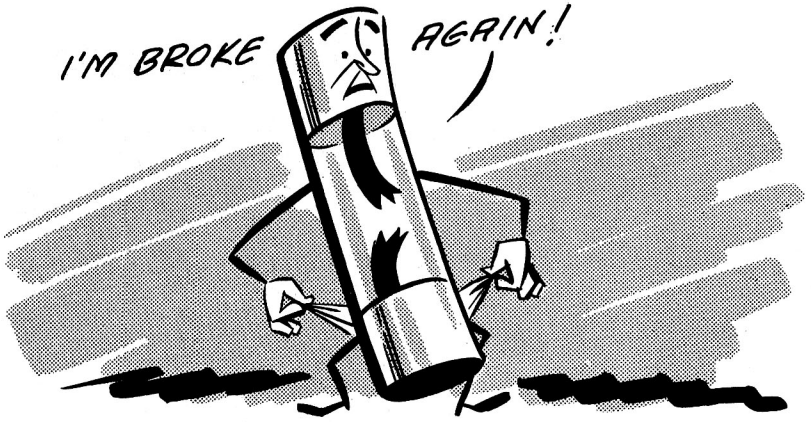
One big advantage gained is that instead of grounding the light and running a hot wire to each controlling switch, *one* hot wire runs to the dome light. A ground wire at each controlling switch grounds the circuit to the body whenever a door opens.



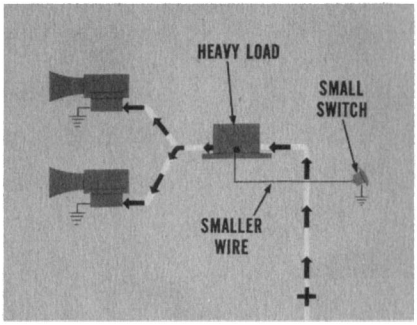
Circuit Breaker. The circuit breaker, an *automatic overload* switch, opens the circuit whenever current flow becomes too great. This protects the system from damage. One of the contact points in a circuit breaker is on a bimetallic strip. Whenever current exceeds the breaker's rated capacity, the strip heats up and bends. This opens the contact points, which opens the circuit. Later, when the bimetallic strip cools off, it straightens out. That closes the points and completes the circuit.

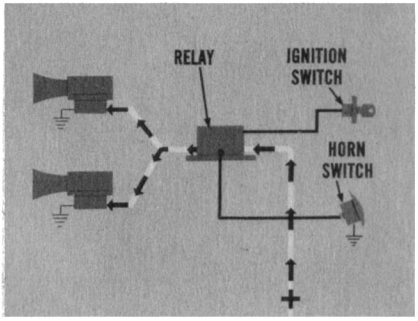


Fuse. Like a circuit breaker, a fuse also is designed to protect the system from damage. A fuse is simply a conductor with a low melting point. It will melt and open the circuit when current becomes excessive. This keeps the circuit open until the short is located and fixed. The radio circuit is a good example of where a fuse provides this protection.



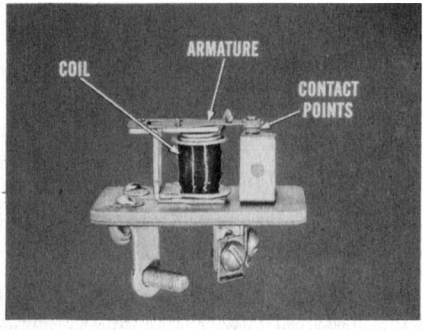
Relay. Most of you have probably noticed a relay used in the horn circuit on some models. In this application, the relay helps reduce the load on the controlling switch and circuit because the relay points carry the heavy load required by the horn. When a relay carries the heavy load, a small switch can be used in the control circuit without any danger of burning the switch points. Also, smaller wire can be used in the horn control circuit.



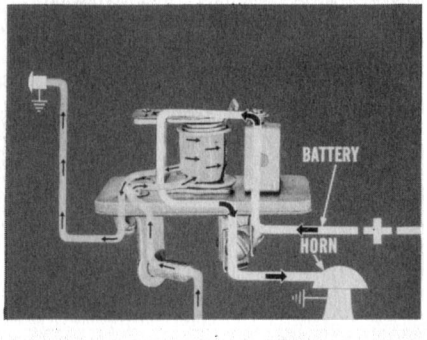


Using a horn relay permits connecting the control circuit through the ignition switch. As a result, the horn won't blow when the ignition is turned off.

