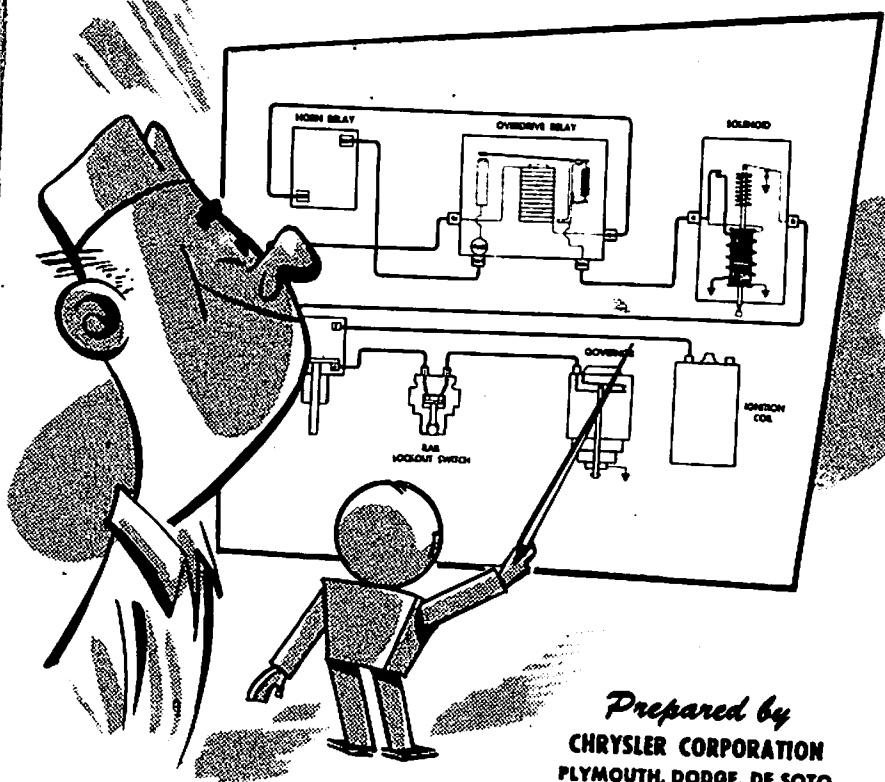


SERVICE REFERENCE BOOK

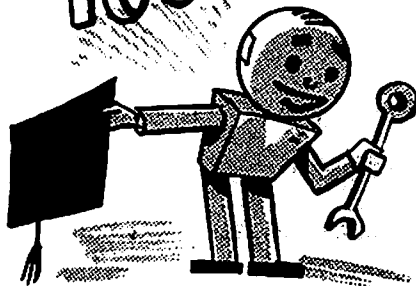
AUTOMATIC OVERDRIVE CONTROLS



Prepared by
CHRYSLER CORPORATION
PLYMOUTH, DODGE, DE SOTO
AND CHRYSLER DIVISIONS
Vol. 5 No. 6

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Tech Sez:



**KNOWLEDGE
IS THE BASIS
OF SKILL!**

Did you ever stop to think about why a lot of older mechanics always seem to be able to come up with the right answers? It's because most of them have a solid foundation of automotive know-how. They can reach back into their experience for the answers.

A lot of automobiles have passed through the service department since they became mechanics. The automobile has become a very complex machine since the first ones putt-putted out on to the road to scare the horses. That's why we all need plenty of know-how to trouble-shoot the modern car.

Although the Automatic Overdrive is a unit composed of gears that function mechanically, it is operated entirely by an externally located electrical system.

In this reference book you'll find a lot of that know-how about the Automatic Overdrive. With this knowledge you're adding to your skill which, after all, is a mechanic's bread-and-butter. Briefly, here's what this book is about:

THE OVERDRIVE ELECTRICAL SYSTEM

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HOW THE ELECTRICAL UNITS OPERATE

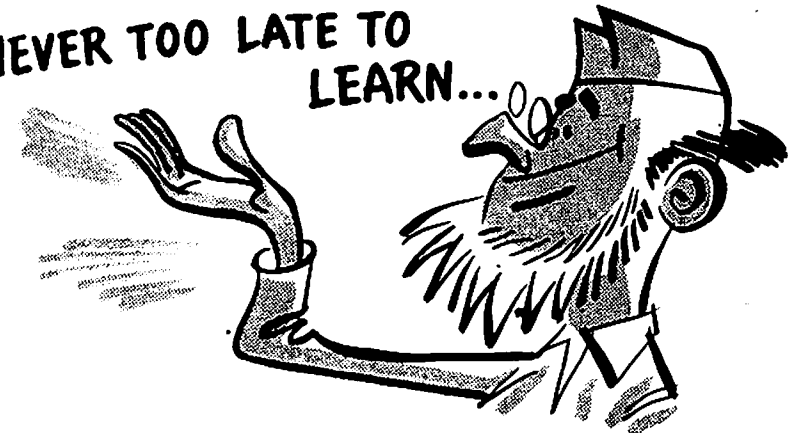
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**NEVER TOO LATE TO
LEARN...**

