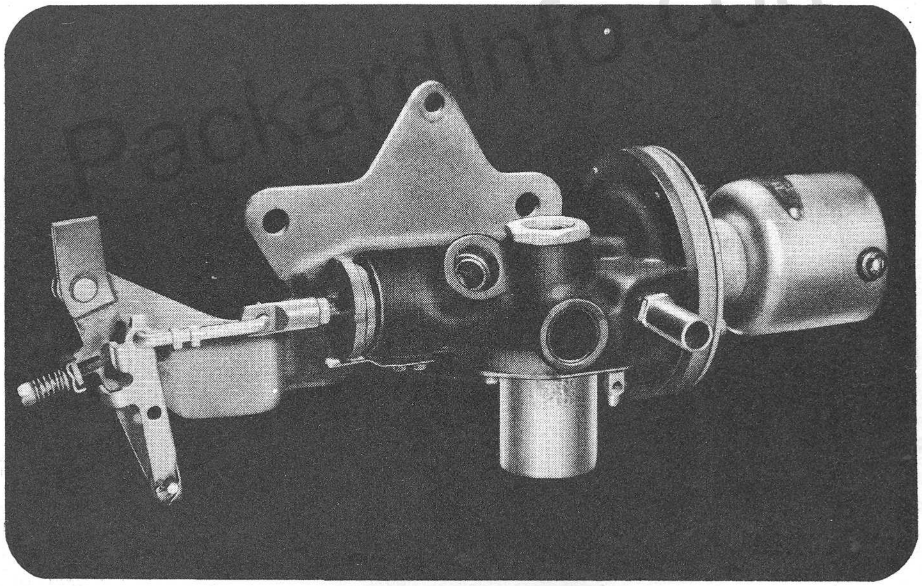
SERVICE TRAINING PROGRAM

Serviceman's Training Booklet

ELECTROMATIC CLUTCH

19th AND 20th SERIES



OCTOBER . . . 1946

PARTS AND SERVICE DEPARTMENT

PACKARD MOTOR CAR COMPANY

DETROIT · 32 · MICHIGAN

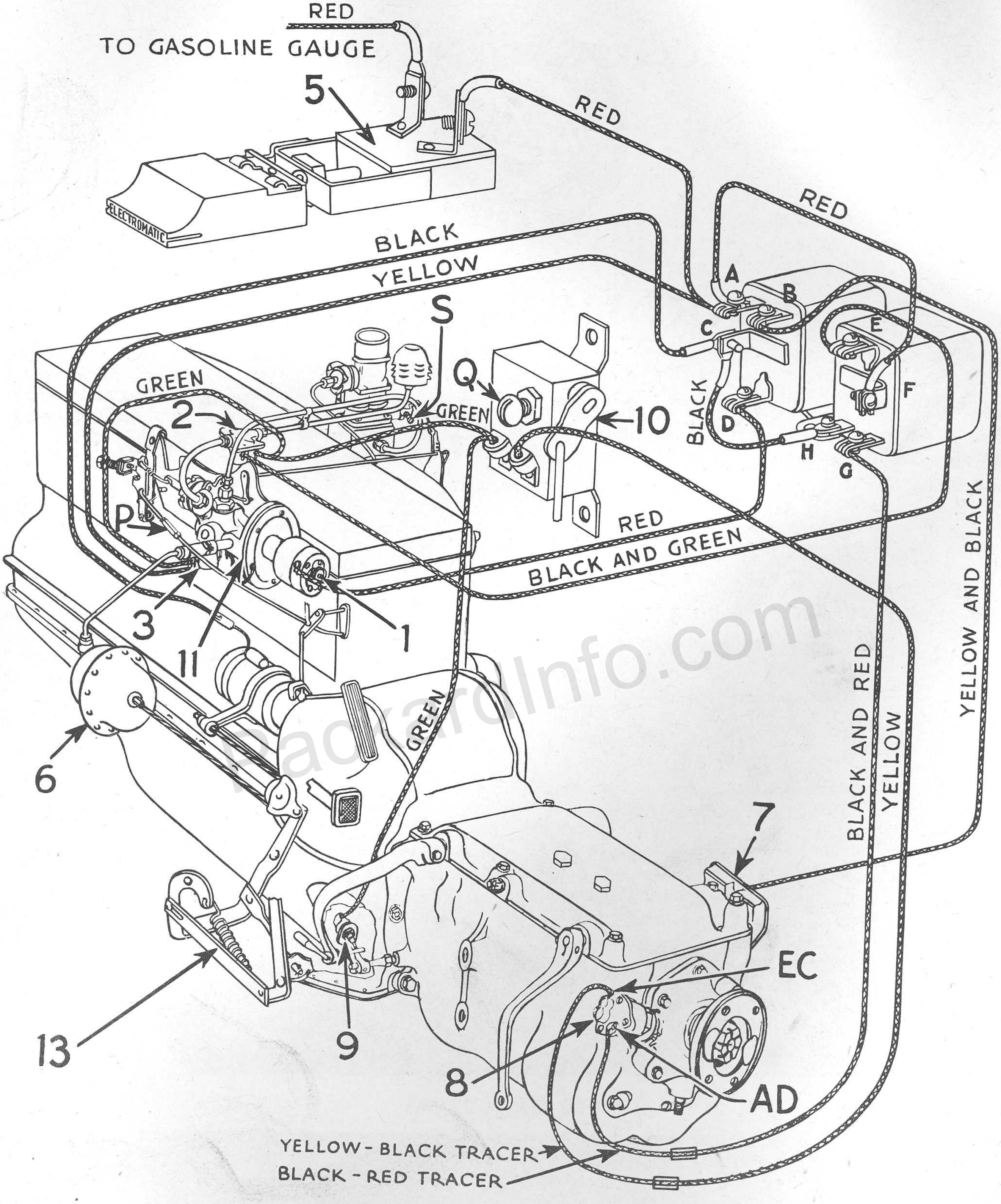


Figure 1—Schematic Diagram of 20th Series Electromatic Clutch

THE PACKARD ELECTROMATIC CLUTCH

INTRODUCTION

The Electromatic clutch is a vacuum-electric device that operates the clutch automatically. The driver uses the accelerator and shifts gears in the normal manner, but without the use of the clutch pedal.

The Electromatic clutch may be made operative or inoperative at the will of the driver by means of a lockout switch on the instrument board.

The two basic units of the Electromatic clutch are:

a. The power cylinder (6, Fig. 1).
b. The clutch control valve (11, Fig. 1).

There are additional electrical and mechanical controls to modify the operation of the clutch control valve to satisfy any specific operating condition.

DESCRIPTION

The construction and operation of the Electromatic clutch used on 19th and 20th Series cars is fundamentally the same. However, the power cylinder, clutch linkage and some of the electrical controls differ.

The description, operation, adjustment and electrical checks that follow apply to 20th Series cars. Where differences occur on the 19th Series cars, they are described and explained separately.

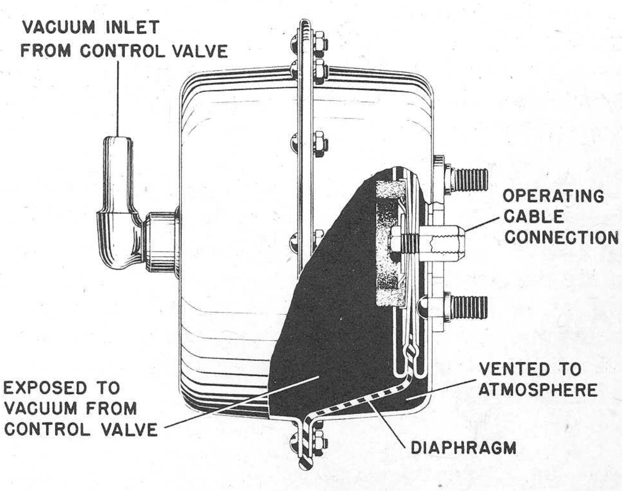


Figure 2—Cutaway of Clutch-Operating Power Cylinder Showing Details of Construction

POWER CYLINDER—20th SERIES

The power cylinder (6, Fig. 1) engages and disengages the clutch by means of a flexible steel cable, one end of which is attached to the cylinder diaphragm. See Fig. 2.

The opposite end of the cable passes over a pulley mounted on an extension of the relay lever and is anchored to a bracket on the starting motor.

The chamber forward of the diaphragm in the power cylinder is connected to the control valve by means of a tube, while the chamber to the rear is vented to atmosphere. When the valve connects the tube with manifold vacuum the diaphragm moves forward pulling the cable and disengaging the clutch.

When the vacuum connection is broken by the valve and air is bled into the cylinder, the diaphragm and cable move to the rear allowing the clutch to engage. The rate, or speed of engagement, is controlled by the rate of the air bleed into the power cylinder by the control valve.

The clutch pedal to relay lever link (13, Fig. 1) is slotted at its forward end to permit the power cylinder to move the relay lever without movement of the clutch pedal.

POWER CYLINDER—19th SERIES

The power cylinder used on the 19th Series cars is of the piston type utilizing a rod for operating the clutch relay lever instead of a cable.

The end of this operating rod is slotted to permit movement of the relay lever by the power cylinder without moving the clutch pedal.

CONTROL VALVE

The smooth engagement of the clutch in all gears and under all driving conditions is made possible by use of an Electromatic clutch valve (11, Fig. 1).

This control valve, located in the vacuum line between the inlet manifold and the power cylinder, controls the vacuum and meters the air bled into the power cylinder.

A hollow piston type valve (called the spool valve) operating in a diaphragm controlled sliding sleeve, connects either the vacuum or air bleed to the power cylinder. See Fig. 2. This spool valve is hollow and flanged at each end to form an annular passage to connect various ports in the control valve sleeve.

The spool valve is positioned in the sleeve by movement of the accelerator pedal, through linkage connecting the control valve to the carburetor control linkage.

Two sets of radially drilled holes, or ports, in the sleeve are so located that the rear set is always in register with the rearmost or power cylinder chamber in the body. The holes nearer the center of the sleeve always register with the center or engine vacuum chamber in the body. These chambers are so positioned and of such size that the ports in the sleeve register with their chambers regardless of the position of the sleeve.

Thus the movement of the spool valve in the sleeve may connect the engine vacuum and power cylinder ports, as shown in Fig. 4, or admit air to the power cylinder port via the hollow center of the spool and the front or air inlet chamber.

A small metering hole is located in an annular groove at the front or air inlet end of the sleeve. See Fig. 3.