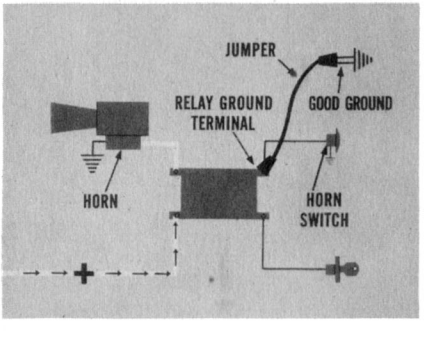
Relay construction is simple. It has a coil, an armature, and a set of contact points. One point is on the armature. The other is on a stationary bridge. Current from the ignition switch goes to the coil. The other end of the coil connects to the horn switch, which acts as a ground switch.



Pushing the horn ring completes the circuit through the coil. The coil, in turn, produces a strong magnetic field which pulls the armature down, closing the contact points. That completes the circuit from the battery to the horn.

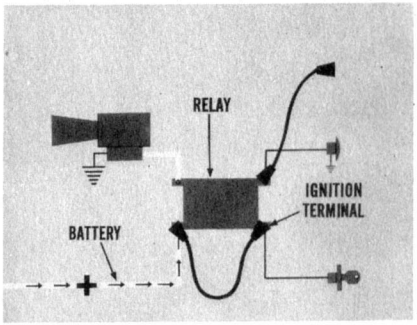


Checking the Horn Circuit. Now, if the horn won't blow, and there is a relay in the circuit, use a jumper to check whether trouble is in the control switch, relay, or the horn. The wiring diagram for the model you're working on will tell you which wires are hot. If a ground, like the horn switch, controls the relay, connect the jumper from the relay ground terminal to a good ground.

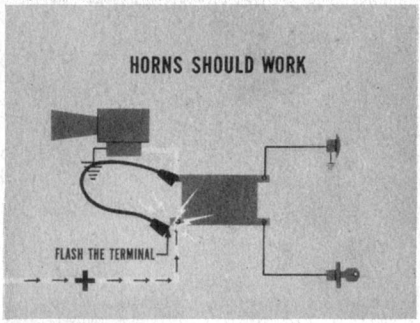


If the horn *blows,* the relay is all right. Trouble is either in the horn switch itself, or in the wires leading to it.

But, if the horn *doesn't* work, the trouble might be in the hot circuit *to* the relay coil. So leave the ground jumper connected, and connect a second jumper from the ignition terminal of the relay to the battery. If the horn *works,* the trouble is in the hot wire circuit to the relay. But if the horn *still won't work,* either the horn or the relay is to blame.

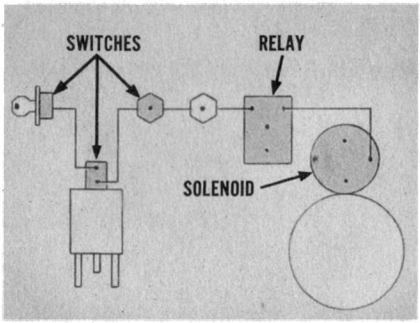


In a case of this kind, remove both jumpers. Then, connect one jumper lead to the horn terminal. Flash the other lead against the relay battery terminal. If the relay is at fault, the horns should work because you've bypassed the relay and completed the horn circuit directly. There's still a chance, of course, that the horn ground might be at fault. So be sure to check the ground if everything else has proved to be all right.

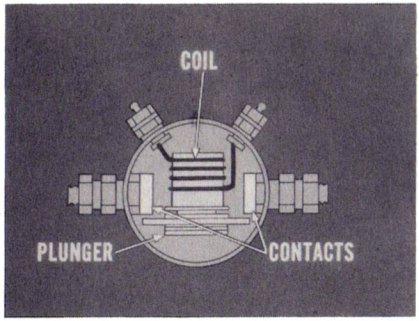


SOLENOIDS AND STARTING CIRCUITS

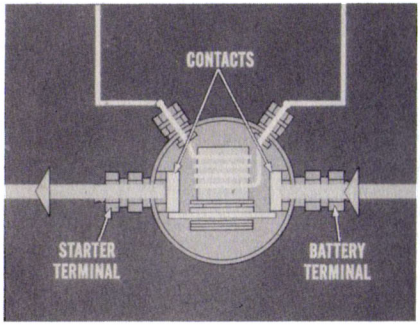
On some models, the simplest starting circuit uses only two control units—a starter switch and a starter solenoid. The most elaborate circuit uses three control switches, one relay, and one solenoid.