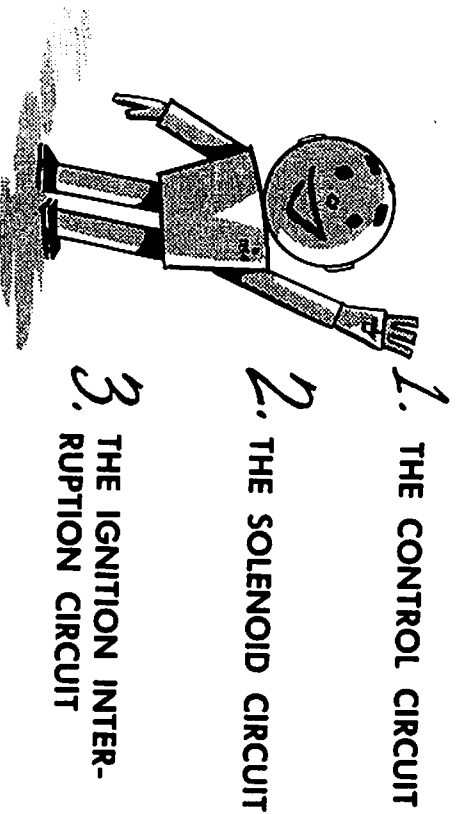


THE OVERDRIVE ELECTRICAL SYSTEM

In order to understand how to trouble-shoot the overdrive unit, we should understand just how the electrical system operates the unit.

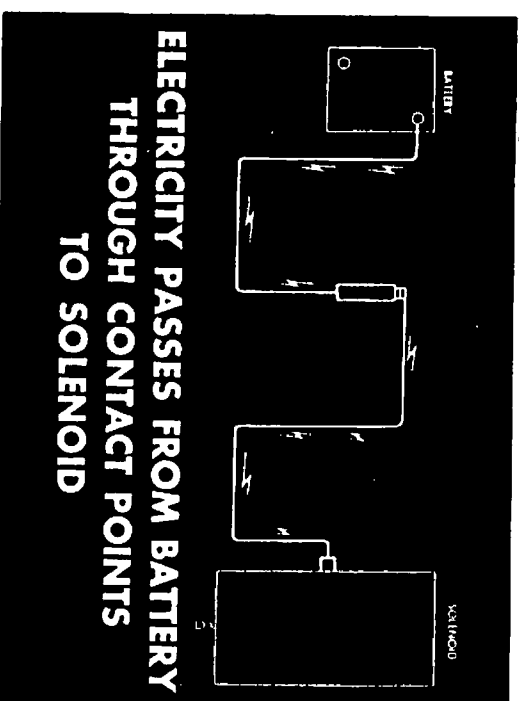
Basically, there are *three* circuits in the overdrive electrical system which affect the operation of the solenoid, which is actually the connecting link between the electrical system and the mechanical parts. So, if we understand what makes this solenoid operate, or fail to operate, we will have gone a long way toward understanding the overdrive electrical system trouble-shooting.

The three circuits affecting the operation of the solenoid are:



SOLENOID CIRCUIT

In order for the solenoid to operate, we need a source of electricity. This source is the battery. You can easily see that, if we had only the battery and the solenoid in the overdrive electrical system, the unit would remain in overdrive. So, we have to have a method of controlling this flow of current from the battery to the solenoid so we can turn it on and off.



We control this flow of current by installing a switch in the circuit. This switch, which is actually a set of contact points, allows us to complete or break the circuit.

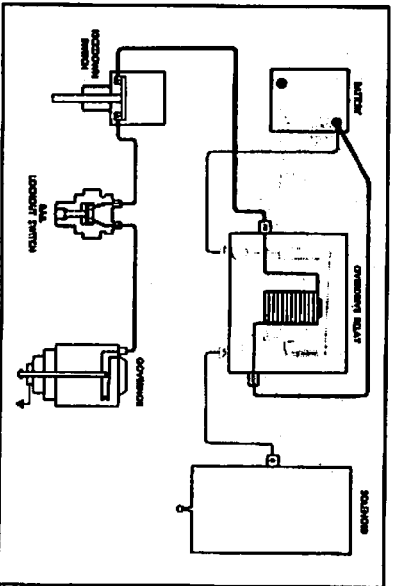
Basically, the solenoid circuit is that simple. A source of current, a control switch, and the solenoid.

CONTROL CIRCUIT

To control the opening and closing of the contacts which we have placed in the solenoid circuit, we have another circuit. This circuit we call the Control Circuit. As its name implies, it *controls* the solenoid circuit.

In this control circuit we place an electromagnet, which also receives its current from the battery. This electromagnet, with the contact points already mentioned, is contained in a unit which we call the overdrive relay. When current passes through the electromagnet, it becomes energized, attracting the contact points and closing them.

In order to complete the circuit through the electromagnet so the solenoid will operate at the right time, we have a governor. This governor is mounted in the overdrive housing and is regulated by car speed. When the car reaches a certain speed, the governor points close, allowing electricity to flow through them to ground. This completes the circuit and energizes the electromagnet—which is in the control circuit—causing it to close the contact points and energize the solenoid.