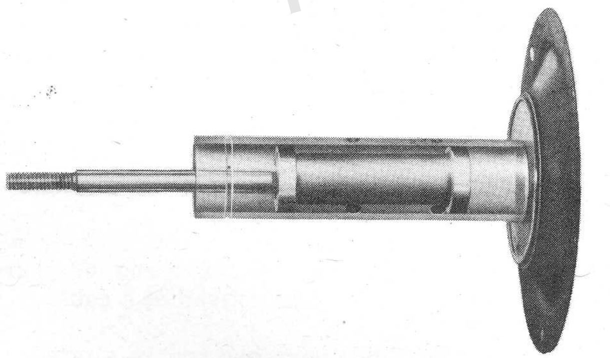


Figure 3— Phantom View of Electromatic Spool Valve and Sleeve Showing Ports and Metering Hole

The forward end of the sleeve bore in the body is closed by means of a threaded plug through which the spool valve operating rod extends.

The rear end of this bore in the body flares out to form a chamber into which the spring-loaded, sleeve positioning diaphragm is fitted. The forward, or sleeve side, of this diaphragm is vented to atmosphere.

The chamber on the rear or spring side of the diaphragm is connected to the power cylinder chamber in the valve body by a drilled passage. Thus this chamber is always exposed to the same pressure or vacuum as the power cylinder.

At the rear of the valve assembly a low and reverse solenoid is mounted. Its purpose is to increase the tension of the spring opposing the diaphragm when starting in either low or reverse gear.

An electrically controlled vacuum shut-off valve, called the direct speed solenoid valve (3, Fig. 1), is fitted to the control valve. Its function is to either shut off or admit vacuum to the control valve and power cylinder.

The entire valve assembly is mounted on a support bracket which carries the levers necessary for attachment to the carburetor control linkage.

OPERATION

CONTROL VALVE

With the Electromatic operating, the engine running, and the throttle in the closed position, the spool valve is all the way into the sleeve, as shown in Fig. 4. In this position the recess between the flanges of the spool connects the engine vacuum (midway) ports with the power cylinder (rear) ports. This admits vacuum to the power cylinder disengaging the clutch. Since the spring-loaded side of the control valve diaphragm is exposed to the same vacuum as the power cylinder, the vacuum acting on the diaphragm will move the diaphragm and sleeve to the extreme inner position.

When the accelerator pedal is depressed, the throttle linkage will move the spool valve forward. Just as the lost motion in the linkage is taken up and the throttle is about to open, the spool valve will have moved far enough forward so that the rear flange of the spool has cut off the engine vacuum from the power cylinder ports.

At this time the rear edge of the spool has started to uncover the power cylinder ports of the sleeve. Since the spool is hollow, it provides an air passage from the forward end of the control valve to the rear end of the spool, so that uncovering of the power cylinder ports will permit air to bleed into the power cylinder chamber and power cylinder.

As air is bled into the power cylinder, it will reduce the vacuum on the power cylinder diaphragm, reducing the pull on the operating cable, allowing the clutch to engage. But, just before the clutch starts to engage and the car

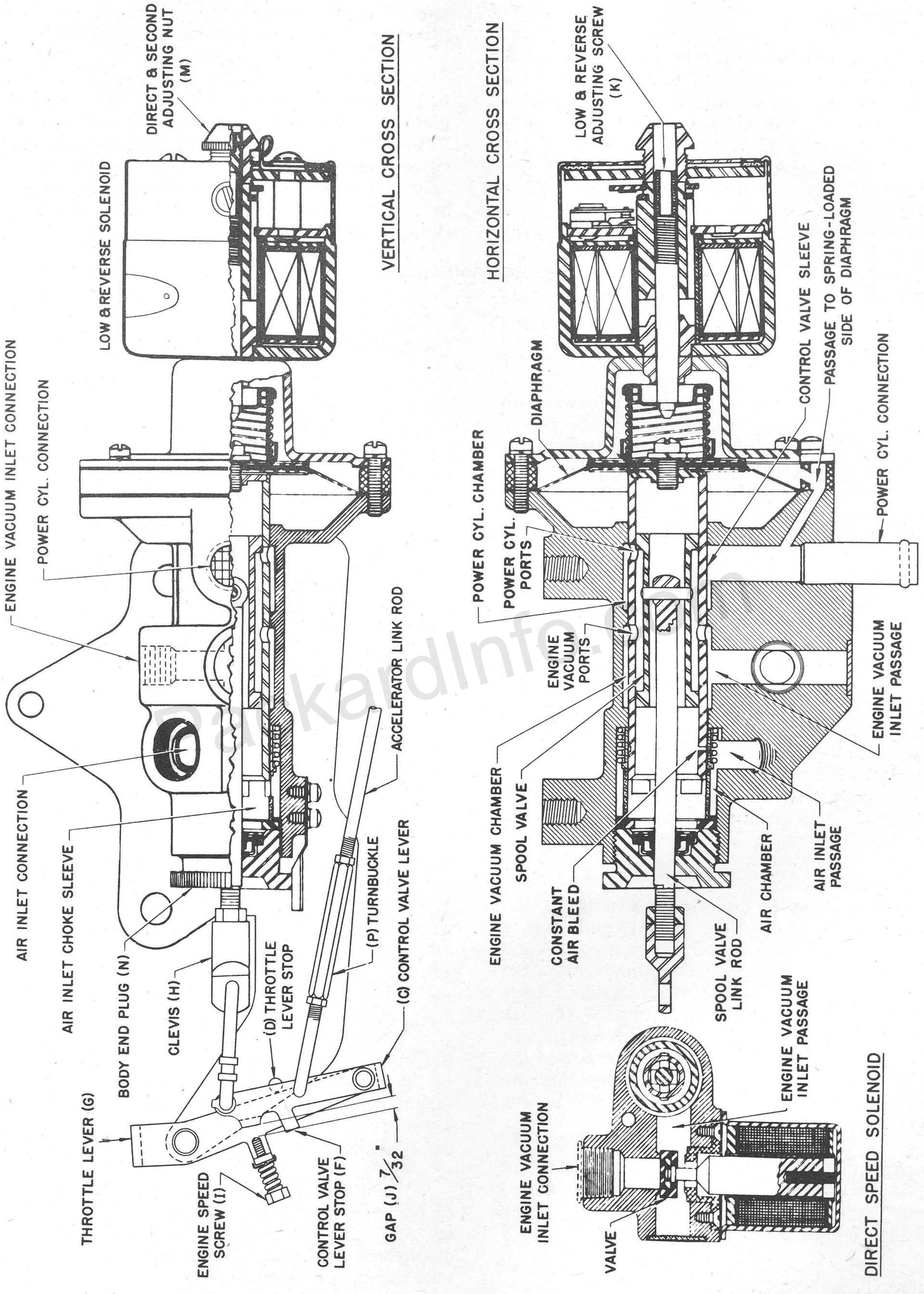


Figure 4—Vertical and Horizontal Cross Section of Electromatic Control Valve Showing Operative Parts in relation to the Various Chambers, Ports, and Passages

starts to move, another action takes place in the control valve.

As the vacuum in the power cylinder chamber is reduced by the air bleed, the vacuum on the spring-loaded side of the diaphragm will also be reduced, since the spring-loaded side of the diaphragm is exposed to the same vacuum as the power cylinder. The decrease in vacuum on the spring-loaded side of the diaphragm will allow the spring to move the diaphragm and sleeve forward in direct proportion to the power cylinder movement. The forward movement of the control valve diaphragm and sleeve tends to shut off the air bleed at the power cylinder ports. This action will retard or check the rate of clutch engagement.

So, as the spool valve is moved forward to increase the air bleed, by increasing the power cylinder port opening, its action is counteracted by the forward movement of the sleeve which tends to reduce the air bleed by reducing the power cylinder port opening. Thus when the accelerator pedal is depressed, the power cylinder diaphragm and cable, and the control valve diaphragm and sleeve move rapidly until they are checked or retarded by the sleeve overtaking the spool valve and reducing the rate of air bleed.

The point at which the power cylinder and control valve sleeve movement are retarded, after moving rapidly for a distance, will be known as the "Electromatic cushion point". The "Electromatic cushion point" simulates the driver's normal habit of unconsciously retarding the clutch pedal movement as he approaches the "clutch cushion point", the point where the car just starts to move.

To satisfy most normal driving conditions and best performance of the Electromatic clutch, it is best to have the "Electromatic cushion point" and the "clutch cushion point" occur almost simultaneously. However, to satisfy the individual personal preference and driving habits of the car owner, the spool valve link rod and clevis are threaded to provide an adjustment to regulate the "Electromatic cushion point", by changing the position of the spool valve in relation to the sleeve (Fig. 4).

Lengthening the link rod by screwing it out of the clevis, will advance the "Electromatic cushion point" or cause the movement of the power cylinder to be checked or retarded sooner.

Shortening the link rod, by screwing it into the clevis, will delay the "Electromatic cushion point" or permit the power cylinder diaphragm and cable to move further before it is checked or retarded.

The calibration of the control valve diaphragm spring controls the rate of clutch engagement *after* the "Electromatic cushion point".

With only the controls described so far, the Electromatic would disengage and engage the clutch at the same rate under all conditions. However, different rates of engagement are required under different driving conditions. The different rates of engagement are accomplished by the use of electrical and mechanical modifying controls.

MODIFYING CONTROLS

Electromatic Relay, 20th Series:

Two single unit relays (Fig. 1) located under the bonnet on the front side of the dash are provided to make contacts for the electrical modifying controls. In operation, closing a switch causes a small current to flow through the winding of the relay (Fig. 6). This current energizes the coil of the relay causing a set of contacts to close. These contacts are capable of carrying the high amperage necessary to operate the electrical modifying units.

Electromatic Relay, 19th Series:

A single three-unit relay is used on the 19th Series cars (Fig. 7).

Low and Reverse Solenoid:

A *slower* rate of clutch engagement is required for a standing start in low or reverse, than in second or direct while the car is in motion. A low and reverse solenoid is provided to give a slower rate of clutch engagement by increasing the load of the diaphragm spring when starting in low or reverse.

The low and reverse solenoid located at the rear of the clutch control valve is a "pusher type" solenoid, with its plunger extending into the control valve diaphragm chamber. One end of the diaphragm spring rests in a seat on the diaphragm, the other end of the spring rests in a seat on the end of the low and reverse solenoid plunger.

When energized the solenoid pushes the plunger forward increasing the load of the diaphragm spring. The increased spring pressure on the diaphragm causes the diaphragm sleeve to overtake the spool valve sooner, and follow the spool valve closer, reducing the opening of the power cylinder ports. This reduces the air bleed and slows up the rate of clutch engagement after the "Electromatic cushion point."

