THE HUDSON DRIVE-MASTER

Hudson Drive-Master is a new conception of simplicity in driving. Clutch pushing is entirely eliminated. Gear shifting is eliminated except when reversing or starting under unusual conditions.

There is nothing new to learn - nothing to get used to - the Hudson equipped with Drive-Master has the same controls as the conventional car and if desired can also be driven in the same manner.

With Hudson Drive-Master, gears are shifted silently and automatically at the will of the driver - there is no pre-determined speed for gear shifting. For forward driving, the gear shift lever is merely placed in the normal high gear position.

Upon depressing the accelerator pedal the car moves forward in "pick-up gear." This is equivalent to second gear and its ratio provides a smooth, fast get-away. After accelerating to the desired speed in pick-up gear - up to any speed the driver wishes - the accelerator pedal is released momentarily and the shift is made instantly and automatically into high gear. When coming to a stop, just apply the brakes. The transmission is automatically shifted from high to pick-up gear and the car is ready to start. That's all there is to driving with the Hudson Drive-Master.

Hudson Drive-Master has many advantages over other devices which minimize or eliminate clutch operation and gear shifting. The power is transmitted from the engine to the rear wheels through conventional units.

NO EXCESSIVE SLIPPAGE

It is economical and positive - no slippage and no lost power.

FAST ACCELERATION

It gives fast acceleration since its action is immediate and positive.

COMPLETE CONTROL

The driver has complete control of the car at all times - he can shift from Pick-Up to High or High to Pick-Up when he wants and at any speed he desires.

NO CREEPING

With Hudson Drive-Master there is no tendency to "creep" when the car is standing with the engine running - no necessity for continually applying the brakes when waiting at traffic intersections.

THREE DRIVING METHODS

With Hudson Drive-Master you have a choice of three driving methods:

1. All normal driving is done without gear shifting or clutch pushing.

2. Automatic clutch operation with manual gear shifting.

3. Manual clutch and transmission operation - the same as with a car not equipped with Drive-Master.

Hudson Drive-Master is one of the most important driving developments introduced in many years.

It is exclusive with Hudson.

It uses the Hudson time proven Clutch and Transmission.

It is the only system of driving control introduced by any American Automobile Manufacturer which can not, through failure of the automatic controls, prevent normal use of the car.
Here is a general view of the chassis showing the driving controls and the location of units which control the Clutch and Transmission Shifting.

It should be noted that except for the Drive-Master switch, which is not touched except when the driver wishes to change the method of driving, all controls are identical to those of a conventional car.
THE INSTRUMENT PANEL SWITCH

This switch is used to select any of the three methods available to the driver of a Hudson car equipped with Drive-Master.

Pressing the right button marked "HDM" prepares the car for driving with automatic clutch operation and automatic shifting of the transmission Pick-Up and High gears.

Pressing the center button marked "Vac" gives automatic clutch operation and manual shifting of gears.

Pressing the left button marked "Off"-reverts to conventional driving with manual operation of the clutch and gear shifting - exactly the same as a car not having Drive-Master Equipment.

ELECTRICAL CONTROLS

Electrical current for Drive-Master control is taken from the Ignition Switch through the Circuit Breaker to the Drive-Master Instrument Panel Switch.

The starter button circuit is also taken from the Circuit Breaker through the Clutch Switch of the Drive-Master to prevent starting the engine with the clutch engaged. (The clutch switch will be described later.)

CIRCUIT BREAKER

This is built into a special fuse block which provides two fused circuits for the electrical units of the car and a thermostatic overload circuit breaker to protect the Drive-Master control units. Should there be an overload due to a short, a clicking noise will be made by the circuit breaker as it operates to protect the Drive-Master Control Units.
CLUTCH CONTROL UNIT

The clutch control unit is mounted on the left side of the engine. A vacuum line connects to the engine intake manifold to provide the power for operation.

The power is transmitted from the vacuum cylinder piston through a rod direct to the clutch throwout yoke shaft.

The engaging and disengaging control is obtained through the accelerator switch and linkage connected with the accelerator pedal.

The unit used with the Drive-Master is identical with the mechanism so successfully used with Vacumotive Drive. It, however, is fitted with a throttle locking device which holds the throttle and the accelerator switch closed to prevent gear clash while the transmission shift is being made.

The throttle lock consists of a vacuum operated diaphragm connected to the accelerator linkage through a cable. Vacuum in the cylinder pulls up on the cable closing the throttle and holding the accelerator switch against the stop even if the accelerator pedal itself is pushed to the wide open position.

A solenoid mounted beside the clutch control solenoid controls the vacuum to the throttle lock.

On the 1942 Clutch control units each solenoid was fitted with two Douglas terminals. Although all wires carried a color code, the wires were sometimes incorrectly connected.

In the 1946 unit a plug connector is used on the throttle lock solenoid. This makes it impossible to connect the wires incorrectly as the wires at the clutch control solenoid can be interchanged without affecting operation.
THE ACCELERATOR SWITCH

When the foot is removed from the accelerator and the throttle is closed, the accelerator switch closes the electrical circuit through the clutch control solenoid, opening the vacuum valve and the clutch is disengaged.