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In the control circuit are two other units—the kickdown switch and the rail lockout switch. The kickdown switch acts as a connection, through its "A" terminals, during normal driving. This switch has another function in the ignition interruption circuit, and will be discussed under that heading. The rail lockout switch is a manually operated switch for making and breaking the control circuit. With the control handle IN, the contacts in the switch are bridged and current passes through the switch. However, when the control handle is pulled OUT, the switch contacts are opened and current cannot pass through the control circuit. When this happens, the overdrive unit is cut out.

LIKE PLUGGIN' IN A LAMP!



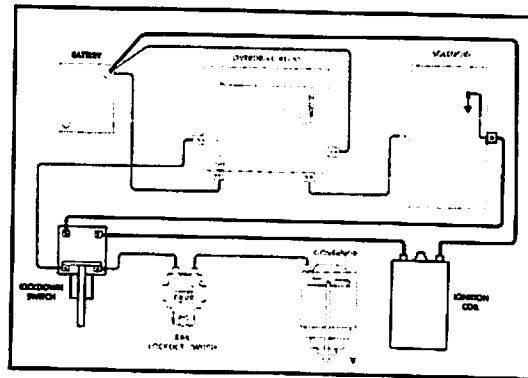
To summarize—the control circuit is from the battery, through the electromagnet in the overdrive relay, the kickdown switch "A" terminals, the rail lockout switch, and through the governor points to ground.

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IGNITION INTERRUPTION CIRCUIT

This circuit is used to enable the driver to get out of overdrive and into direct drive in a hurry. When the driver presses the accelerator pedal past the wide-open throttle position, a switch plunger (operated by the throttle linkage) breaks the control circuit at the "A" terminals in the kickdown switch.

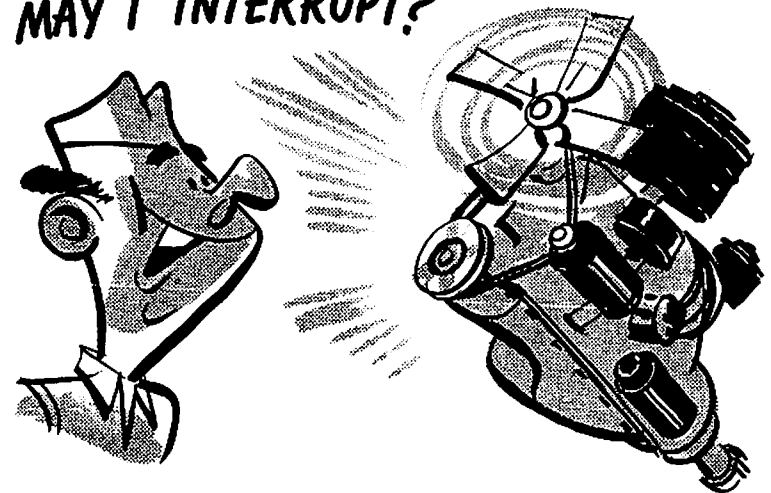
When the "A" contacts in the kickdown switch are opened, the electromagnet in the overdrive relay is de-energized, breaking the control circuit. With the electromagnet de-energized, the contact points in the relay open, which de-energizes the solenoid.



However, another action must take place before the shift from overdrive to direct drive is completed. Engine torque must be relieved so the pawl can be pulled out of the sun gear control plate. With the solenoid de-energized, the only thing that holds the pawl in the control plate is the friction between the plate and the pawl, caused by engine torque. Therefore, engine torque must be relieved. This is done by momentarily interrupting engine ignition.

As the kickdown switch plunger moves away from the "A" contacts, it continues until it closes the "B" contacts. What we are doing when we open the "A" contacts and close the "B" contacts in the kickdown switch is actually taking the kickdown switch out of the control circuit and putting it in the ignition interruption circuit.

MAY I INTERRUPT?



With the "B" contacts closed, engine ignition current flows from the distributor stud of the ignition coil through the "B" terminals of the kickdown switch, to the number six terminal of the solenoid. From there it goes through the ignition ground points in the solenoid, and to ground. This interrupts the engine ignition just long enough to relieve torque so the pawl can be pulled out of the control plate.

To summarize—the three separate circuits in the overdrive electrical system, and their functions, are as follows:

1... THE SOLENOID CIRCUIT

This circuit controls the flow of current to the solenoid. The circuit starts at the battery terminal of the horn relay, goes through the points in the overdrive relay and to the number four terminal of the solenoid, and then to ground in the solenoid.

2... THE CONTROL CIRCUIT

This circuit controls the operation of the solenoid circuit so the solenoid becomes energized at the right time to make the shift from direct drive to overdrive. The circuit starts at the ignition terminal of the horn relay, flows through the electromagnet in the overdrive relay, through the kickdown switch and the rail lockout switch, through the points in the governor, and to ground.

3... THE IGNITION INTERRUPTION CIRCUIT

This circuit provides a means of getting out of overdrive and into direct drive in a hurry. The flow of current is from the distributor terminal of the ignition coil, through the "B" terminals of the kickdown switch to the number six terminal of the solenoid. From there it flows through the ignition ground points in the solenoid, and to ground.