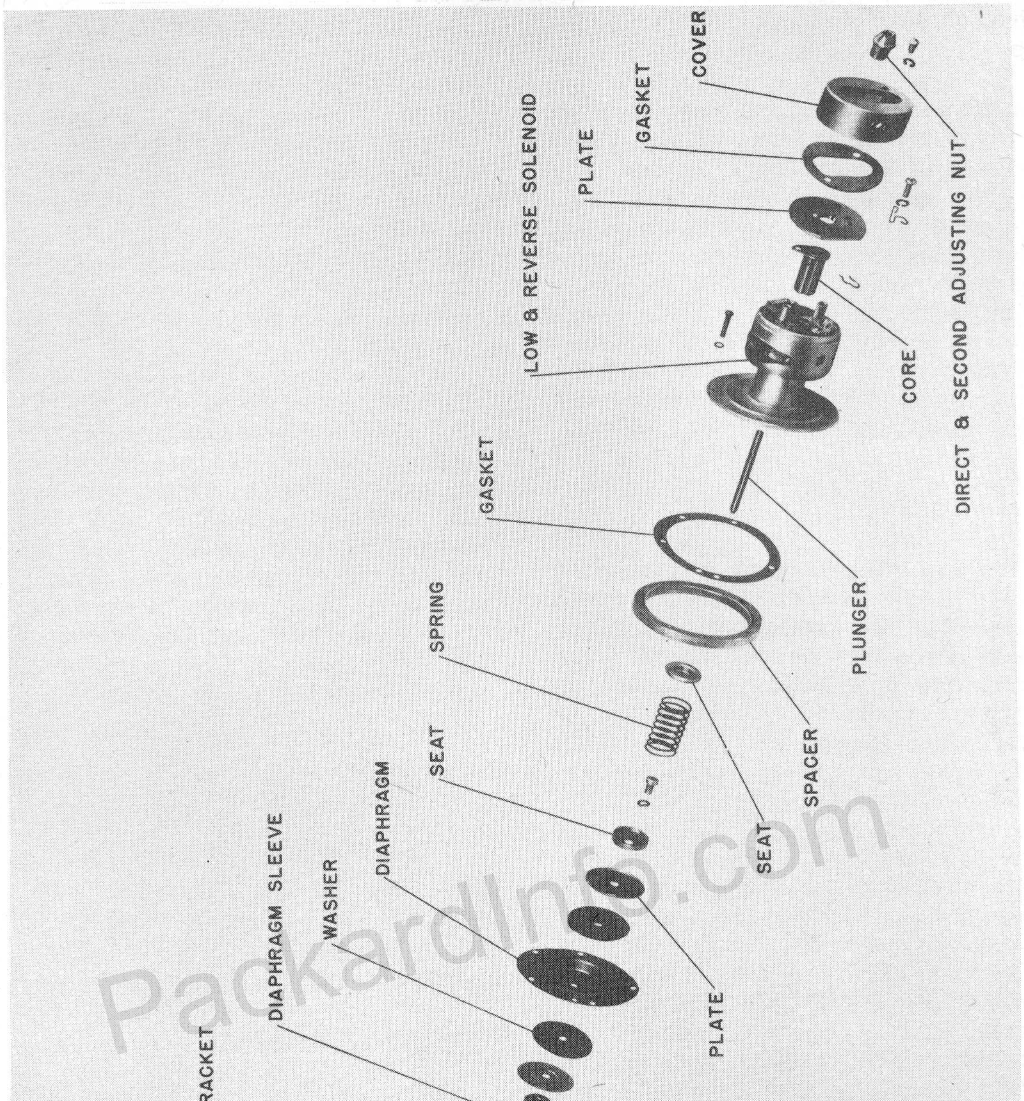


Figure 5—Exploded View of Electromatic Control Valve

The low and reverse solenoid plunger is threaded into the solenoid core to provide an adjustment (K, Fig. 4). The rear end of the low and reverse solenoid plunger has a female hex (K, Fig. 4) to fit an "Allen" wrench used in adjusting the diaphragm spring load *when the solenoid is energized*. Once this adjustment is properly set, it never needs changing for operational adjustments.

Another adjustment is provided to regulate the initial spring load when the solenoid is not energized. This adjustment is the knurled nut (M, Fig. 4) which provides a stop for the solenoid core.

Low and Reverse Switch:

The low and reverse solenoid is controlled by the low and reverse switch (7, Fig. 1) which is located on the transmission cover and is operated by the low and reverse shifter shaft. The solenoid is energized only when the gearshifter lever is in low or reverse. The solenoid is deenergized at all other times.

Governor Switch:

With only the controls described so far, the clutch would be disengaged and the car would free wheel each time the accelerator was released. To prevent clutch disengagement when the accelerator is released at higher speeds, a centrifugal governor switch is provided.

The governor switch contains two sets of contacts:

a. One set marked "EC" (Electromatic clutch) which is normally closed below governed speeds (22 mph) provides the ground for the direct speed solenoid circuit.

b. The other set marked "AD" (overdrive) which is normally open below governed speeds (22 mph) controls the engaging mechanism of the overdrive.

In operation the centrifugal force of the governor flyweights will open the "EC" contacts and close the "AD" contacts while driving above governed speed. Opening of the "EC" contacts breaks the direct speed solenoid ground circuit, de-energizing the solenoid and shutting off the vacuum to the power cylinder. This locks out the Electromatic mechanism above governed speeds.

Direct Speed Switch:

With the governor switch locking out the Electromatic mechanism above governed speed, it would be impossible to shift gears above governed speed without some device to cancel the effect of the governor switch. The direct speed switch (9, Fig. 1) is provided for this purpose. The direct speed switch is connected in parallel with the governor switch so that when the direct speed switch contacts are closed they will complete the ground circuit for the direct speed solenoid. This will energize the direct speed solenoid and make the Electromatic mechanism operative even though the governor "EC" contacts are open.

The direct speed switch is a plunger type switch, mounted on a bracket attached to the transmission case and is operated by the direct and second speed shifting lever rod end (9, Fig. 1). The switch is so adjusted that when the shifting lever is moved to the high gear position, the rod end pushes the plunger in, opening the switch contacts. This breaks the direct speed solenoid circuit and locks out the Electromatic mechanism.

When the shifting lever is moved out of the high gear position, the first movement of the lever will close the direct speed switch contacts, making the Electromatic operative and disengage the clutch before any movement of the high gear takes place. The direct speed switch contacts are open *only* when the shifting lever is in high gear position and are closed at all other times.

Accelerator Switch:

With only the controls described, the clutch would be disengaged each time the accelerator was let up below governed speed. This is prevented by the use of an accelerator switch (10, Fig. 1) connected in series with the governor "EC" contacts.

The accelerator switch is operated by a lever connected by a link rod to the throttle linkage and is so adjusted that the switch contacts are closed *only* when the accelerator pedal is fully released. As the accelerator pedal is depressed, the switch contacts open just as the lost motion in the throttle linkage has been taken up. While driving below governed speed in high gear this slight movement of the accelerator pedal breaks the direct speed solenoid ground circuit and locks out the Electromatic mechanism, except when the accelerator pedal is *fully* released.

In all other gears the Electromatic is operative, since the direct speed switch contacts are closed, completing the direct speed solenoid circuit even though the accelerator switch contacts are open.

Second Speed Solenoid Valve:

When the car is operated above governed speed in second gear, the clutch is disengaged each time the accelerator pedal is released. Under these conditions an objectionable lurch would result from a sudden decrease in car speed if the clutch was re-engaged rapidly before the engine speed was brought up to car speed. This lurch is prevented by the use of the second speed valve which delays clutch engagement until engine speed and car speed are synchronized.

The second speed solenoid valve is an electrically operated choke valve located in the air bleed line to the clutch control valve (2, Fig. 1). When energized, the second speed solenoid valve restricts the air flow to the control valve and power cylinder, thus delaying the clutch engagement.

In order that the second speed solenoid valve will operate only above governed speeds, the current to the solenoid is controlled by the "AD" contacts of the governor switch.

On 20th Series cars, the second speed solenoid circuit is completed to ground through the direct speed switch (9, Fig.1). This arrangement makes the second speed solenoid valve operate above governed speed in any except high gear.

On the 19th Series cars, the second speed solenoid circuit is completed to ground through the second speed switch (2, Fig. 7). The second speed switch is operated by the direct and second shifter shaft and the switch contacts are closed only when the gear shifting lever is in the second gear position. At all other times the second speed switch contacts are open allowing the second speed solenoid valve to remain open.

Air Inlet Choke Sleeve:

The controls described so far control the Electromatic mechanism only when the accelerator is depressed slowly with only part throttle opening during engagement of the clutch. If the accelerator pedal was depressed quickly and the throttle opened wide, the clutch would engage very suddenly with a severe lurch. To prevent this sudden engagement of the clutch on fast starts, an air inlet choke sleeve is used (Fig. 5).

The air inlet choke sleeve is located in the forward end of the control valve body and its inner bore fits over the forward end of the diaphragm sleeve. The air inlet choke sleeve has four square ports which admit air into the forward end of the diaphragm sleeve from the air inlet chamber (Fig. 4).

On fast starts the vacuum drops suddenly in the power cylinder chamber and the spring-loaded side of the diaphragm. This causes the spring to move the diaphragm and sleeve all the way forward, causing the diaphragm sleeve to close off the four ports in the choke sleeve. This cuts off the air bleed to the control valve and power cylinder, except the constant air bleed, slowing the rate of clutch engagement to a smooth even start.

So that the air inlet is not cut off completely when the diaphragm sleeve moves all the way forward, four shallow grooves are milled in the inner bore of the choke sleeve forward from the four ports. These shallow grooves provide an air passage from the four choke sleeve ports to the constant air bleed groove of the diaphragm sleeve, even though the constant air bleed groove has moved past the four ports.

A small shoulder is located midway on the outer surface of the choke sleeve against which a coil spring seats, keeping the choke sleeve seated against the end body plug rubber seal ring.

The control valve end body plug is threaded to provide an adjustment for full throttle starts. Screwing the end plug in or out changes the position of the choke sleeve in relation to the diaphragm sleeve, increasing or decreasing the rate of clutch engagement on fast starts.

SEQUENCE OF OPERATION OF THE ELECTRICAL UNITS

LOCKOUT

As long as the Electromatic lockout switch is in the open position (pulled out), the direct speed solenoid circuit is broken and the solenoid is de-energized.

Lockout Circuit, 20th Series Cars: (Fig. 6.)