On Plymouth, Dodge, and De Soto Firesweep models, the starter solenoid acts like a heavy-duty relay. It is a magnetically operated switch. But because the starter sometimes draws more than 100

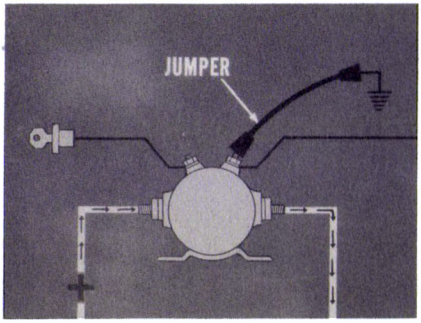


amperes, solenoid construction differs from that of a relay. The solenoid has a coil, a plunger, and a set of heavy duty contacts. Turning the ignition switch to Start completes the solenoid coil circuit and the coil becomes a powerful electro-magnet.

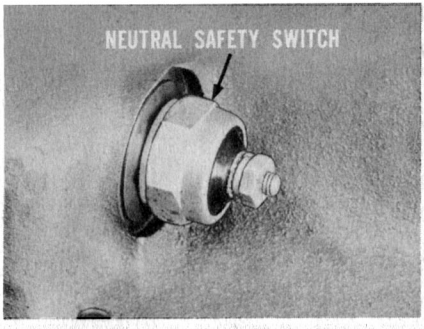


Right away, the plunger is pulled toward the center of the magnetic field set up by the coil. A contact plate on the end of the plunger bridges the contacts. This completes the circuit from the battery terminal to the starter terminal of the solenoid.

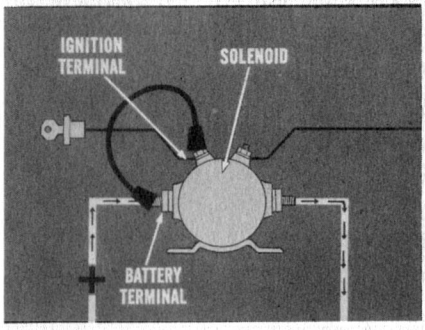
How to Test the Solenoid. If you ever have to test the solenoid, remember that all models except Dodge, Chrysler, and Imperial with TorqueFlite, use ignition-key starting. On key-starting circuits, therefore, be sure the transmission is in Neutral. Then, connect a jumper from the ground terminal of the solenoid to a good ground, and turn the key to start the engine.



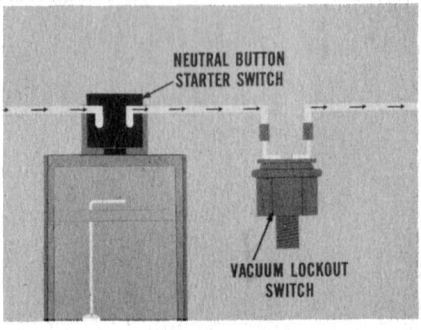
If the starter works, the trouble is in the ground circuit. On cars with PowerFlite or TorqueFlite, the trouble may be at the neutral safety switch on the transmission.



Now, if the engine doesn't start . . . remove the jumper. Connect it to the ignition terminal of the solenoid. Touch the other end to the positive battery terminal. If the engine now starts, the trouble is in the starter switch circuit. If it *doesn't* start, the solenoid is at fault. If you should narrow the trouble down to the starter switch, just check the switch and the wires to and from it.



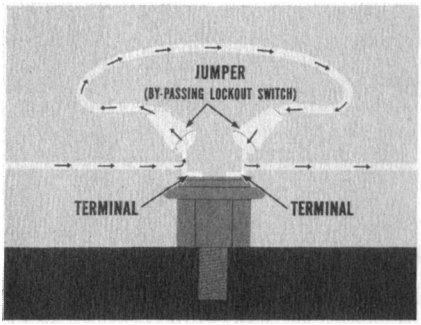
Neutral Push-button Starting. Dodge, Chrysler, and Imperial TorqueFlite cars, as you know, use Neutral push-button starting. This adds two more units to the starting circuit: the Neutral button starter switch and the vacuum lockout switch. The Neutral button starter switch is simple. Overtravel of the Neutral push button flips it mechanically.