Now that we know each circuit, let's see how the various units in the circuits operate to do the job for which they are intended.

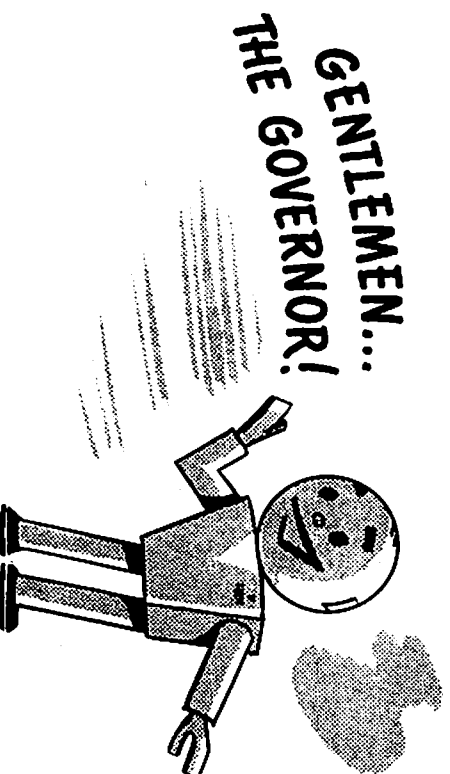
HOW THE ELECTRICAL UNITS OPERATE

THE CONTROL CIRCUIT

Suppose we start out with the control circuit and see just what each individual unit does. Remember, we said that we got our current for this circuit from the ignition terminal of the horn relay. We take the current from this terminal so that current is in the control circuit only when the ignition key is turned on. We do this to eliminate the chance of current leakage due to a short in the circuit.

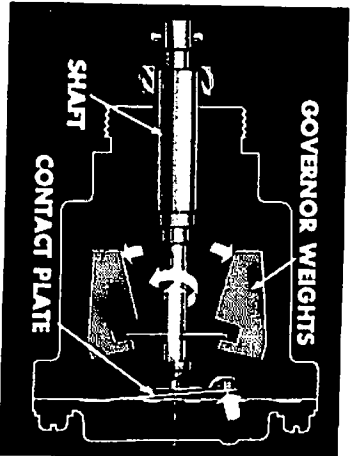
From the horn relay, current flows to the electromagnet in the overdrive relay and from there, through the kickdown switch and the rail lockout switch, to the governor.

So, let's take a look at the governor and see just what its function is in the control circuit.

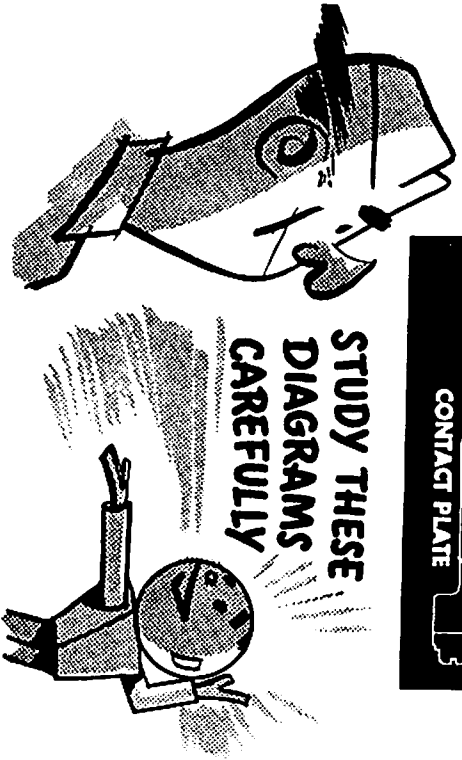


THE GOVERNOR

The governor is actually an automatic switch, used to make and break the control circuit, according to car speed. When the car speed is somewhere between twenty-four and twenty-seven miles per hour, the centrifugal force of the governor weights cause the tip of the governor shaft to move away from the contact plate. This action allows the governor points to close, completing the control circuit through these points to ground. When these points are closed, the electromagnet in the relay is energized, closing the contact points and completing the *solenoid* circuit.



**STUDY THESE
DIAGRAMS
CAREFULLY**



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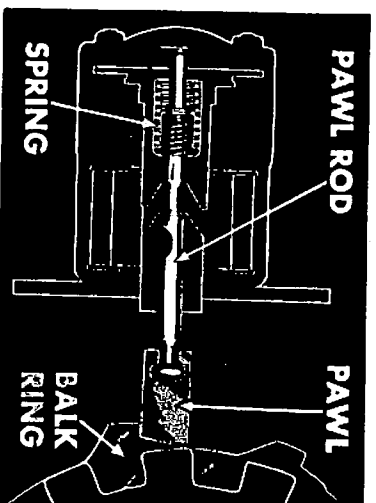
THE SOLENOID CIRCUIT

Remember, we said that current for the solenoid circuit also comes from the horn relay. However, we take this current from the *battery* terminal of the horn relay. From the horn relay, current passes through a twenty-amp fuse in the side of the overdrive relay and across the closed contact points.