When the lockout switch is pushed "in", the contacts close completing the circuit to the direct speed solenoid. The current then flows from the battery, through the ignition switch and the lockout switch, to the "F" terminal on the relay. From the "F" terminal, the current flows to one terminal of the direct speed solenoid, through the solenoid coil, out the other solenoid terminal, to ground through the direct speed switch, which is closed in all except the high gear position. Current flowing through the solenoid will energize it, opening the valve.

Lockout Circuit, 19th Series Cars: (Fig. 7.)

On the 19th Series cars, an "EC" relay is provided to control the current to the direct speed

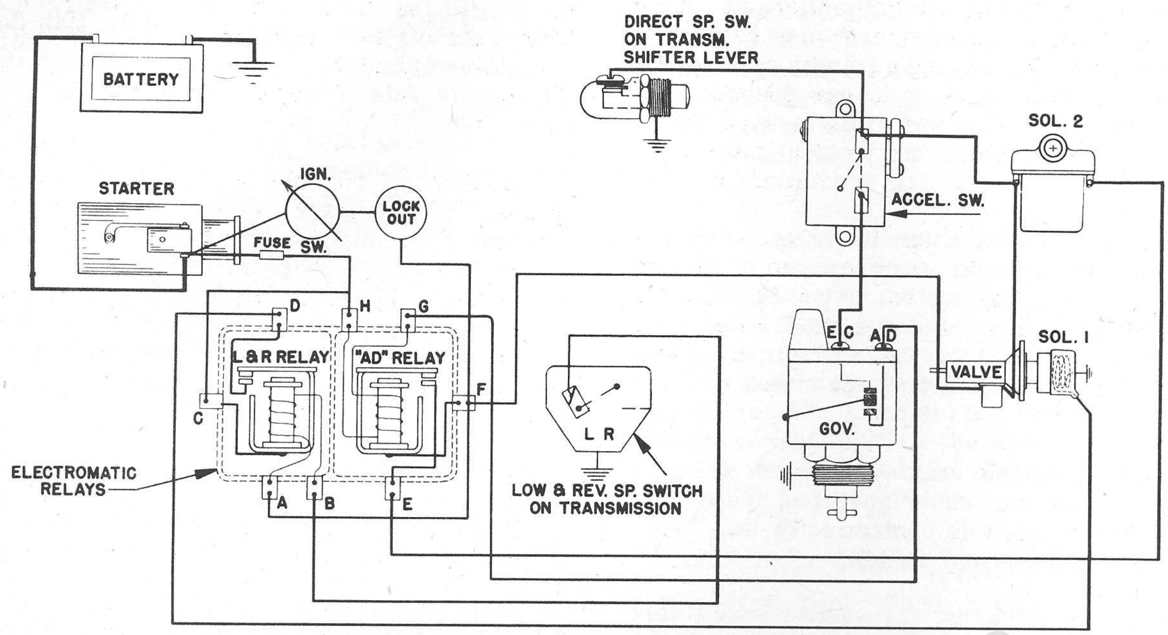


Figure 6—Schematic Wiring Diagram of 20th Series Electromatic

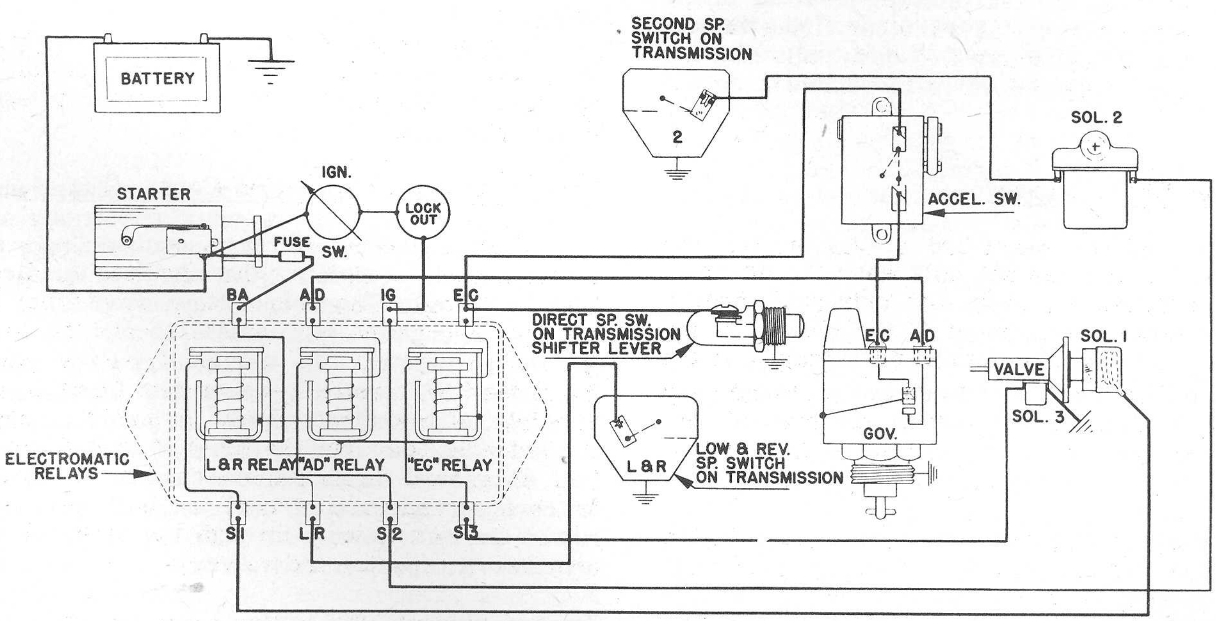


Figure 7—Schematic Wiring Diagram of 19th Series Electromatic

solenoid. With the lockout switch closed, current flows from the battery through the ignition switch and the lockout switch to the "IG" terminal of the relay. From the "IG" terminal, the current flows to the soldered connection on the frame of the "EC" relay, through the frame to the "EC" relay coil, to the "EC" terminal and then to ground through the direct speed switch, which is closed in all except the high gear position. This will energize the "EC" relay and close the contacts.

When the "EC" relay contacts are closed, current which is flowing from the battery through the ignition switch, the lockout switch, and the "EC" relay frame now also flows through the relay contacts to the "S3" terminal of the relay. From the "S3" terminal, the current flows to the direct speed solenoid terminal (Sol. 3, Fig. 7) through the solenoid winding, to ground through the solenoid base. Current flowing through the direct speed solenoid will energize it, opening the valve.

LOW AND REVERSE

When the shifting lever is moved to either the low or reverse gear position, the low and reverse shifter shaft will operate the low and reverse switch, closing the contacts. Closing the low and reverse switch contacts will provide a ground, completing the circuit for the "L and R" relay coil.

Low and Reverse Solenoid Circuit, 20th Series: (Fig. 6)

With the low and reverse switch contacts closed, current flows from the battery, through the ignition switch and the lockout switch to the "A" terminal of the relay. From the "A" terminal, the current flows through the "L & R" relay coil to the "B" terminal of the relay and then to ground through the low and reverse switch. This will energize the "L & R" relay and close the contacts.

Current will then flow from the battery through the fuse and main feed cable to the "C" terminal of the relay (Fig. 6). From the "C" terminal, the current flows to the soldered connection on the frame of the "L & R" relay, through the frame to the relay contacts, through the closed contacts to the "D" terminal of the relay, and then through the low and reverse solenoid windings to ground.

Current flowing through the solenoid windings will energize the solenoid, causing the core and plunger to move forward, increasing the load of the control valve diaphragm spring (Fig. 4).

The same sequence of operation takes place when the shifting lever is placed in either the low or reverse gear position.

Low and Reverse Solenoid Circuit, 19th Series: (Fig. 7)

With the low and reverse switch contacts closed, current flows from the battery through the ignition switch and the lockout switch to the "IG" terminal of the relay. From the "IG" terminal, the current flows to the soldered connection on frame of the "AD" relay, through the "L & R" relay coil to the "LR" terminal and then to ground through the low and reverse switch. This will energize the "L & R" relay and close the contacts.

With the "L & R" relay contacts closed, current will then flow from the battery, through the fuse and main feed cable, to the "BA" terminal of the relay. From the "BA" terminal the current flows to the soldered connection on the frame of the "L & R" relay, through the frame and the closed relay contacts to the "S1" terminal. From the "S1" terminal, the current continues to the low and reverse solenoid and then through the windings to ground. This will energize the low and reverse solenoid, causing the solenoid core and plunger to move forward, increasing the load of the control valve diaphragm spring (Fig. 4).

The same sequence of operation takes place when the shifting lever is placed in either the low or reverse gear position.

SECOND SPEED

After the car accelerates up to the speed when shifting into second is desired, the driver will release the accelerator. This will disengage the clutch and the shifting lever may be moved to the second gear position.

After the shift into second has been made, the driver will again depress the accelerator causing the clutch to engage as previously described. But, in second speed, the clutch will tend to engage more rapidly than it did in low or reverse, because as the gearshift lever was moved out of the low gear position breaking the low and reverse solenoid circuit, it released the additional pressure on the diaphragm spring. However, to prevent a sudden lurch resulting from a too rapid clutch engagement, the second speed solenoid valve reduces the rate of air bleed to delay the clutch engagement.

Second Speed Solenoid Circuit, 20th Series:
(Fig. 6)

(Above governed speed)

When the car is traveling above governed speeds, the centrifugal force of the governor fly-weights will cause the governor "AD" contacts to close (Fig 6).

Current then flows from the battery through the fuse and main feed cable to the "H" terminal of the relay and then through the "AD" relay coil to the "G" terminal. From the "G" terminal the current flows through the governor "AD" contacts to ground. Current flowing through the "AD" relay coil will energize the relay, closing the relay contacts (Fig. 6).

With the "AD" relay contacts closed, current will then flow from the battery through the ignition switch and the lockout switch to the "F" terminal of the relay. From the "F" terminal the current flows to the soldered connection on the frame of the "AD" relay through the frame and the closed "AD" relay contacts to the "E" terminal of the relay. From the "E" terminal the current continues to one terminal of the second speed solenoid, through the solenoid winding, out the other terminal and then to ground through the direct speed switch which is closed in all except high gear (Fig. 6). Current flowing through the second speed solenoid energizes it, closing the second speed solenoid valve.

Second Speed Solenoid Circuit, 19th Series:
(Fig. 7)

(Above governed speed)

Current then flows from the battery through the fuse and main feed cable to the "BA" terminal of the relay. From the "BA" terminal, the current flows to the frame of the "L & R" relay, through the "AD" relay coil to the "AD" terminal and thence through the governor "AD" contacts to ground. Current flowing through the "AD" relay coil will energize the relay, closing the contacts (Fig. 7).