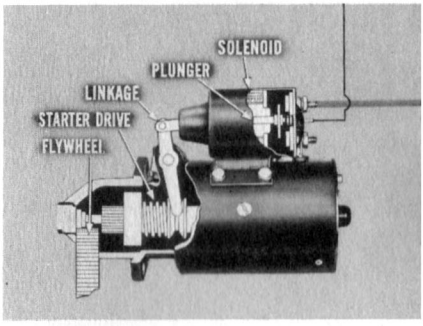
The vacuum lockout switch is mounted in the intake manifold and connected directly with the starter switch. Contacts in the lockout switch are held closed until the engine starts, and then they are opened by engine vacuum.

The vacuum lockout switch was added to prevent the starter from engaging the flywheel when the engine is already running.

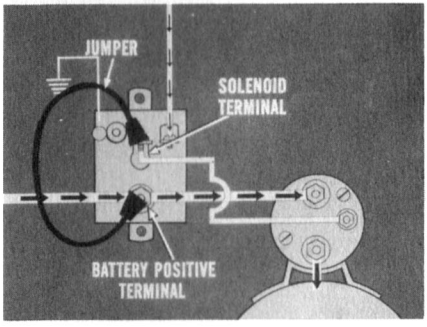
If you suspect the lockout switch, connect a jumper across its terminals to take it out of the circuit by bypassing it. Then, if the starter operates when the Neutral button is pushed, the trouble is in the lockout switch. But, if the starter is still dead, and the starter solenoid and starter relay are okay, the trouble is in the Neutral push-button starter switch.



Starter Solenoid (Chrysler, Imperial, De Soto). Chrysler, Imperial, and all De Soto models except the Firesweep, use a starter solenoid mounted on the starter motor. This solenoid does two jobs: first, when the solenoid coil is energized, the plunger pulls on a linkage that shifts the starter drive into engagement with the flywheel: second, the final bit of plunger travel completes a contact between the two main terminal studs. This closes the circuit to the starter motor, and the motor then cranks the engine.

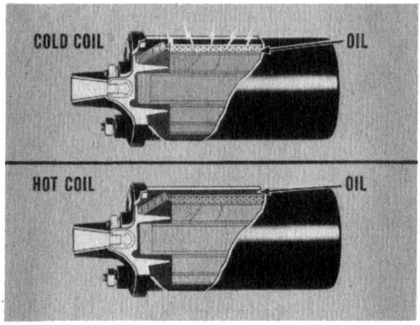


On these models, too, a relay is used in the circuit leading to the solenoid. To learn whether trouble is in the solenoid, or in the relay, connect a jumper between the solenoid terminal of the starter relay and the battery positive terminal. This bypasses the relay. Now, if the solenoid operates, the relay was faulty. But if the solenoid doesn't work, then the solenoid is at fault.



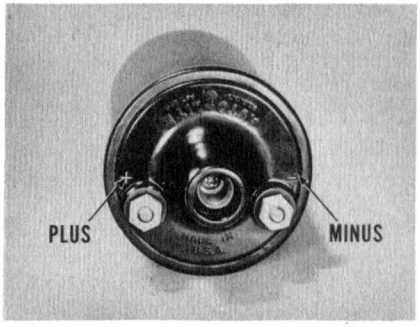
THE IGNITION COIL

Oil-Insulated Coils. Our cars are now equipped with oil-insulated coils. If some of the insulating oil leaks out, high-tension voltage can jump to the coil case and cause ignition difficulty. Once in a while, this condition isn't easy to spot. For instance, if only a little oil is lost,



the engine might not start when cold. But with the ignition "on" and the distributor points closed, the oil can heat up and expand. That can fill up the air space, correct the internal short, and the engine will then start.

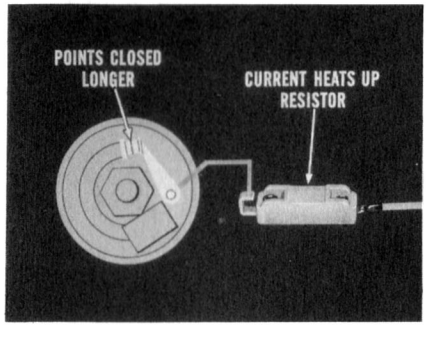
If you ever get a case where intermittent cold starting is reported, check for oil leakage at the tower terminal. If you find oil at that point, replace the coil.