From these contact points, current flows to the number four terminal of the solenoid, and from there to ground inside the solenoid.

The Solenoid—Now, let's take a look inside the solenoid and see just how it operates. Inside the solenoid, there are two coils—a closing coil and a holding coil. The closing coil is located outside of the holding coil, and is made up of a few turns of heavy wire. This coil draws a large amount of current for the few seconds that it is energized.

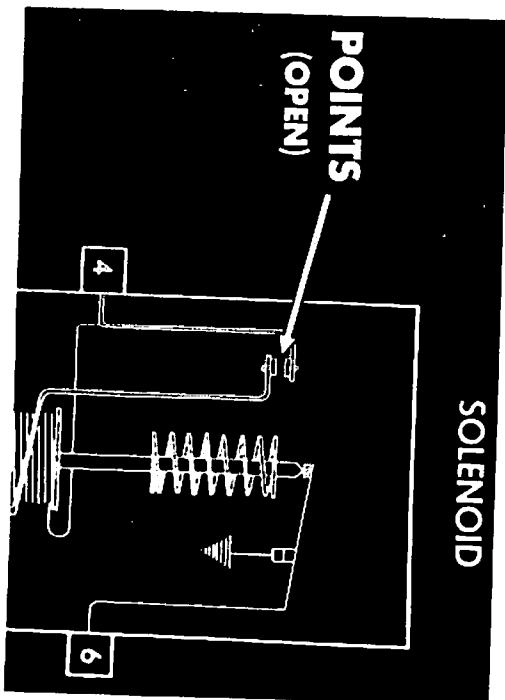
The holding coil, directly surrounding the upper part of the pole piece and the lower end of the plunger, is made up of many turns of fine wire. This holding coil draws a comparatively small amount of current.



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Located at the upper end of the pawl rod are two springs. The smaller diameter spring is known as the rod spring and exerts a pressure on the pawl rod when the solenoid is first energized. The larger diameter, heavier gauge spring, is the return spring. This spring disengages the pawl from the sun gear control plate when the solenoid is de-energized and torque from the engine is relieved.

Within the solenoid are two separate sets of contact points. One of these sets of points—connected to the *number four* terminal—is called the closing coil contacts, and is closed when the solenoid is not energized. These closing coil contact points are secured to the plate which covers the coil. They allow current to go through the closing coil to ground when the solenoid is first energized. As soon as the solenoid is energized and the pawl rod and spring are loaded, these points open. The holding coil then takes over, holding the pawl rod against the pressure of the return spring.



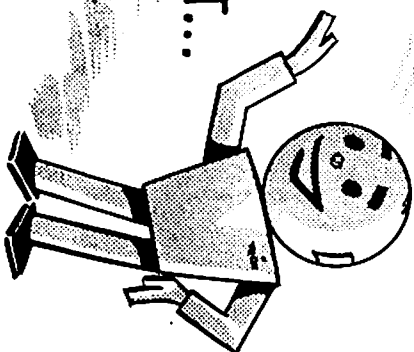
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The second set of contact points—called the ignition ground points—is located on a plate mounted on the cover studs. These contact points are connected to the *number six* terminal, and are open when the solenoid is not energized; closed when the solenoid is energized. One point is located on the cover and the second is mounted on a contact spring riveted to the plate. Their purpose is to ground the ignition system momentarily to allow the pawl to be withdrawn from the sun gear control plate when the kickdown switch is operated by the driver.

When the governor and relay contacts close, completing the circuit through the solenoid number four terminal to ground, the solenoid engages the pawl in the sun gear control plate to lock up the unit for overdrive operation.

**THAT'S ALL ON THE
SOLENOID...**

**BE SURE YOU'VE
GOT IT STRAIGHT...**

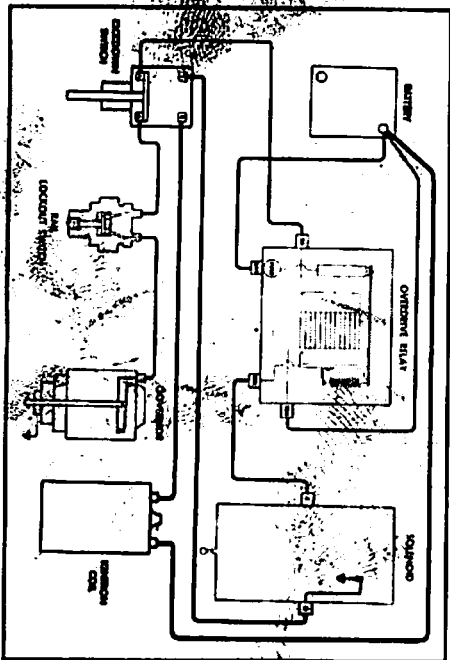


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THE IGNITION INTERRUPTION CIRCUIT

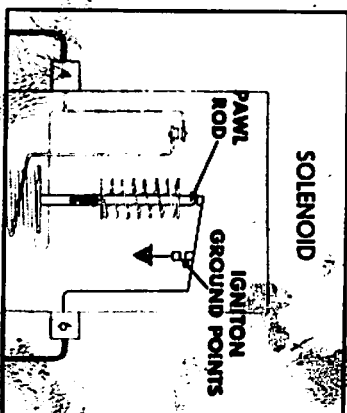
Let's review what takes place in order for the ignition interruption circuit to be put in operation. When the driver presses the accelerator past the wide-open throttle position, the switch plunger, operated by the throttle linkage, breaks the control circuit at the "A" contacts in the kickdown switch. As these contacts are opened, the switch plunger moves a bridge from the "A" contacts to the "B" contacts in the kickdown switch. This, as we have said earlier, de-energizes the solenoid. We also said that, before the pawl can be withdrawn from the sun gear control plate, the ignition must be interrupted.