Depressing the accelerator pedal opens the points of the accelerator switch permitting the clutch to reengage.

On the 1942 accelerator switch there are three Douglas terminals so that it is necessary to check the wire color code to insure correct wiring.

On the 1946 accelerator switch the terminals have been replaced by a three prong plug making it impossible to connect the wires improperly.

SHIFT RAIL SWITCH

The circuit is completed from the accelerator switch terminal to the transmission rail switch which forms a ground except when the transmission is in high gear. The circuit is also completed from the "RW" terminal to the governor which forms a ground at car speeds below 20 miles per hour.

TRANSMISSION POWER UNIT LOCATION AND CONNECTIONS

The power unit is mounted on the frame X member and connected by a tube to the engine intake manifold, from which the vacuum power is obtained. A breather line connects the power unit with the carburetor air cleaner to prevent dirt from entering the unit.

A shifting rod and transfer rod are connected to the transmission shifting linkage to transmit the motion of the power unit.
THE TRANSMISSION POWER UNIT

The power unit consists of:

1. A vacuum cylinder to provide the power for actually shifting the gears.

2. A vacuum diaphragm cylinder, called the Transfer Cylinder, which disconnects the manual shifting linkage and connects the power shifting linkage to the transmission shift rail when the HDM button is pushed in.

3. Electrically operated valves for controlling the vacuum to the shifting and transfer cylinders.

There are four terminals on the cover plate of the solenoid valve housing marked from top to bottom BK - BL - W & B.

The BK wire is connected to the car frame to form a positive ground for the valve solenoids.

When the circuit is closed to the BL terminal, the valve opens connecting the front of the shifting cylinder to the engine manifold vacuum. The shifting cylinder piston moves forward and through the linkage shifts the transmission into second gear.

The B terminal is connected to the solenoid which controls the vacuum to the rear of the shifting cylinder. When the circuit is closed to the B terminal, the valve opens admitting vacuum to the rear of the shifting cylinders. The piston moves to the rear and through the linkage shifts the transmission into high gear.

The W terminal is connected to the solenoid which controls the vacuum to the Transfer Cylinder (Diaphragm.)

Normally the spring behind the diaphragm holds the diaphragm forward. In this position the manual shifting linkage is connected to the Transmission shifting shaft. When the circuit is closed to the W terminal, the solenoid opens the valve connecting the rear of the Transfer cylinder to the engine manifold vacuum. The diaphragm moves backward disconnecting the manual shifting linkage and connecting the power shifting linkage to the transmission shift shaft.
The description of the power unit just given refers to the terminal arrangement used in 1942. The individual terminals have been replaced by a three prong plug connector on the 1946 units. The ground wire is still connected to a separate terminal, marked BK.

The plug connector is used to prevent incorrect connection of the wires to the unit and also to protect the connections from road splash and corrosion.

THE TRANSMISSION SWITCH ASSEMBLY

The transmission switch box is mounted on the left side of the transmission and contains the mechanically operated switches used to control the operation of Drive-Master.

The switches contained in this unit are:

(a) Transfer Switch
(b) Clutch Switch
(c) Selector Switch
(d) Neutral Switch and Limit Switch.
THE TRANSFER SWITCH

The transfer switch lever is located on top of the Transmission Switch housing and is operated by a non-adjustable link connected to the transmission cross shift selector lever.

When the manual shift lever on the steering column is moved through the neutral cross over to the high and second side, the Transfer switch lever is moved forward closing the switch points.

When the HDM button is in, the circuit is closed to the Transfer Switch. The circuit is completed through the transfer switch to the solenoid of the power unit which controls the diaphragm Transfer cylinder. The diaphragm is therefore always drawn backward connecting the transmission power shift linkage when the HDM switch is on and the manual shifting lever is on the high and second side.

Moving the manual lever to the low and reverse side moves the transfer switch lever backward, opening the switch and the diaphragm spring moves the transfer linkage to disconnect the power shift lever and reconnect the manual shift in preparation for manual shifting into low or reverse.

THE CLUTCH SWITCH

The clutch switch is located at the bottom of the transmission switch housing. The lever is connected to the clutch throwout shaft lever. When the clutch is disengaged, the clutch switch lever is moved backward.

One set of points is closed to complete the circuit of the starter button.

A second set of points is closed completing the circuit to the selector switch and the neutral and limit switches.

Since the clutch switch is open when the clutch is engaged, no electrical current is used while the car is being driven in any gear.
THE SELECTOR SWITCH

The selector switch lever is connected to the transmission shifting lever by a non-adjustable rod.

When the gear shifting lever on the steering column is moved to second gear position, the selector lever is moved forward closing the circuit to the BL terminal of the power unit which causes the power unit piston to move forward and shift the transmission into second gear.

When the gear shifting lever is moved to the high gear position the selector switch closes the circuit required for automatic shifting of the transmission into pick-up and high gear.