With the "AD" relay contacts closed, current will then flow from the battery, through the ignition switch and the lockout switch, to the relay "IG" terminal. From the "IG" terminal, the current flows through the frame of the "AD" relay, the closed "AD" relay contacts to the "S2" terminal and thence through the second speed solenoid winding to ground through the second speed switch which is closed when the shifting lever is in the second speed position. Current flowing through the second speed solenoid energizes it, closing the second speed solenoid valve.

DIRECT SPEED

After the car accelerates up to the speed when shifting into high gear is desired, the driver will release the accelerator disengaging the clutch. Moving the gearshift lever into high will open the direct speed switch contacts.

After the shift into direct speed has been made, the driver will again depress the accelerator causing the clutch to engage as previously described. But since there are no modifying controls to delay its engagement, as there are in low or second, the clutch will engage more rapidly to prevent excessive slip.

As the accelerator pedal is again depressed, the accelerator switch contacts open, breaking the direct speed solenoid circuit and locking out the Electromatic mechanism below governed speeds. Above governed speeds the governor "EC" contacts open, locking out the Electromatic mechanism even though the accelerator switch contacts may be closed by releasing the accelerator pedal.

* * *

PART 2

ELECTROMATIC CLUTCH ADJUSTMENT

Important:

It must be remembered that the purpose of Electromatic clutch adjustment is to regulate the Electromatic operation to the driver's personal preference and the specific operating conditions. The Electromatic clutch adjustments are *not* provided to offset any misadjustments, wear, or faulty operation of the clutch and linkage. Once the Electromatic clutch adjustments are accurately made, they need *not* be changed except for wear of the throttle linkage. Excessively worn throttle linkages should be replaced. The clutch itself and the clutch linkage must be in good operating condition before an accurate Electromatic clutch adjustment can be made.

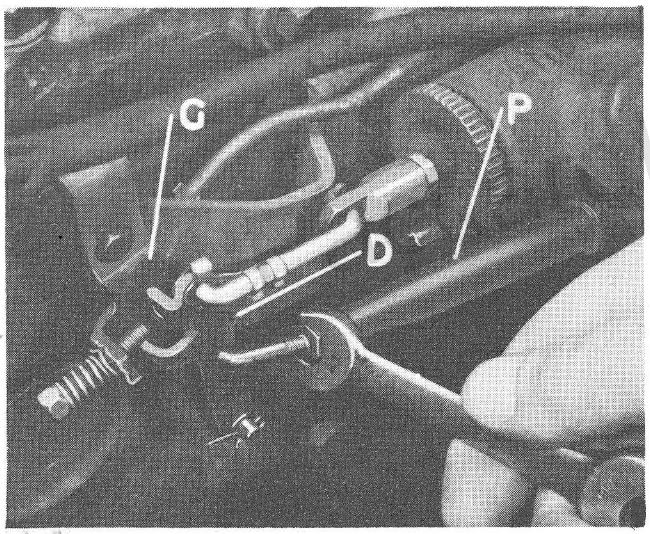


Figure 8—Adjusting Turnbuckle for 1/32" to 1/16" Clearance between Cross Shaft Lever and Stop

Before any of the following adjustments are made, the clutch pedal free play should be checked and if necessary adjusted to obtain two inches of free play. Maintaining the proper clutch pedal free play is the most important factor in the operation of the Electromatic clutch and, in many cases, further adjustments of the Electromatic mechanism may not be necessary.

1. ACCELERATOR LINKAGE (PRELIMINARY ADJUSTMENT)

Purpose:

To remove excess free play in throttle linkage.

Procedure:

a. Disconnect carburetor to cross shaft link from carburetor.

b. Adjust foot accelerator to Electromatic clutch valve operating lever rod by means of turnbuckle (P, Fig. 8) until, with the lever (G, Fig. 8) against its stop pin (D), there is 1/32 inch to 1/16 inch clearance between the throttle cross shaft lever and its stop.

c. Adjust carburetor to cross shaft link so that carburetor throttle stop screw is against the stop while lever (G) is against its stop. When making this adjustment the carburetor idle screw must not be on the fast idle cam.

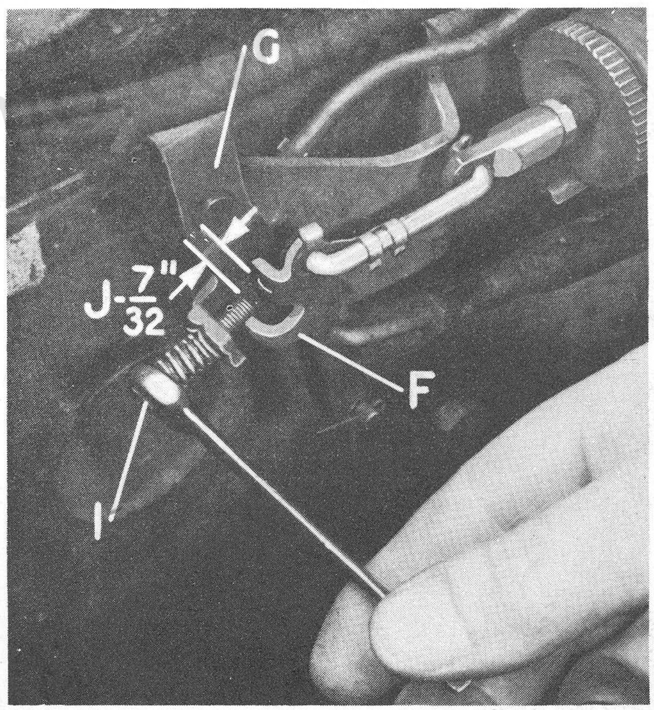


Figure 9—With Stop (F) against Lever (G) Obtain 7/32" Gap (J) by Adjusting Engine Speed Screw (I)

2. ENGINE SPEED ADJUSTMENT (PRELIMINARY ADJUSTMENT)

Purpose:

To adjust the approximate spool valve movement before throttle opens.

Procedure:

Holding control valve lever stop (F, Fig. 9) against the lever (G), adjust the engine speed adjusting screw (I) to provide a gap of 7/32 inch at point (J).

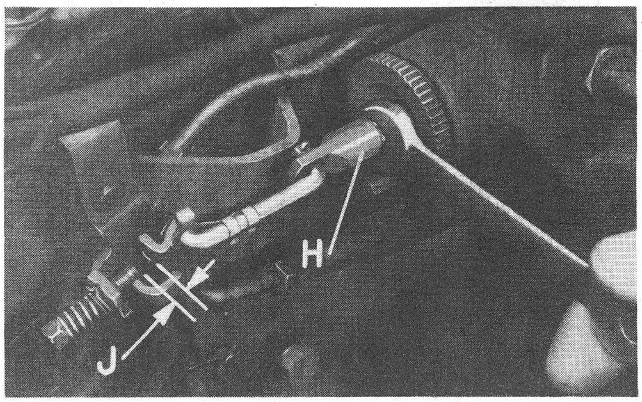


Figure 10—Adjust Spool Rod until Power Cylinder Starts To Move as Clearance (J) Is Taken Up

3. SPOOL VALVE ROD ADJUSTMENT

Purpose:

To locate the "Electromatic Cushion Point" in relation to the clutch cushion point. This adjustment determines the point in the accelerator linkage travel and the engine speed at which the clutch starts to engage.

Procedure:

a. With the engine running and gear shift in neutral, depress the accelerator pedal until the clearance (at J, Fig. 9) is just taken up. The clutch power cylinder rod or cable should just start to move as the clearance is taken up.

b. If the power cylinder cable starts to move before this clearance is taken up, loosen the lock nut on the spool valve rod and screw the spool rod out of the clevis (H, Fig. 10).

c. If the cable does not start to move when the clearance is taken up, screw the spool rod into the clevis until the proper action is obtained.

d. To check the spool valve adjustment, start the engine, place the gear shifter lever in low gear position and depress the accelerator pedal slowly. The car should start to creep forward at an engine speed of approximately 900 rpm. To increase engine speed, decrease the gap (at point J, Fig. 9) by turning the adjusting screw (I, Fig. 9) in, 1/4 turn at a time, until the speed is correct. If the engine speed is too high, decrease by turning the adjusting screw out, 1/4 turn at a time, until proper engine speed is obtained.

e. Recheck the engine speed adjusting screw gap (J, Fig. 9) and, if less than 3/16 inch or more than 1/4 inch, the spool valve must be readjusted. If the gap is above limit, screw the spool rod into the clevis 1/2 turn (H, Fig. 10). Readjust the engine speed screw gap (J, Fig. 9) to the original gap setting of 7/32 inch. Recheck the adjustment with the car in low gear as previously described. If the car does not creep at the prescribed engine speed, repeat the above adjustments.

4. RATE OF CLUTCH ENGAGEMENT ADJUSTMENT

Purpose:

To adjust the rate of clutch engagement after the Electromatic cushion point and to properly establish the difference in engaging rate between low and reverse and second and high an adjustment is provided on the low speed solenoid. This adjustment recalibrates the valve by changing the load of the control valve diaphragm spring. The low and reverse adjustment must always be made before the second and high adjustment as any change in low and reverse setting will affect the second and high adjustment. Once the difference between the rate of engagement in low and in second has been properly established, these adjustments need *never* be changed.

a. Low and Reverse Adjustment: This adjustment regulates the diaphragm spring load when the low and reverse solenoid is energized by lengthening or shortening the plunger rod.

Procedure:

The inner adjustment (K, Fig. 4) at the rear of the low and reverse solenoid is adjusted by means of an Allen wrench. If clutch engagement in low gear is too sharp (grabs), turn the Allen head adjusting screw in (clockwise) 1/4 turn at a time (Fig. 11) until a smooth clutch engagement is obtained at not more than 900 rpm engine speed. If too much slippage is noted, turn the adjusting screw out (counterclockwise) one turn at a time until the clutch grabs. Then turn in, 1/4 turn at a time, until engagement is correct.

b. Second and High Adjustment: This adjustment regulates the initial diaphragm spring load (when the low and reverse solenoid is not energized) by adjusting the solenoid core stop, which is the knurled nut (M, Fig. 4).