As soon as the engine ignition current is grounded through the points in the solenoid, the engine skips a beat or two. This relieves the torque of the control plate against the pawl. The pawl rod return spring immediately pulls the pawl out of the plate. As soon as this takes place, the unit is out of overdrive and into direct drive.



When the solenoid circuit is broken, you have cut out the holding coil which, up to this point, has been holding the pawl in place on the sun gear control plate. When you do this, there is only the friction between the control plate and the pawl, caused by engine torque, holding the pawl in place. So, by relieving torque, we allow the pawl to be pulled out of the sun gear plate, so the shift can be completed.

We do this by interrupting engine ignition for an instant. When the "B" contacts in the kickdown switch are bridged, current flows from the ignition coil, across these "B" contacts in the kickdown switch, to the number six terminal of the solenoid. From there, the current flows through the ignition ground points to ground in the solenoid.



Of course, engine ignition must be restored immediately. Here's how that is done. As the pawl rod is moved outward by the return spring, the end of the rod pushes against a contact spring on which one of the ignition ground points is mounted. This action opens the ignition ground points, destroying the ignition-to-ground circuit. Therefore, the ignition current is restored to the engine.

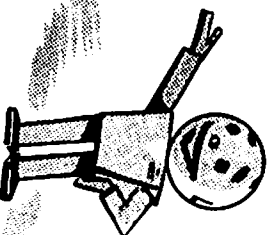
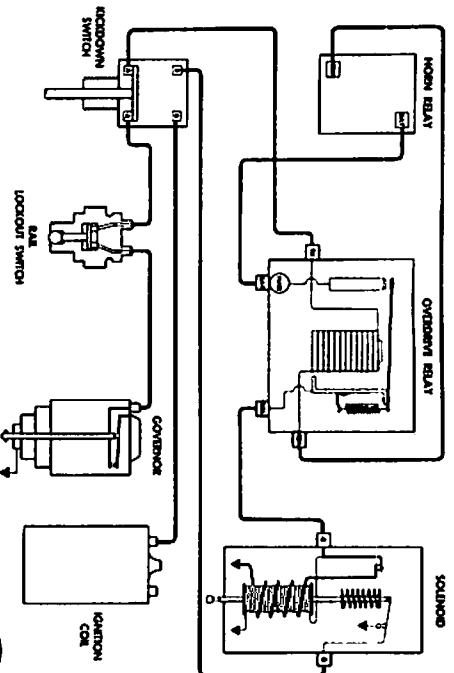
In order to get back into overdrive from direct drive, the driver momentarily lifts his foot from the accelerator pedal (assuming that the car is travelling above the overdrive cut-in speed) and the unit shifts to overdrive.

TROUBLE-SHOOTING THE OVERDRIVE ELECTRICAL SYSTEM

There are *four* basic types of difficulty you may have to contend with when you consider trouble-shooting.

1. UNIT WON'T SHIFT INTO OVERDRIVE
2. UNIT WON'T SHIFT OUT OF OVERDRIVE
3. UNIT WILL NOT KICKDOWN AT SPEEDS ABOVE THE OVERDRIVE CUT-IN SPEED
4. ENGINE STALLS DURING KICKDOWN

NOTE: Before making any extensive electrical checks of the overdrive electrical system, check all connections for looseness and corrosion. A large number of electrical failures are due to these two simple conditions—loose or corroded connections.



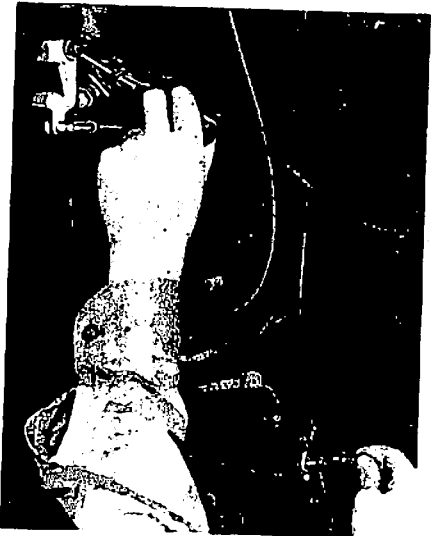
UNIT WON'T SHIFT INTO OVERDRIVE—

This is an indication that the solenoid isn't being energized so it can push the pawl into the sun gear control plate. Therefore, either the control circuit isn't being completed to close the points in the relay, or the solenoid circuit is not complete.