THE NEUTRAL SWITCH AND LIMIT SWITCH

Both of these switches are operated by one lever which is connected by an adjustable link to the transmission power shifting lever.

The neutral switch has two sets of points both of which are open when the transmission is in neutral.

When the transmission is in second or high gear one set of points are closed and the other open.

If neutral is selected on the gear shift lever when the transmission is in high gear, the circuit from the neutral point on the selector switch goes through the closed points of the neutral switch to the power unit solenoid which controls the forward (shift to second) movement of the piston. The piston moves forward moving the transmission out of high gear. When the transmission reaches the neutral position the neutral switch points are opened and the shift stops.

If the transmission is in second gear when neutral is selected, the other set of points of the neutral switch are closed and complete the circuit to the power unit solenoid which controls rearward movement (shift to high) of the piston. Again when the transmission reaches neutral the neutral switch points are open and the shift stops.

The limit switch also has two sets of points but both sets are closed when the transmission is in neutral. One set of points is opened only when a shift is completed into high gear and the other opened only when a shift is completed into second gear. This switch completes the circuit to the throttle lock solenoids and prevents the throttle being opened until the shift is completed.
THE GOVERNOR SWITCH

The governor switch is located at the rear of the transmission and is driven by the speedometer drive gear.

The governor controls circuits in both the clutch control and transmission control circuits and is also capable of controlling the overdrive unit on cars so equipped.

(b) The terminal "R" is grounded through a set of points at speeds above 20 miles per hour. This terminal and points are used only on cars equipped with overdrive.

(c) When the gear shift lever is moved to the high gear position, the circuit is completed from the selector switch in the Transmission Switch housing to the "Y" terminal of the governor. At speeds below 14 miles per hour the governor points are closed to connect from the "Y" to the "BL" terminal. The "BL" terminal of the governor is connected to the "BL" terminal of the transmission Power Unit so that the front of the power cylinder is connected to the engine manifold vacuum and the transmission is shifted into second gear.

At speeds above 14 miles per hour the "Y" terminal of the governor is connected to "B" terminal which in turn is connected to the "B" terminal of the transmission power unit and causes a shift into high gear.

The governors used in 1942 and in 1946 are identical except that the individual terminals formerly used are now replaced by a 4 prong connector plug. This prevents improper installation of the wires and protects the contacts from road splash and corrosion.

The governor circuits are:

(a) Terminal "R" is connected to ground through a set of points, which are closed at speeds below 20 miles per hour, to complete the clutch control circuit from the accelerator switch.

When these points are closed the clutch will be disengaged when the foot is removed from the accelerator pedal, closing the accelerator switch.
Before proceeding with the checking of the other units of Drive-Master, it should first be determined if Vacuum Drive, or the automatic clutch control portion of the system is functioning properly. This can be done by depressing the "Vac" button on the instrument panel switch and operating the car by manually shifting the gears. If everything functions as intended with a car equipped with only Vacuum Drive, that portion of the system can be passed up and the difficulty looked for in the other Drive-Master units. If at this point Vacuum Drive operation does not appear to be entirely satisfactory the following adjustments should be made to this unit before proceeding with other Drive-Master checks.

1. Lash at Bellcrank Yoke
With engine shut off there should be 1/8" clearance between the clevis pin and end of slot in the link as shown at (D). This can be checked by pulling the piston rod backward as far as possible. At this point the front end of the pull rod link should be flush with the front edge of the bellcrank as shown at (E). If adjustment is required, loosen lock nut and adjust nut (F) in the link on the rod to increase or decrease the clearance. Tighten lock nut and recheck as above.

(a) Excessive lash at this point may cause the clutch to drag. This drag will prevent completion of the gear shift and the throttle will lock. When the throttle is locked because of this condition, the gear shift can be completed and the throttle unlocked by depressing the clutch pedal manually. Excessive lash might also result in complete failure of Drive-Master due to insufficient travel of clutch switch.

(b) No lash at this point will cause clutch to slip.

2. Accelerator Cross Shaft Adjusting Screw
Depress the clutch pedal (IMPORTANT) and start engine. Back out cam lever adjusting screw until there is approximately 1/2" clearance between cam and the screw end. Slowly rotate bellcrank, until clutch begins to take hold. Turn throttle cross shaft adjusting screw until there is a slight increase in engine speed when the car begins to move. If engine speed is too great, turn out adjusting screw. Be sure to tighten lock nut.

(a) Excessive clearance at this throttle screw will cause the engine to stagger on clutch engagement.

(b) Insufficient clearance will give excessive engine speed before clutch engagement.
3. Disengagement Travel of Piston

With the engine running and with the compensating pin (M), away from its stop, check the movement of the piston rod. Make this check by pressing on valve lever at (O) and releasing it. When lever is released, piston rod end (N) should move back 1/2". If lever does not move back 1/2", check to see that cam swivel (P) is set in rear hole of cam lever (Q). Then adjust threaded sleeve (R) in or out until piston rod end (N) returns to proper position. Moving sleeve in opposite direction moves rod end away from dash.