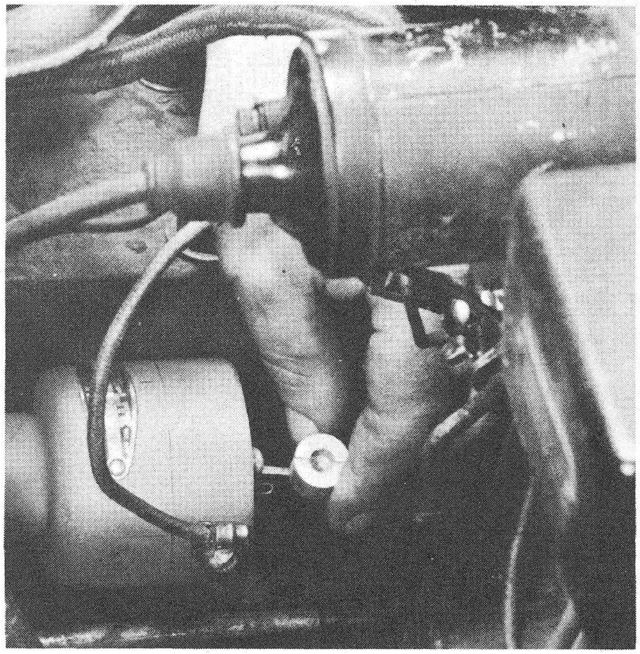


Figure 11—Adjusting Low and Reverse Engagement Rate by Turning Solenoid Plunger Rod

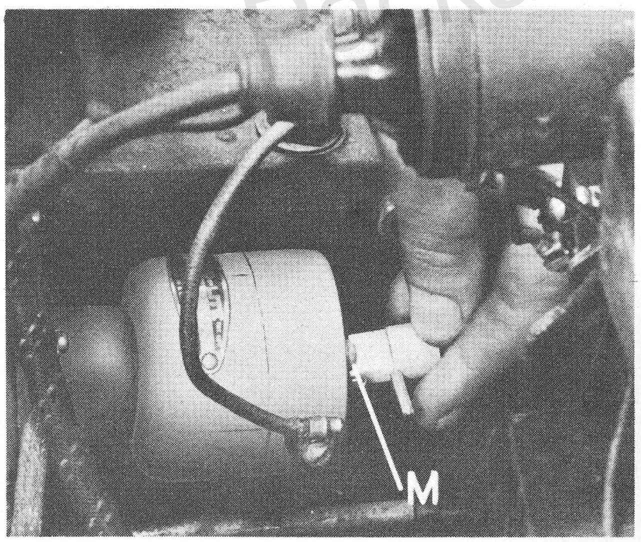


Figure 12—Turning Solenoid Core Stop (M) Adjusts Rate of Engagement in Second and High Speeds

Procedure:

With the gearshift in second speed position, the car should begin to creep forward smoothly at approximately 900 rpm engine speed. If the engagement is too sharp (grabs), turn the knurled adjusting screw clockwise (M, Fig. 12), 1/4 turn at a time until a smooth engagement is obtained at not more than 900 rpm engine speed. If too much slippage is noted, turn the adjusting screw counterclockwise one turn at a time until the clutch grabs. Then turn clockwise 1/4 turn at a time until smooth engagement is obtained.

5. ACCELERATOR SWITCH ADJUSTMENT:

Purpose:

To adjust the accelerator pedal movement necessary to open the accelerator switch contacts.

Procedure: (20th Series)

a. Disconnect the three wires from the accelerator switch terminals. Ground one terminal of the accelerator switch with a jumper lead and attach one lead of a test lamp to the other switch

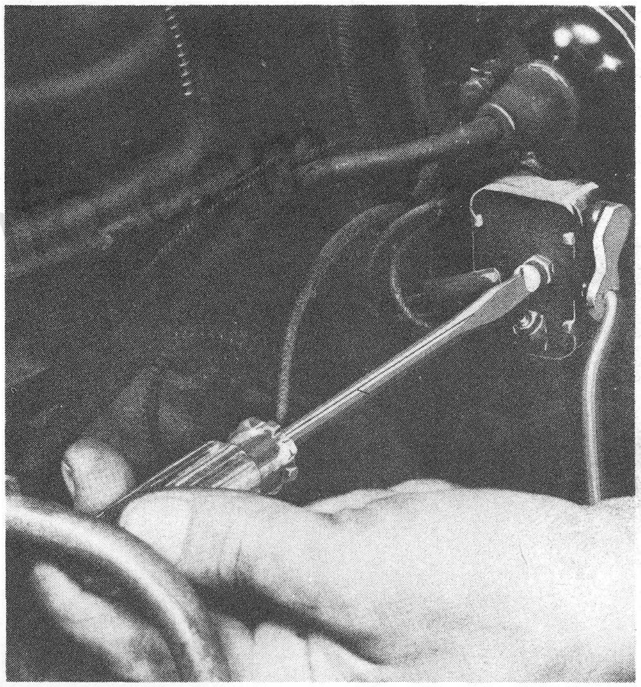


Figure 13—Adjusting 20th Series Accelerator Switch To Open Contacts just as Lost Motion Is Taken Up

terminal (Fig. 18). Clip the other lead of the test light to the relay main feed terminal (C, Fig. 6). With the accelerator pedal released, the light should burn.

b. Slowly depress the accelerator pedal. The light should *go out* just as the lost motion in the accelerator linkage is taken up. If the light does not burn when the accelerator pedal is released, turn the adjusting screw counterclockwise (Fig.13) until the light burns. Slowly depress the accelerator pedal. The light should go out just as the lost motion in the accelerator linkage is taken up.

c. If the light remains on too long (until after the throttle has started to open) turn the adjusting screw clockwise until light goes out.

Procedure: (19th Series)

This adjustment is the same as on the 20th Series except that since this model switch does not incorporate an adjusting screw, the adjustment is made at the accelerator switch control rod turnbuckle. If the light does not go on when the accelerator is released, shorten the control rod at the turnbuckle.

If the light remains on too long (after the throttle has started to open), lengthen the control rod until light goes out.

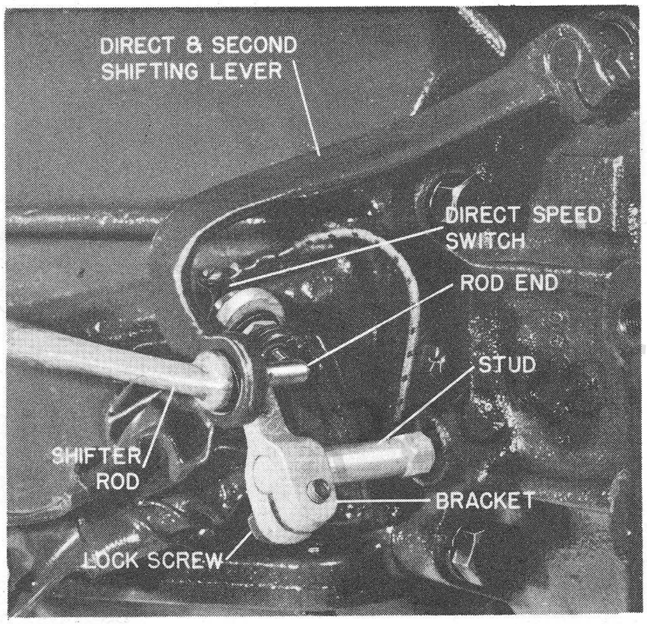


Figure 14—The Direct Speed Switch Is Adjusted by Rotating the Bracket on the Stud

6. DIRECT SPEED SWITCH ADJUSTMENT

Purpose:

To adjust the movement of the gear shifting lever necessary to close the direct speed switch and cause the clutch to disengage when shifting from high to second speed.

Procedure:

a. Disconnect the green lead from the terminal of the accelerator switch. Clip one test light lead to the green lead (Fig. 17) and the other test light lead to the main feed terminal (C) of the Electromatic relay (Fig. 6). Place the shifting lever in high gear position. The light should *not burn*.

b. Move the gearshift lever toward the neutral position. The light should go on when the linkage slack has been taken up, but before the transmission shifter fork moves out of its detent. If the light does not go on in this position, adjust the switch bracket on the transmission (Fig. 14) away from the shifter lever rod end until the light goes on. If the light burns continually, adjust the switch bracket nearer to the lever rod end so that the light will go out in the high gear position and will go on just as the linkage lost motion is taken up (Fig. 14).

7. FAST START ENGAGEMENT ADJUSTMENT:

Purpose:

To locate the position of the air inlet choke sleeve in relation to the diaphragm sleeve.

This adjustment should be made on the road in second gear after the previous adjustments have been made. Fast start adjustments should be made as sharp as possible without causing the clutch to grab upon full engagement.

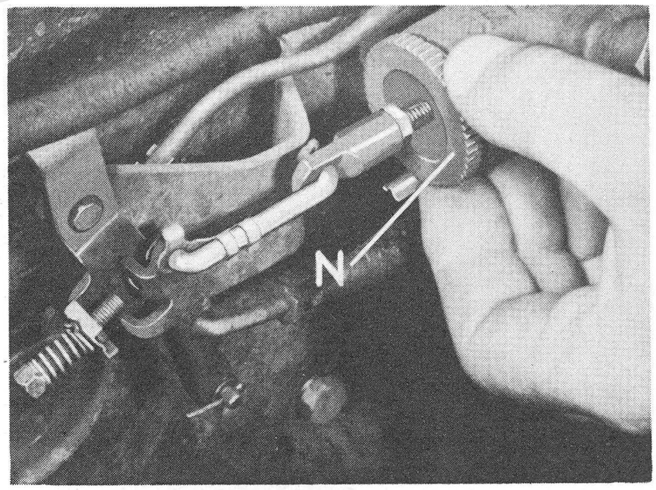


Figure 15—Adjusting Body Plug (N) to Obtain Correct Clutch Engagement for Making Fast Starts

Procedure:

a. Screw the body plug (N, Fig. 15) out until the clutch grabs when starting from a standing position with full throttle. Then turn in one notch at a time until smooth engagement is obtained. If clutch slippage is excessive during the intermediate portion of the engagement, after car starts to move but before full clutch engagement, screw out the second and high adjusting nut (M, Fig. 12) to reduce slippage.

PART 3

ELECTRICAL TESTS

Important: To test accurately the switches, solenoids, and circuits of the Electromatic, use a suitable test light such as any 6-volt ignition timing light. Before any electrical tests are made, check the fuse in the main feed cable near the starting motor.