To check out the control circuit and the solenoid circuit, the ignition key must be "ON" and the overdrive control handle must be pushed in.

1. Ground one of the "A" terminals of the kickdown switch. This should cause a click in the overdrive relay, indicating that the points have closed. Also, you should hear a second click indicating that the solenoid is being energized.

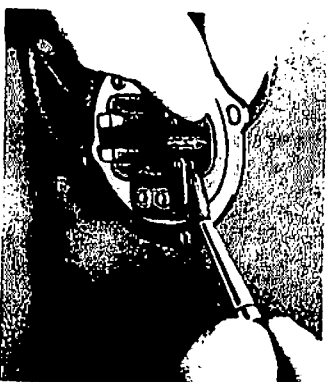
2. If you hear a click in the relay, but no click in the solenoid, hold the ground at the "A" terminal of the kickdown switch and remove the fuse from the relay. You should hear a click in the solenoid as the fuse is removed, and another as the fuse is replaced. If you do not, check the fuse to be sure it isn't burned out. If it is good, check to see that it is making a good contact in the fuse holder.



3. If both the relay and the solenoid click when making the tests given above, you'll have to continue checking the control circuit to find out why the circuit isn't being completed. Connect a jumper wire between the wire terminal on top of the governor, and ground. If the relay clicks, it proves the control circuit is good all the way from the horn relay to the governor.

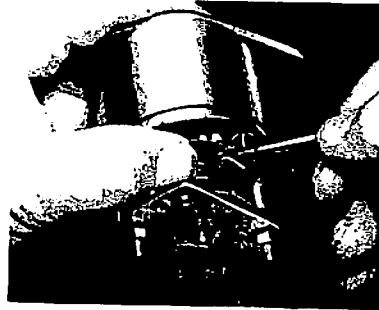
Therefore, you would suspect that the governor points were not closing, or that they were not making a good contact when they closed. The only way you can test the action of the governor is by a road test.

Leave the jumper wire connected to the terminal on top of the governor. Run the other end of the wire into the car where you can hold it as you drive. Take the car out on the road, drive it up through the overdrive cut-in speed and try to make the shift. If it won't shift, ground the end of the jumper wire. If it shifts with the jumper wire grounded, you have proved that the governor is not operating to complete the circuit. Remove the governor cover and clean the points. If this does not correct the condition, replace the governor cover and contact point assembly.



4. Assuming that the control circuit is operating properly to complete the circuit through the relay, but the solenoid doesn't click, check out the solenoid circuit from the "BAT" terminal of the horn relay right on to the solenoid. You can do this with a test light. With the ignition key "ON" and one of the "A" terminals of the kickdown switch grounded, you should get a light at each of the connection points. If you don't, look for a broken wire or a loose connection.

5. If the solenoid circuit checks out right up to the *number four* terminal of the solenoid, remove the solenoid cover and clean and inspect the closing coil points. If the points are making good contact, but still the solenoid doesn't operate, you'll have to replace the solenoid.



UNIT WON'T SHIFT OUT OF OVERDRIVE—

This condition is produced by causes just the reverse of those which prevent the unit from shifting into overdrive. In other words, instead of the control or solenoid circuits not being completed, they are not being broken when they should. Therefore, the solenoid remains energized and holds the pawl in the control plate.

1. A simple test to determine whether this is caused by an electrical or a mechanical condition is to push the control handle "IN" and turn the ignition key "ON." If a click is heard, you know the control circuit is grounded.
2. Pull the control handle out and turn the key "ON" again. If you still hear the click in the relay, you know the ground is between the horn relay and the rail lockout switch. If you do not hear a click in the relay with the control handle out, but *do* hear it with the control handle in, you know the ground is between the rail lockout switch and the governor, or in either of those two units.

3. If you hear no click in the overdrive relay with the control handle in and the ignition key turned "ON," you know the electrical circuit is probably all right, and that there is some mechanical difficulty preventing the pawl from being pulled out of the control plate. This could be a broken return spring in the solenoid, or the solenoid pawl rod may not be connected to the pawl.
4. With the ignition key "OFF," connect a test light between the solenoid terminal ("SOL") of the overdrive relay, and ground. If you get a light, it indicates that the relay points are stuck closed and you'll have to replace the relay.
5. With the ignition key "ON," check out the control circuit to find the ground by starting at the rail lockout switch. Disconnect the wire between the lockout switch and the governor. If you hear the relay click, you know the ground is either in the governor itself or in the wire just disconnected.
6. If no click is heard when the wire is disconnected, disconnect the wire at the lockout switch, which leads to the kickdown switch. If you hear the click then, you know the ground is in the lockout switch. Disconnect both wires from the lockout switch and touch them together. If the relay doesn't click, you know the ground is in the lockout switch, so you'll have to replace it.
7. Continue the same tests at the kickdown switch if you have not located the ground up to this point. When you disconnect a wire and hear the click of the relay, you know the ground is between that point and the last point checked.