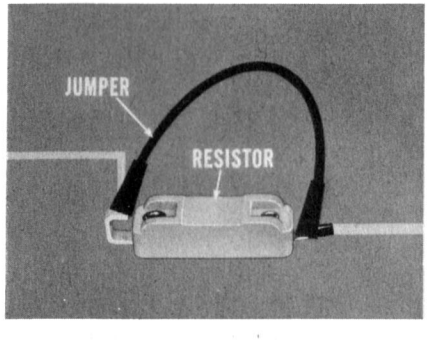
Coil Polarity Is Important! In case you've ever wondered, reversing the coil primary leads *does* affect the strength of the spark at the plugs. So, always connect the coil primary wires according to the plus and minus marks on the coil. Reversing the wires may cause ignition trouble.

THE BALLAST RESISTOR

Most of you know that high primary current isn't needed while the engine is idling. But when the engine runs at high speeds, it requires all the primary current it can get. Without a ballast resistor in the circuit, there would be excessive burning of the distributor points during slow driving. The resistor guards against that in this way. At low engine speeds, the distributor points are closed for longer intervals. Current flows through the ballast resistor long enough to heat it up. This heat, in turn, increases the resistance of the resistor. That reduces current to the points and the points don't burn. At higher engine speeds, the points are closed for shorter intervals. Current doesn't have time to heat up the resistor. It stays cooler, its resistance is reduced, and high primary current is maintained for high-speed operation.

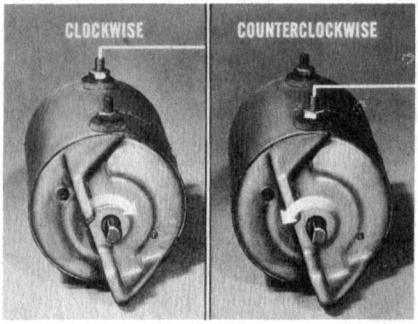


Now, if the ballast resistor ever fails, it will break the primary circuit to the coil. You can check for this failure possibility by connecting a jumper across the two resistor terminals to bypass the resistor. If the engine starts, then you'll know the resistor should be replaced.

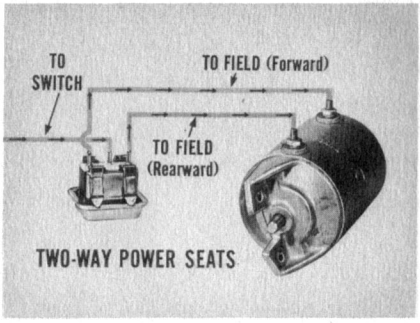


Bypassing the resistor won't damage the ignition system during this short test. There'll be more arcing at the points, but nothing serious unless you try to run the engine a long time without the resistor.

REVERSIBLE ELECTRIC MOTORS

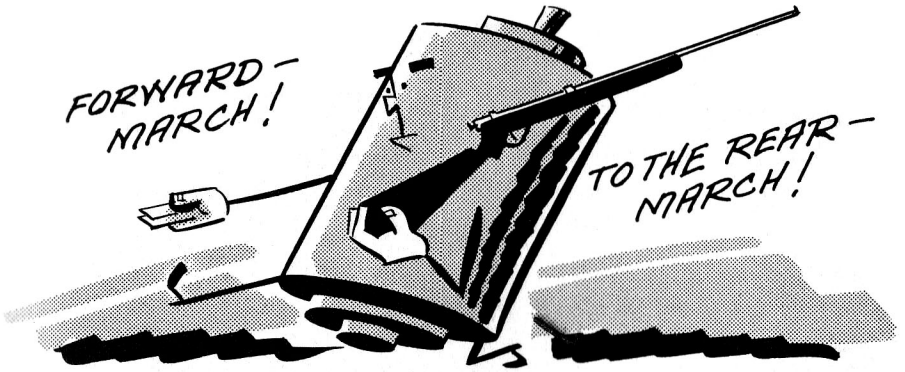


Power seats, power windows and convertible tops are operated by reversible electric motors which have two sets of field windings. When one field is energized, the motor runs clockwise. When the other field is energized, the motor runs counterclockwise. A two-way switch controls the direction of rotation.