SWITCHES

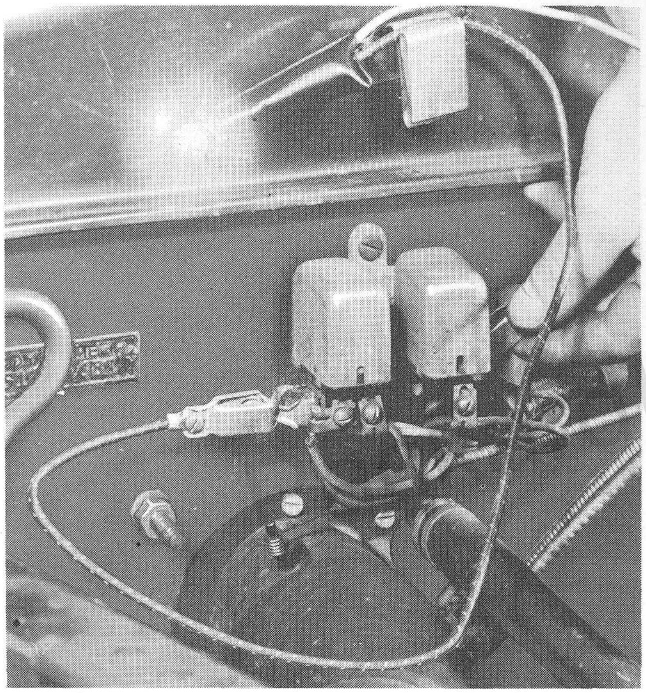


Figure 16—When Shift Lever Is in Low or Reverse, Light Should Be On—when in Neutral, Off

1. LOW AND REVERSE SWITCH

Test Light Connection, 20th Series: Clip one lead of the test light to the relay main feed terminal (C, Fig. 6). Clip the other lead of the test light to the relay terminal (F, Fig. 6).

Test Light Connection, 19th Series: Clip one lead of the test light to the relay main feed terminal (BA, Fig. 7). Clip the other lead of the test light to the relay terminal (LR, Fig. 7).

Test:

With the ignition switch off, move the steering column gearshift lever into the low gear position and then into the reverse gear position. The test light should *burn* when the gearshift lever is in either the low or reverse gear position and should *go out* upon returning the gearshift lever to the neutral position.

2. DIRECT SPEED SWITCH

Test Light Connection, 20th Series: Disconnect the double green wire from the accelerator switch terminal (Fig. 17). Clip one lead of the test light to the relay main feed terminal (C, Fig. 6) and the other lead of the test light to the disconnected wires.

Test Light Connection, 19th Series: Disconnect the green wire from the accelerator switch terminal. Clip one lead of the test light to the relay main feed terminal (BA, Fig. 7) and the other lead of the test light to the relay terminal (EC, Fig. 7).

Test:

With the ignition switch "off" move the steering column gearshift lever in the high gear position. The light should *not burn.* Move the gearshift lever to the neutral position. The light should *go on* just before the shifter fork moves out of its detent.

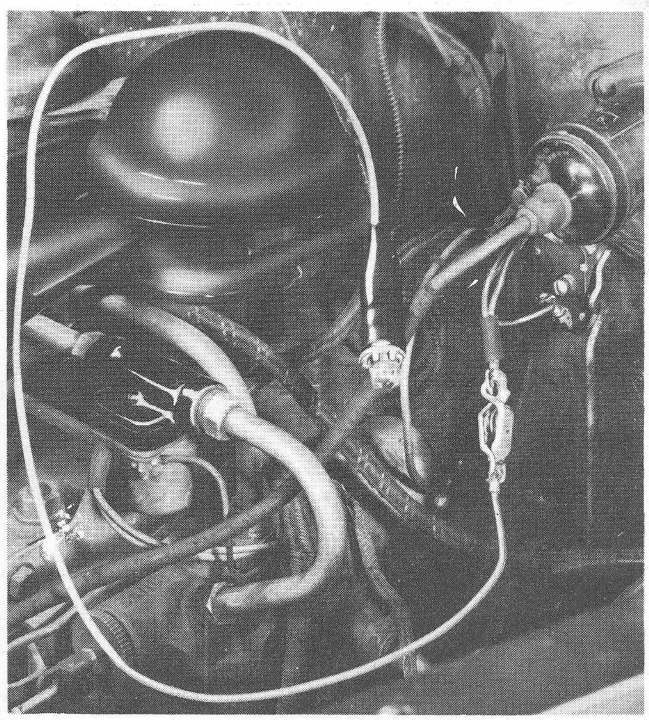


Figure 17—Light Should Be Off with Shift Lever in High—On when Lever Is Moved toward Neutral

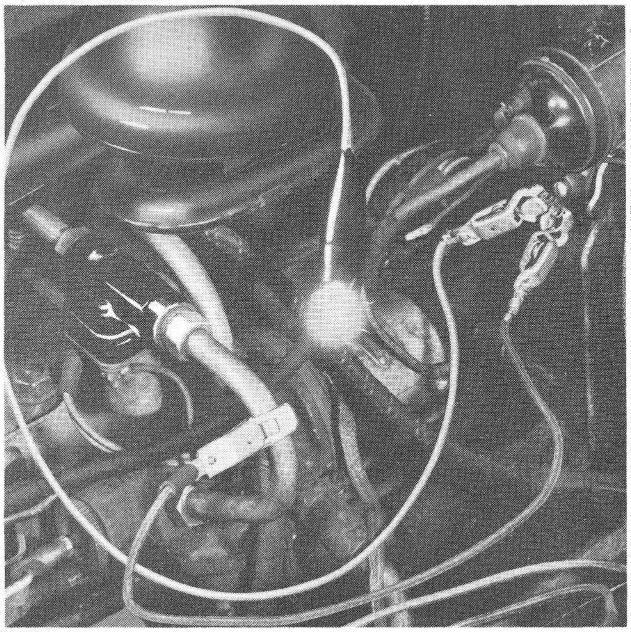


Figure 18—Light Should Be On with Accelerator Released—Go Off as Lost Motion Is Taken Up

3. ACCELERATOR SWITCH

Test Light Connection, 20th Series: Disconnect the wires from the accelerator switch terminals. Ground one terminal of the accelerator switch with a jumper wire. Clip one lead of the test light to the other accelerator switch terminal. Clip the other lead of the test light to the relay main feed terminal (C, Fig. 6).

Test Light Connection, 19th Series: Disconnect the wires from the accelerator switch terminals. Ground one terminal of the accelerator switch with a jumper wire. Clip one lead of the test light to the other accelerator switch terminal. Clip the other lead of the test light to the relay main feed terminal (BA, Fig. 7).

Test:

The test light should *burn* with the accelerator released. Slowly depress the accelerator pedal. The test light should *go out* just as the lost motion in the throttle linkage is taken up.

4. SECOND SPEED SWITCH (19th SERIES)

Test Light Connection: Disconnect the yellow wire from the second speed solenoid terminal (Fig. 7). Clip one lead of the test light to the yellow wire and clip the other lead of the test light to the relay main feed terminal (BA, Fig. 7).

The light should *burn* when the gear shift lever is in the second gear position and should *go out* when the gearshift lever is returned to neutral.

5. LOCKOUT SWITCH

Test Light Connection, 20th Series: Disconnect the wires from the relay terminals (A and F, Fig. 6). Clip one lead of the test light to the red wire, disconnected from terminal (A), (the red wire from the lockout switch, Fig. 1) ground the other test light lead.

Test Light Connection, 19th Series: Disconnect the red wire from the relay terminal (IG, Fig. 7). Clip one lead of the test light to the red wire disconnected from relay "IG" terminal. Ground the other test light lead.

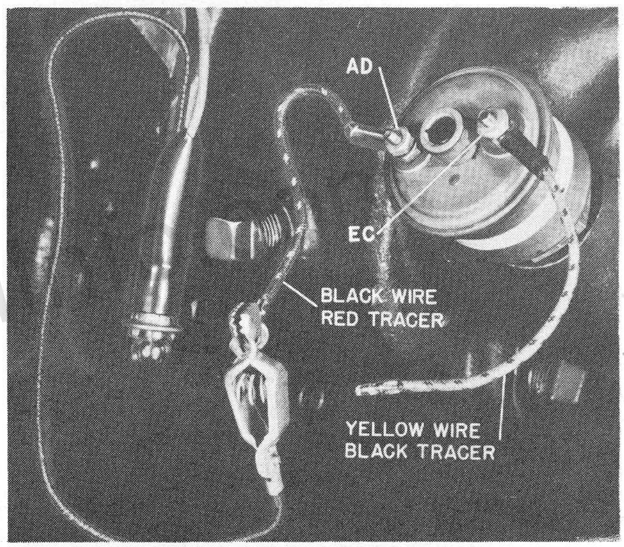


Figure 19—Light Should Not Burn when "AD" Lead Is Contacted, Should Burn when "EC" Lead Is Contacted

Test:

With the ignition switch and the lockout switch closed the light should *burn.*

6. GOVERNOR SWITCH

Test Light Connection, 20th Series: Clip one lead of the test light to the main relay main feed terminal (C Fig. 6). Contact each of the governor terminals with the other test light lead (Fig. 19).

Test Light Connection, 19th Series: Clip one lead of the test light to the relay main feed terminal (BA, Fig. 7). Contact each of the governor terminals with the other test light lead (Fig. 19).

Test:

The light should *burn* when the "EC" terminal is contacted and should ***not burn*** when the "AD" terminal is contacted (Fig. 19). The "EC" terminal has a yellow wire with black tracer attached to it. The "AD" terminal has a black wire with a red tracer attached to it.

SOLENOIDS AND CIRCUITS

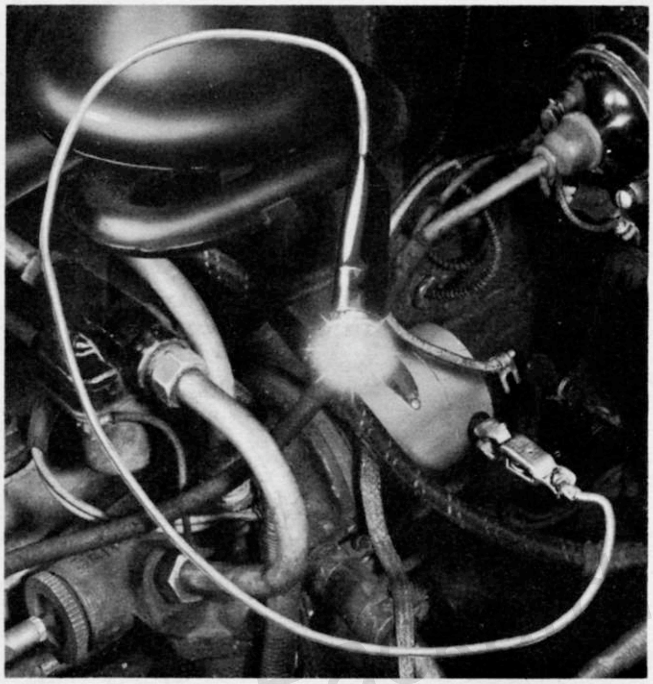


Figure 20—If Low and Reverse Solenoid Windings Are Continuous, the Light Will Burn

1. LOW AND REVERSE SOLENOID

Test Light Connection, 20th Series: Disconnect the wire from the solenoid terminal. Clip one lead of the test light to the relay main feed terminal (C, Fig. 6). Clip the other lead of the test light to the solenoid terminal.