UNIT WON'T KICK DOWN—

This indicates an open circuit in the ignition interruption circuit, and could be caused by lack of contact at the "B" terminals of the kickdown switch. If this switch is slightly out of position, the plunger will not be moved into the switch far enough to bridge the "B" contacts. The position of the kickdown switch may be checked with the aid of a test light.

1. Connect the test light between one of the "B" terminals of the kickdown switch and the battery. Ground the other "B" terminal.



2. Depress the accelerator pedal past the wide-open throttle position. The test light should light.

NOTE: The test light may come on before the accelerator pedal is depressed (if the distributor points are closed), depending upon which "B" terminal is connected to the battery. If the light does come on as soon as connected, move the connection to the other "B" terminal.

3. If the light does not come on when the pedal is depressed, adjust the lock nuts on the switch to position the switch correctly. Further adjustment may be made by loosening

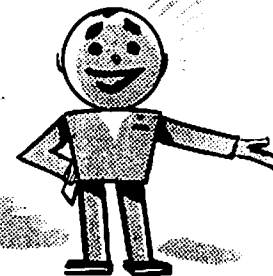
the mounting bracket nut and rotating the bracket until it is flat against the cylinder head. Then make a final adjustment of the locking nuts.

ENGINE STALLS DURING KICKDOWN—

If the engine stalls during the kickdown operation, it means that the ignition current is not being restored to the engine following ignition interruption. This could be due to the ignition ground points sticking so they did not open when the solenoid was de-energized. Another possibility, although remote, is that the fiber block on the underside of the contact point spring is missing so the ignition circuit remains grounded even though the ground points are open.

Another condition which would prevent re-establishing the ignition circuit, would be a ground at the "B" terminal of the kickdown switch that leads to the solenoid. If this terminal was grounded, the ignition circuit would be grounded as long as the "B" contacts were bridged, but would be restored as soon as the kickdown switch plunger moved away from the "B" contacts. If the ignition ground points are sticking, and cleaning them does not correct the condition, you'll have to replace the solenoid. If the fiber block on the underside of the contact point spring is missing, you'll have to replace the solenoid. If there is a ground at one of the "B" terminals of the kickdown switch, the switch will have to be replaced.

NOW, LET'S SUM
IT ALL UP...

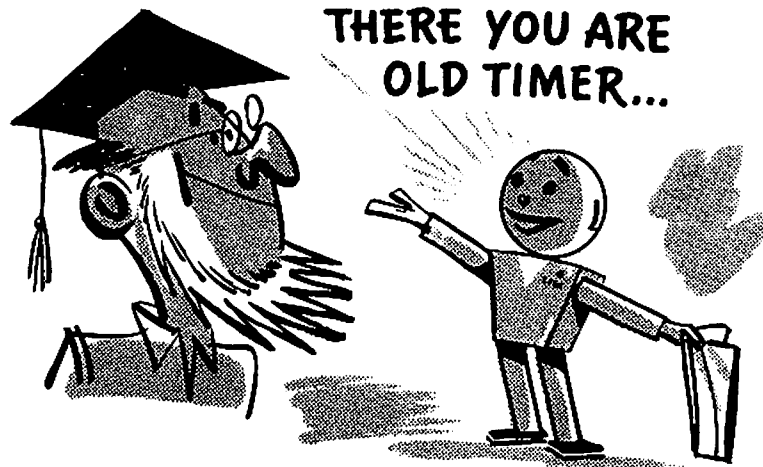


SUMMARY

There is nothing difficult about the overdrive electrical system. Just remember that in order for the overdrive unit to operate, the solenoid must be energized at the right time. That means the governor has to complete the control circuit, and the points in the relay have to close to complete the solenoid circuit. Anything which will prevent either of these circuits from being completed, will prevent the overdrive unit from operating.

Then, for the unit to shift out of overdrive and back into direct drive, both of the circuits have to be opened. A short in either circuit which grounds the circuit and prevents the solenoid from being de-energized, will keep the unit in the overdrive position.

Trouble-shooting for either of these conditions is simply a matter of testing the various circuits to locate the short or open circuit.



QUESTIONNAIRE

TEST YOURSELF
WITH THESE QUESTIONS!

1. The control circuit gets its name because it *controls* the solenoid circuit. RIGHT ☐
WRONG ☐
2. The electromagnet in the overdrive relay is controlled by the governor. RIGHT ☐
WRONG ☐
3. The "A" terminals of the kickdown switch are in the solenoid circuit. RIGHT ☐
WRONG ☐
4. When the governor points are closed, the control circuit is completed through them to ground. RIGHT ☐
WRONG ☐
5. When the ignition ground points in the solenoid are opened, ignition is restored to the engine. RIGHT ☐
WRONG ☐
6. When the solenoid circuit is broken, the holding coil no longer functions. RIGHT ☐
WRONG ☐
7. The twenty-amp fuse protects the solenoid circuit. RIGHT ☐
WRONG ☐
8. A ground in the control circuit will prevent the unit from shifting into overdrive. RIGHT ☐
WRONG ☐
9. The ignition interruption circuit is grounded in the governor. RIGHT ☐
WRONG ☐
10. There are two coils in the solenoid—the holding coil and the closing coil. RIGHT ☐
WRONG ☐