(a) Insufficient travel of the clutch control piston will have the same effect as excessive lash at bellcrank yoke.

(b) Too much travel of the piston will cause it to stick in the end of the cylinder and make clutch engagement erratic.

4. Cushion Point or Final Adjustment

This adjustment should be made immediately after starting the engine and with the compensator pin (M), forward away from the stop. Set brakes and shift transmission into second gear, hold cam "U" against screw (S) by pressing on valve lever at (O) and turn adjusting screw out until engine stalls. Restart engine and stall it a second time in the same manner.

(a) Improper adjustment of the cushion point will affect the engagement of the clutch in the same way as improper clearance at accelerator cross shaft adjusting screw.

(b) If this adjustment results in excessive slippage on road test check bellcrank yoke lash.
The power for operating the clutch and shifting the transmission is obtained from the engine intake vacuum. Inability to shift or sluggish operation may be due to low manifold vacuum. The vacuum gauge should read from 19 to 21 to insure proper engine performance as well as correct Drive-Master operation.

Leaks in the vacuum lines will cause failure or sluggish operation of the Drive-Master.

All vacuum line fittings should be checked for tightness but the hose connections should be given particular attention.

These are as follows:

1. In vacuum line connecting clutch power unit with intake manifold.

2. In vacuum line between clutch power unit solenoids.

3. In vacuum line connecting throttle lock solenoid with throttle lock diaphragm.

4 & 6. In breather pipe connecting Transmission power unit with carburetor air cleaner.

5 & 7. In vacuum line connecting Transmission power unit with intake manifold.

8. In vacuum line connecting Transmission power unit solenoid housing to front of power cylinder.

9. In vacuum line connecting Transmission power unit solenoid housing to rear of power cylinder.
The hose connections used on the line from the manifold to the transmission power unit and from the air cleaner to the power unit in 1942 were sometimes cut by the ends of the metal tube pinching the inner rubber. To avoid this in 1946 a spring is placed inside the hose to prevent the metal tube ends pinching the rubber. Hose clamps have been added to keep the spring from pushing the tubes out of the hose.

The electric current for controlling the clutch and Drive-Master originates at the battery. It is important that the battery be in good condition and that there are no abnormal electric losses in the system.

The important points to be checked are indicated on the illustration and are as follows:

1. Solenoid terminals on clutch unit.
2. Terminals on accelerator switch.
4. Governor switch.
5. Power unit terminals.

The battery must be in good condition - specific gravity not less than 1,200.
The terminals on the governor and wire ends must be clean. Scrape each wire end and be sure each is securely held in its proper terminal.

Apparently people not acquainted with Drive-Master remove these wires and replace them without regard to position as improper operation is frequently traced to incorrect installation of the wires. When cleaning these terminals be sure to check the wire color code. In some cases it will be necessary to strip the braid back about an inch to see the wire color. Experience shows definitely that this check will save a lot of unnecessary work in servicing Drive-Master.

The terminals and wire ends at the transmission power unit require the same cleaning and checking as those at the governor. Be sure they are clean and securely held in the proper terminals. Again it is important to check the color code of the wires.

The clutch control and throttle lock solenoid terminals and wire ends must be clean and the wires securely held.

It may be well here to get acquainted with some details which will help later in diagnosing service troubles.
The Clutch Control Solenoid contains a single winding with each end brought out to a terminal. It makes no difference which direction the current flows through this winding, as the only important thing here is to be sure the clutch control wires and not the throttle lock wires are attached to the right hand solenoid. The Black wire with white tracer, which is the hot wire from the circuit breaker and the Brown wire with White tracer, which goes to the accelerator switch, must be securely connected to the Clutch Control terminals.

The throttle lock solenoid looks like the Clutch Control Solenoid but is very different. This solenoid contains two windings. One end of each winding is connected to a terminal while the other end of the windings is grounded to the solenoid housing. One winding opens the valve to apply the throttle lock when a shift is being made into high gear and the other when a shift is being made into second gear. It makes no difference which winding controls either shift so the important thing is to have both green wires securely connected to throttle lock solenoid terminals.

In order to make this set-up absolutely fool proof, the terminals on the throttle lock of the 1946 unit have been replaced by a plug connector. The only place the plug can be put, is on the throttle lock solenoid plug prongs. This leaves two wires and two terminals on the clutch control solenoid. As already explained, interchanging these two wires between the terminals will not affect the clutch control unit operation, so just plug them into the two terminals and if they are clean and tight, there will be no trouble at this point.

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You won't have any trouble at the transmission switch plug, unless the plug has not been pushed clear in. Once this plug is in place the clips will hold it. It can only be assembled in one way insuring proper connections and since the prongs and sockets are silver surfaced, you won't have to worry about corrosion. Just see that the plug is all the way in and held by the clips, then be sure to put the boot in place to keep water from entering the switch housing.
Check the dash plug to see that it is properly inserted. Occasionally this will get partially disengaged by being bumped when under-hood servicing is being done. Be sure to check this plug before doing a lot of guessing. A little push here may be all that is necessary to get proper operation.