Test Light Connection, 19th Series: Disconnect the wire from the solenoid terminal. Clip one lead of the test light to the relay main feed (BA, Fig. 7). Clip the other test light lead to the solenoid terminal. See Fig. 20.

Test:

If the windings are continuous the light should *burn*.

To Test The L & R Relay and Circuit: Clip one lead of the test light to the disconnected wire and ground the other test light lead. Turn the ignition switch "on" and push "in" the Electromatic lockout switch. If the "L & R" relay is operating properly, the light should burn when the gearshift lever is placed in low or reverse position.

2. DIRECT SPEED SOLENOID

Test Light Connection, 20th Series: Disconnect the yellow wire from the direct speed solenoid. Clip one lead of the test light to the solenoid terminal. See Fig. 21.

Test Light Connection, 19th Series: Disconnect the black and green wires from the direct speed solenoid. Clip one lead of the test light to the relay main feed terminal (BA, Fig. 7). Clip the other test light lead to the solenoid terminal.

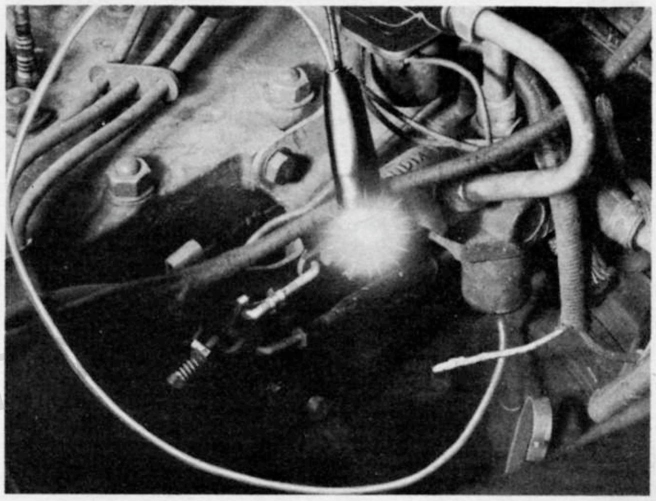


Figure 21—When the Gearshift Lever Is Placed in Neutral, the Light Should Burn

Test:

With the gearshift lever in neutral, the light should *burn*.

To Test The Circuit From the Ignition Switch: Clip one lead of the test light to the disconnected wire and ground the other test light lead. With ignition switch "on" and the Electromatic lockout switch pushed "in", the light should burn.

3. SECOND SPEED SOLENOID

Test Light Connection, 20th Series: Disconnect both wires from the second speed solenoid terminals. Ground one solenoid terminal with a jumper wire. Clip one lead of the test light to the other solenoid terminal. Clip the other lead of the test light to the relay main feed terminal (C, Fig. 6). See Fig. 22.

Test Light Connection, 19th Series: Disconnect both wires from the second speed solenoid terminals. Ground one solenoid terminal with a jumper wire. Clip one lead of the test light to the other solenoid terminal. Clip the other lead of

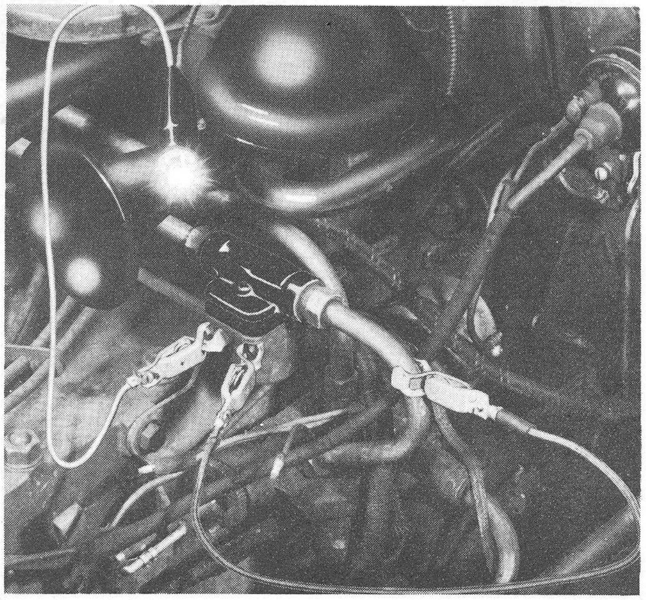


Figure 22—If Second Speed Solenoid Windings Are Continuous, the Light Will Burn

the test light to the relay main feed terminal (BA, Fig. 7).

Test:

If the windings of the solenoid are continuous, the light *will burn*.

4. SECOND SPEED SOLENOID CIRCUIT

Test Light Connection, 20th Series: Clip one lead of the test light to the disconnected black and green wire. Ground the other lead of the test light. With a jumper wire ground the "G" terminal of the relay (Fig. 6).

Test Light Connection, 19th Series: Clip one lead of the test light to the disconnected green wire. Ground the other test light lead. With a jumper wire ground the "AD" terminal of the relay (Fig. 7).

Test:

If the "AD" relay and circuit is in normal operating condition, the test light should *burn*.

* * *

PART 4

TROUBLE SHOOTING AND CORRECTIVE MEASURES

ELECTROMATIC CLUTCH

1. Engine speed too high, and excessive clutch slippage when making a part throttle start in low or reverse.

   Cause:

   Engine speed screw gap too small.

   Correction:

   Adjust engine speed screw (I, Fig. 9) turning it counterclockwise (1/4 turn at a time) so that the engine attains a speed of about 900 rpm as the clutch engages and the car starts to move. Recheck gap and adjust spool rod if necessary.

2. Engine speed too low, clutch grabs and engine tends to stall when making a part throttle start in low or reverse.

   Cause:

   Engine speed screw gap too great.

   Correction:

   Adjust engine speed screw (I, Fig. 9) turning it clockwise (1/4 turn at a time) until a smooth engagement is attained and the engine reaches a speed of about 900 rpm as the clutch engages and the car starts to move. Recheck gap and adjust spool rod if necessary.

3. Excessive clutch slippage after shift has been made into second or high gear. Engine races immediately after gears have been shifted before clutch engages.

   Cause:

   Control valve diaphragm spring "initial" load too great.

   Correction:

   Adjust knurled head screw on the low and reverse solenoid (Fig. 12) by turning counterclockwise (one turn at a time) until clutch grabs, then turn the knurled screw clockwise (1/4 turn at a time) until clutch engages smoothly.

4. Clutch engagement too rapid after shift has been made into second or high.

   Cause:

   Control valve diaphragm spring "initial" load too light.

   Correction:

   Adjust knurled head screw on the low and reverse solenoid (Fig. 12) turning it clockwise (1/4 turn at a time) until a smooth and satisfactory clutch engagement is attained.

5. Car "free wheels" in high gear at above governed speed.

   Cause:

   Direct speed switch at transmission shifter lever out of adjustment or grounded.

   Correction:

   Check adjustment of switch. Test switch with test lamp (Fig. 17). Switch should be open when plunger is depressed 1/8 inch when shift lever is in high gear position. Adjust switch so that the contacts close just as the shift lever linkage free play is taken up. Replace the switch if it is faulty. Check wiring to switch for ground.

   A governor switch in which the "EC" contacts are burned and stuck together will cause this condition. See Electrical Checks to test for this condition (Fig. 19).

6. Clutch disengages when driving in high gear with very small throttle opening below governed speed.

   Cause:

   Accelerator switch inoperative or out of adjustment.

   Correction:

   Check and readjust as per instructions (Fig. 18).

7. Electromatic clutch will not disengage clutch when attempting to shift from direct to second speed while driving above governed speed, but clutch operation is satisfactory otherwise.

Cause:

Direct speed switch faulty or out of adjustment.

Correction:

Test direct speed switch as shown in Fig. 17 and adjust according to instructions.

8. Car "lurches" in second speed above governed speed each time accelerator is released and depressed again.

Cause:

Second speed solenoid not operating properly. Faulty or burned "AD" governor contacts (Fig. 6), burned out fuse, or in the case of the 19th series cars a faulty second speed switch (Fig. 7).

Correction:

Remove fuse and examine. Check "AD" governor contacts (Fig. 19), second speed switch, and second speed solenoid according to electrical check instructions. Check above governed speed in second gear.

9. Excessive clutch slippage on fast starts in all gears.

Cause:

Front end clutch valve body plug being out of adjustment (turned in too far).

Correction:

Turn the front end valve body plug out (counterclockwise) one full turn as shown in Fig. 15. Then if clutch engagement on fast starts is too severe, turn the valve body plug in (clockwise) 1/4 turn at a time until clutch engagement is satisfactory.

10. Clutch engagement too rapid on fast starts but otherwise satisfactory.

Cause:

Front end clutch valve body plug out of adjustment (turned out too far).

Correction:

Turn the clutch valve body plug in (clockwise) 1/4 turn at a time until clutch engagement is satisfactory (Fig. 15).

11. Excessive accelerator pedal movement before the clutch starts to engage.

Cause:

Gap too great at the engine speed screw.

Correction:

Adjust engine speed screw gap to 7/32 inch plus or minus 1/32 inch according to adjustment instructions (Fig. 9).

12. Failure of Electromatic to operate at proper time or spasmodic operation of Electromatic.

Cause:

Loose or bad electrical connections.

Correction:

Examine and tighten all electrical connections of the Electromatic mechanism, especially the cable connectors at the governor switch (Figs. 6 & 7). Be sure to examine fuse in main feed cable near the starting motor terminal.

13. Overdrive engages as soon as the gearshift lever is placed in low or reverse gear on cars equipped with Electromatic clutch and overdrive.

Cause:

Fuse in the Electromatic main feed cable burned out (Fig. 6 & 7). A broken or disconnected Electromatic main feed cable would also cause this condition. A burned out Electromatic fuse will permit a current reversal through the governor switch "AD" terminal and the low and reverse solenoid. This will cause the overdrive solenoid to become energized, engaging the overdrive.

Correction:

Replace Electromatic clutch fuse and check wiring.

* * *