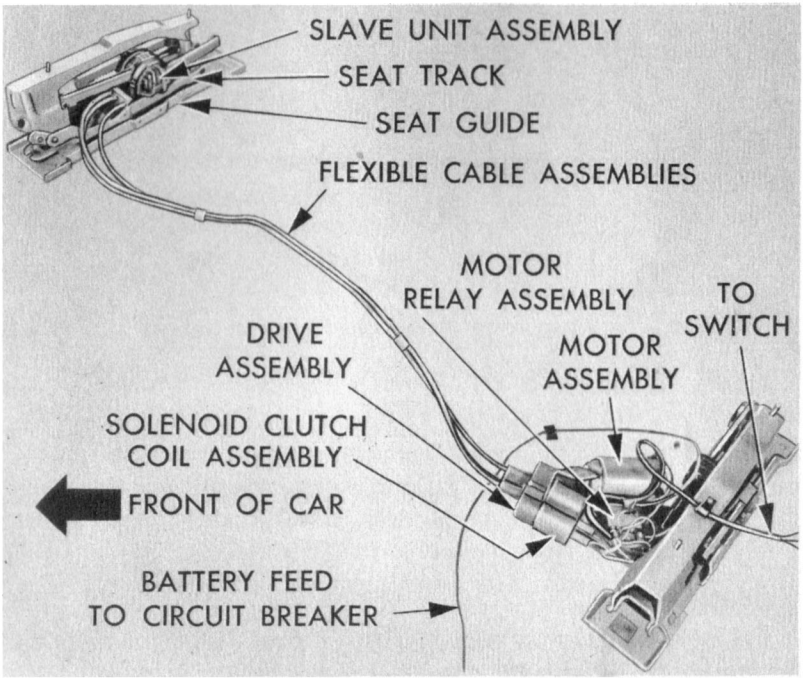


Two-Way Power Seat Circuit. On two-way power seats, the switch and circuit use three wires. One wire supplies current to the switch. One sends current to field windings which move the seat forward on its inclined track. One wire goes to the other field windings which move the seat rearward.

Six-Way Power Seat Circuit. With this power equipment, the driver's seat can be moved forward, rearward, up, down, and tilted through an angle of 18°. The seat will move in the direction that the bar control is moved. For example, move the bar forward, and the seat moves forward. If just the front of the bar is lifted, the front of the seat will tilt up while the rear remains stationary. If the rear edge of the bar is lifted, the rear of the seat will tilt up while the front part remains as a stationary pivot. One reversible motor under the front seat provides the power required.

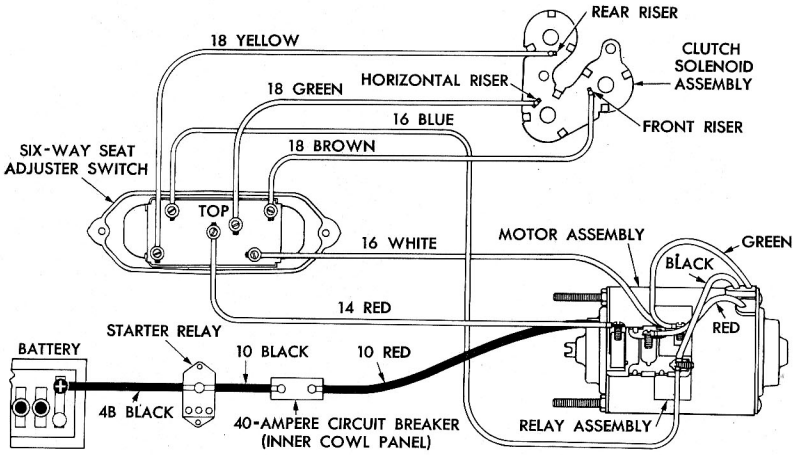


This motor operates a gear drive train which supplies power through flexible drive cables to a slave unit in the seat track. The control switch assembly (on the left side of the seat) is wired through a relay to a 40-ampere circuit breaker. The circuit breaker is located next to window lift circuit breakers behind the left front kick pad.



A wire from the starter relay supplies current to the circuit breaker. If the car is also equipped with electric window lifts, current comes from a brass jumper connected in parallel with the window lift circuit breakers.