Maybe we should have brought this up before - always be sure the HDM switch is on. A quick check can be made by moving the gear shift lever back and forth through neutral with the engine running. The transfer key should be heard as the lever is moved.

While under the car checking the power unit wires and terminals, check the linkage to see that all rods are in place and connected at both ends. Take a second look at the ball socket joint on the front of the transfer key rod shown in the circle.
This joint is an unusual design to permit adjustment of the rod without affecting clearance of the ball in the socket. Pull the rod back and forth. If looseness is felt, turn the threaded adjusting sleeve in. Lubricate this joint and the transfer key pivot with viscous chassis lube through the fitting on the key to be sure there is no binding.

All of the accelerator linkage as well as the bellcrank having the torsional spring assembly should be free and well lubricated.

The entire throttle mechanism must return solidly against the stop on the accelerator switch as shown when the accelerator pedal is released. This is very important. If the accelerator switch does not return to its stop the clutch will not be disengaged and the Drive-Master will not work.
CLUTCH SWITCH

Before making any check on the clutch switch, which is located in the transmission switch housing, check clutch pedal lash. This must be 1 1/2 inches as shown. Then make the following check.

With the engine not running, ignition key on, and starter button depressed, slowly push the clutch pedal down.

The starter should operate before the pedal is 2 inches from the toe board, if the clutch switch and linkage is properly connected.

TRANSFER KEY

The gear shift lever, when in neutral, must return by means of its own return spring positively to the second-high side when released from any position in the crossover. If any binding occurs free up the cross shift linkage before attempting any other servicing.

The gear shift lever must be on the high and second side at all times to energize the transfer cylinder and hold the transfer key engaged in the power shift lever as shown.
Check the transfer key operation by moving the gear shift lever back and forth through the neutral crossover. The transfer key should engage in the manual shift lever during the upper part of the movement of the gear shift lever and in the power shift lever, during the lower half of this movement.

The preceding checks are general but experience has shown that it is good practice to make these checks before making any changes or adjustments.

DRIVE-MASTER TROUBLE SHOOTING

In the previous sections we have tried to give a general knowledge of the construction and operation with some service checks on the Drive-Master. Now let's put this to use in diagnosing and correcting actual service problems.

Before you start repairing an engine you look at the symptoms, the things it doesn't do or does wrong and from this you determine what correction is required.

Let's look at the Drive-Master in the same way. Find out first what it does or does not do, then determine what correction should be applied. If this procedure is followed you can usually go right to the source of the trouble instead of having to make a "complete overhaul" of each job.

PLUGS AND SOCKETS

Here are shown the various plugs and sockets used with the car wiring and Drive-Master wiring harnesses. On the first production 1946 cars, numbering of the connection terminals, shown here on both plugs and sockets, was omitted, and in making the checks covered in the following it will be necessary to count the terminal positions. As will be noted, all plugs are numbered in a counterclockwise direction starting from the indentation on the outside of the plug, while the mating sockets are numbered clockwise, from the same starting point.
HERE ARE SOME SERVICE PROBLEMS

CONDITION NO. 1.

When coasting against engine in high gear.

(1) Car speed falls below 20 M.P.H.
   (a) Clutch automatically disengages.
   (b) Throttle lock comes on.

(2) Car speed falls below 15 M.P.H.
   (a) Transmission shifts to 2nd gear.
   (b) Throttle lock releases.

Now to analyze a minute:

What happens in the normal operation at 20 M.P.H.? The governor opens or closes the clutch control circuit - so as car speed falls below 20 M.P.H., the clutch control circuit is closed and since the throttle is closed, as we are coasting against the engine, the clutch disengages - so far this is normal operation.

Now, let's look at symptom (b) under condition (1). The throttle lock comes on. - What is the purpose of the throttle lock? When does it come on? - The throttle lock is to prevent opening the throttle until the shift is complete. It comes on when a shift is selected manually or automatically and stays on until the shift is completed. Then if it stays on we may assume that the previously selected shift - to high gear - was not completed.

Condition No. 2 gives us a further clue to our trouble. At 15 M.P.H. the Drive-Master governor changes the circuit to shift from high to second when speed is being reduced so the shift to 2nd gear is normal. The releasing of the throttle lock after the shift is also normal.

Actually we have found only one thing that is not normal and that is an incomplete shift into high gear.

CAUSE:

Incomplete Shift into High Gear Due To:

A. Improper adjustment of power shift rod.

B. Incorrect adjustment of power lever stop screw.

We, of course, assume that a normal shift is obtained into high gear when shifting manually. If this is the case, the causes shown are the only things which could prevent complete shift into high and have all other operations normal.
CORRECTION A

If the power cylinder piston rod is too long, the piston will bottom against the rear end of the cylinder stopping the shift into high before the limit switch has opened to release the throttle lock.

To check this, put the transmission in neutral with the gear shift lever. Pull back on the transfer diaphragm cylinder rod and fully engage the transfer key in the power lever. Now measure the distance from the rim on the front housing to the end of the piston shaft as shown. This should be 4 inches and is most easily measured with Power Unit Gauge J-1861.

If this measurement is more or less than 4 inches, loosen the shaft lock nut and rotate the shaft until correct measurement is obtained. Tighten lock nut securely after this adjustment.

CORRECTION B

If the above is correct and the condition still exists, we must adjust the power lever stop screw.

When the transmission is shifted by the power cylinder into high gear, the power lever rests on top of the stop screw and when shifted into second the power lever rests against the bottom of the stop screw.

To adjust loosen the Allen set screw indicated by the lower arrow. Turn the stop screw up and shift the transmission manually into second gear. Push the piston rod forward until the transfer key can be engaged in the notch in the power lever. Turn the stop screw down until it just touches the power lever. Then back off 1/2 turn and lock the set screw securely.
The adjustment of the stop screw on 1942 cars requires the removal of the floor mat and cover plate. On the 1946 cars the screw is slotted on both ends so that it is possible to make the adjustment from under the car. When making the adjustment from below, shift the transmission into high gear instead of second as described above. Turn the stop screw up to the lever then back off 1/2 turn.

Before we leave this case, there may be some of you who would like to know how we could be driving in high gear above 20 M.P.H., if the throttle lock would stay on when the shift to high gear was incomplete.

That is a good question and the answer is, we went above 20 M.P.H. in second gear so the clutch control circuit was opened in the governor. The shift to high was near enough complete so that the high gear shift rail switch was opened. This let the clutch control solenoid close off the vacuum, so the clutch disengaged opening the clutch switch and there was no electrical connection to the Drive-Master to hold the throttle lock on.

Just as soon as the circuit in the clutch control was reestablished by the governor closing at 20 M.P.H., the throttle lock came on as described in the statement of our conditions.

**CONDITION NO. 2**

Transmission shifts into high gear with car standing when gear shift lever is moved into high gear position.

(a) Throttle lock releases after shift.

(b) Throttle lock does not release after shift.

Normally when the car is standing with HDM on the transmission should shift into second gear for pickup. If it shifts into high gear it is probably due to the transfer key not having engaged in the power lever, so that the shift to high was actually a manual shift. If this is the case you should be able to feel the extra effort required to place the gear shift lever into high gear position.

In some cases this will happen if the shift lever is moved very rapidly through the neutral cross-over into high gear, so before making any further checks shift back to neutral and shift slowly into high gear.

If the transmission shifts into second as it should, check the transfer key linkage for binding and proper lubrication.

If however, the transmission still shifts into high gear there are two causes which must be checked.

**CAUSE:**

(a) Transfer key not operating.

In this case the throttle lock releases because the power unit has shifted to second gear position as it should, but with the transfer key still engaged in the manual lever, the transmission was actually shifted manually into high gear.

(b) Transfer key not operating and power unit not shifting.

Failure of the power unit to move to second gear causes the throttle lock to remain on.
CORRECTION

The current for the transfer key is taken from #3 terminal of the Instrument Panel Control Switch through the Black wire, so we should start our check here to see that the wire is tight in the terminal.

The black wire from the panel switch is connected to socket #4 in the body dash plug, so our next check will be with a test lamp from #4 socket to ground.

No light indicates trouble in the body harness, but before removal check the connection of the black wire to the plug by snapping the plug cover off.

If the test lamp lights, reconnect the plug and proceed with the test.

We must go under the car for the next checks and should first look at the linkage.

(1) Link from transmission crossover lever to transfer switch.

(2) Rod from diaphragm cylinder to transfer key.

See that both rods are properly connected and move freely. The rod to the transfer switch will have to be moved by the gear shift lever while the diaphragm rod can be moved backward to engage the key by pulling on the rod.
Now to get back to our electrical circuit. The black wire has been checked as far as the dash plug. Be sure the dash plug is reinserted, the HDM button pushed in, the ignition switch on and the gear shift lever is on the high and second side of the shift.

Place a test lamp from the "W" wire at the power unit "W" terminal to ground. If the lamp lights, the wiring circuit through the chassis harness and the transmission switch is O.K. and the difficulty is in the power unit. (We will come back to this in a moment.)

If the lamp does not light we must check the circuit at the Transmission switch.

Before going on with our check here is the method for using the test lamp on the 1946 harness having a multiple plug at the power unit. Simply place the test lamp prod in the #3 socket of the plug to which the "W" wire is connected and place the other prod to ground. If your test lamp prod is too big to go into the socket, put a cotter pin in and contact this with the lamp prod.

We still have to check the black wire from the body dash socket to the Transmission Switch.

By removing the Transmission Switch plug we can contact Prong #8 to which the black wire is attached and ground the lamp as shown. No light indicates trouble in the chassis harness. This could be due to a poor connection of the black wire to the prong of the body dash plug and should be checked before removing the harness for replacement.
If the test lamp lights when attached to Prong #8 we must look for an open circuit from the Transmission switch to the "W" terminal of the power unit.