Current to the relay flows from the circuit breaker. Six wires go to the switch. One supplies current to the switch; two supply current to the motor fields. They also actuate the relay for the motor armature current. Three wires connect to solenoids which control movement of the front and rear risers, and horizontal positioning. The wiring harness to the motor is looped to permit up-down movement.



Thermal Cut-Out. On window lift motors, additional circuit protection is provided by an internal thermal cut-out. It works like a circuit breaker except that its points are opened by *excessive motor temperature* instead of excessive current flow. If an owner holds the control switch closed after the glass reaches the limit of its travel, the thermal switch cuts out to protect the motor from overheating damage.

The power window circuit is designed so an owner can operate all windows from his driving position and passengers can operate their

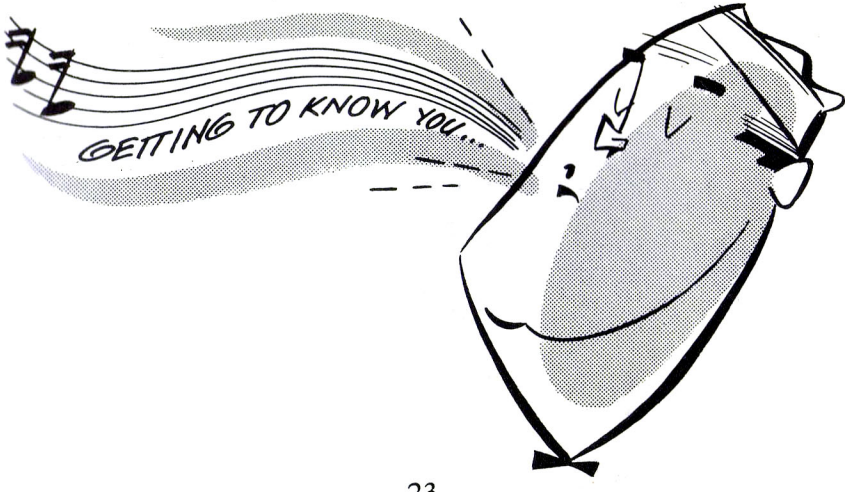
own windows independently. Each switch has a hot input lead which supplies current to the switch. Each switch also has two wires leading to the motor it controls. One wire energizes the field that rotates the armature for raising the window. The other wire energizes the field that provides lowering movement.

Suburban Tailgate. Some suburban models have an instrument panel switch so the driver can operate the tailgate glass. A tailgate switch at the Spectator Seat can also be operated by third seat passengers. In addition, a key-operated tailgate switch permits raising or lowering the glass from outside the car.

ELECTRICAL KNOWLEDGE PAYS OFF!

As you can see, many electrical control units show up in engine, transmission, body work—and, well, almost everywhere you look.

With this growing increase in automotive electricity, there's a growing need for us to be up on electrical maintenance. Knowing your way around each new circuit, then, is your best bet to stay high in our service customers' favor.



RECORD YOUR ANSWERS TO THESE QUESTIONS ON QUESTIONNAIRE NO. 118

When using a jumper, you bypass parts of the circuit so you can narrow down the section that may be at fault. RIGHT 1 WRONG

Always use a good set of jumpers with insulated clips to avoid accidental grounding. RIGHT 2 WRONG

Wiring diagrams are useful in that they tell what units are in the circuit, how they are hooked up and where the circuit may be bypassed when checking for possible trouble. RIGHT 3 WRONG

Some lights, such as the dome light, are not permanently grounded, so they can be controlled from more than one location. RIGHT 4 WRONG

A circuit breaker is an automatic overload switch that opens the circuit whenever current flow becomes too great. RIGHT 5 WRONG

A relay, like the one used in horn circuits, helps reduce load on the controlling switch and circuit because the relay points carry the heavy load. RIGHT 6 WRONG

The vacuum lockout switch, mounted in the intake manifold, is used to keep the starter from engagement with the flywheel when the engine is already running. RIGHT 7 WRONG

Without the ballast resistor in the ignition circuit there might be excessive burning of the distributor points during slow driving. RIGHT 8 WRONG

You can bypass the ballast resistor permanently without any damage to the ignition system. RIGHT 9 WRONG

Reversing the coil primary leads has no effect on the strength of the spark at the plugs. RIGHT 10 WRONG

Litho in U.S.A.