This is done by connecting a lamp at the "W" terminal of the power unit to ground and touching a "hot" wire to #1 prong of the transmission switch plug as shown. If the lamp does not light the chassis wiring harness must be replaced.

If the lamp lights the trouble is in the transfer switch and the Transmission switch must be replaced.

Now going back to the testing at the power unit. You will remember that we said if the lamp lit when connected to the "W" terminal and ground the trouble was in the power unit. Let's look for that trouble.

This is the way we made the same check and found the circuit O.K. on the 1946 unit. Test lamp from socket #3 to ground.
First we check the ground of the power unit to the frame. The power unit is mounted on rubber, and the vacuum lines have rubber connectors, so a separate ground must be made. This is made by the wire from the BK terminal to the frame, but for a check we will make a separate ground with another wire or a tool. With this ground made and the engine running, the transfer key should operate. If it does not, we must look further for our trouble.

We know the "W" wire is "hot" so we remove it from its terminal and touch it against the "B" terminal with the engine running. The power unit piston should move backward. If it does, we have proven that the full vacuum is reaching the power unit and further have proven that our power unit ground is good.

If the power cylinder piston does not move backward when the "W" wire is touched against the "B" terminal, make a further check by touching the "W" wire against the BL terminal.

If the piston moves forward, it is proof that the vacuum lines are O.K. but the valve operated by the "B" wire is probably inoperative.

If however, the piston does move and the diaphragm does not move back when the "W" wire is attached to the "W" terminal, the "W" solenoid is burnt out, the valve stuck, or the diaphragm punctured. Any of these conditions will require removal and repair of the power unit.
Here is how we make the above tests on the 1946 model—simply put a cotter pin in the #3 socket to which the "W" wire is attached and touch the cotter key against prong #1 for forward movement of the power cylinder piston and prong #2 for rearward movement.

If the above checks showed insufficient vacuum to the power unit, check the four hose connections at the power unit as well as the two at the right side of the engine, just above the engine pan. Cracked or collapsed hoses should be replaced.

**CONDITION NO. 3**

A. Transmission does not shift when high gear is selected.

B. Transmission does shift from neutral to second or second to neutral when selected.

This, of course, refers to shifting with the car standing, engine running and HDM on.

**CAUSE:**

A. Poor electrical contacts of wires at governor terminals.

B. Improper operation of governor.
CORRECTION A

If you can’t see the color code on the wires at the governor it is well to tag the wires before removing them from the terminals. Remove the wires from the governor and clean the terminals and the wire ends. When replacing be sure each wire is held securely in the terminal.

Where there is any reason for doubt, and there usually is, identify the colors of all wires to be sure they are properly connected.

If cleaning the wires and terminals does not correct your trouble - remove the governor. Remove the cover and clean the four sets of points. Care must be taken not to bend the point mountings as this will change the speed at which the points open and close.

CONDITION NO. 4

Hard or impossible to move gear shift lever from high and second side to low and reverse side of neutral when HDM is on. Manual shifting O.K.

CAUSE:
Transfer key notches in manual and power shift levers not in line, when gear shift lever and power unit are in neutral.
CORRECTION A

The position of the manual lever notch is determined by the engagement of the plunger in the depressions in the back face of the lever. Since this position cannot be adjusted it is necessary to change the position of the notch in the power lever to obtain alignment. The position of the power lever when the transmission is shifted to neutral by the power unit, is determined by the point at which the neutral switch points open.

When describing the neutral switch and its operation earlier, you will remember we said that when neutral is selected with the HIM the circuit is through the neutral switch to the power unit. When the neutral position of the switch is reached due to movement of the power unit, which is at the same time shifting the transmission toward neutral through the power cylinder rod connected to the power lever, the neutral switch points are both open so the power unit and the transmission movement are stopped.

Please note we say the transmission is being shifted "Toward" neutral. Whether it is shifted exactly to neutral or not depends upon the length of the rod which connects the neutral switch lever and the transmission power shift lever.

CORRECTION B

Remember as you are making this adjustment you are simply adjusting the rod so that the transmission is in neutral when the neutral switch points are open.

When the mark on the neutral switch lever is in line with the mark on the transmission switch housing, the neutral switch points are open. This is so because the manufacturer of the switch built it that way. Put a 10-32 screw through the lever and screw into the housing as shown at the arrow to the right on the illustration, align the mark on the arm with the one on the housing and tighten the screw. Now we know we have the neutral switch in exact neutral.

Next we back off the two nuts on the front end of the rod as shown at the left of the illustration. This permits movement of the power lever to bring it into alignment.

Now shift the transmission into high or second gear manually and back to neutral. This puts the transmission exactly in neutral aligning the internal shifting linkage for proper cross shifting.

Now we simply align the notch in the power lever so that the transfer key will enter. This is done by pulling backward on the transfer key rod as indicated by the arrow in the insert, then —
CORRECTION C

Moving the power cylinder rod backward or forward to turn the power lever until the transfer key engages in the power lever notch. Finally the nuts at the front of the neutral switch rod are tightened against the trunnion block to retain the position of the power lever.

In connection with this adjustment remember this - You are not adjusting the neutral switch - You are synchronizing the neutral position of the neutral switch with the exact neutral position of the transmission.

Never tamper with the adjustment unless you experience difficulty in cross-shifting when HDM is on. There is no other condition that this adjustment will cure.

CORRECTION D

In making the previous check it may have been impossible to get complete engagement of the transfer key in either the manual or power shift lever. If this occurs you will probably find that the transfer cylinder diaphragm rod is improperly adjusted.

Measure the distance from the front cover of the diaphragm cylinder to the end of the diaphragm rod. This should be 3 1/4 inches and is most easily measured by use of Power Unit Gauge J-1661 shown in the illustration.

The adjustment is made by loosening the lock nut and turning the rod. Always hold the diaphragm rod with a wrench when making this adjustment to prevent damaging the diaphragm.

CONDITION NO. 5

Engine runs when accelerator pedal is depressed after release for shift.

CAUSE:
Throttle does not lock.
CORRECTION A

As explained previously the throttle lock should come on at the beginning of every shift and remain on until the shift is completed.

The throttle lock has no function in the operation of shifting but simply prevents opening the throttle and accelerator switch before the shift is completed. Without the throttle lock this could occur when trying a fast getaway where the accelerator is released and quickly depressed. If the throttle lock does not work, the shifting will be normal if a slight hesitation is made before depressing the accelerator pedal.

If the throttle lock does not come on, we should first check the mechanical set-up including all linkage which means that from the throttle lock to the throttle and also to the accelerator pedal.

This linkage must be properly connected and free in action to "snap" back against the accelerator switch stop, when the accelerator pedal is released.

With engine running and HDM on, watch the throttle lock cable while the gear shift lever is being moved to second, neutral or high gear. Each time the shifting lever is moved the throttle lock cable should move up and then down.

If the cable moves each time a shift is made, the trouble is in the adjustment of the stop nuts on the cable lower end.

To adjust, back off the stop nuts. With engine running and gear shift in neutral, connect a "hot" wire from the battery to one of the throttle lock solenoid terminals. The diaphragm should pull the cable up.

Now turn the stop nut up on the cable until it contacts the lever. Remove the "hot" wire to release the cable.

Turn the nut up 2 1/2 turns farther and lock in this position with the lock nut.

With the engine running and HDM button "on", connect a hot wire to one of the throttle lock solenoid terminals, and then to the other terminal. If the throttle lock does not operate when either terminal is connected, check the ground wire which can be seen in the illustration, attached by the two lower solenoid mounting cap screws.

After making sure this ground is good, repeat the test with the hot wire. If operation is not obtained, turn off the engine and listen for the valve to click when the wire is touched to either terminal. If clicking of the valve is not heard, the solenoid should be replaced.
CORRECTION B

If operation of the throttle lock was obtained by contacting the solenoid terminals with a hot wire, the trouble is in the wiring. The first check is to use a test lamp as shown to the left solenoid terminal and then -

CORRECTION C

- to the right terminal.

If the 1946 units are being tested, the test lamp is connected into one plug socket to ground as shown here, then to the other socket.
CORRECTION D

If the lamp is not lighted in the above test, disconnect the transmission switch plug. Connect a hot wire from the battery to one solenoid terminal on the 1942, or into one solenoid plug socket on 1946, as shown in the upper left. The test lamp should light when connected to transmission plug prong 6 or 7 and ground. The lamp should light on only one of these connections.

Next connect the hot wire to the other solenoid terminal and again try the lamp on prongs 6 and 7. The lamp should light on only one of these prongs.

If the lamp does not light with the hot wire connected to either solenoid terminal, the chassis harness must be replaced.

If the lamps light on above tests, the transmission switch must be replaced.

CORRECTION E

This illustration shows points which should be checked for vacuum leaks when difficulty is experienced with throttle lock operation.

CORRECTION F

In a previous illustration we showed the hot wire connected from battery to the prongs of the 1946 solenoid. This depicts the same operation with the 1942 unit having terminals.
CONDITION NO. 6

Clutch disengages when accelerator is released at speeds above 20 M.P.H. in high gear.

CAUSE:

A. Governor not opening automatic clutch ground circuit contacts.
B. Shift rail switch points do not open.
C. Wires from accelerator switch to governor and rail switch grounded.

Here are the points which must be checked together with the connecting wiring.

A. Governor switch.
B. Shift rail switch.
C. Accelerator switch.

CORRECTION A

Disconnect the RW wire from the Governor and tape the end to prevent it from grounding.

Drive the car with HDMI or VAC in high gear above 20 M.P.H.

After shifting into high gear the clutch control should be inoperative at all speeds since the governor wire is disconnected and the transmission rail switch is open. If the clutch does not disengage the governor points are not opening and the governor must be replaced.
If the test is being made on a 1946 car it is only necessary to pull the plug from the governor. In this case, however, the VAC button should be on and gear shifting done manually.

**CORRECTION B**

If the clutch disengages when driving in high gear in the previous test, the shift rail switch should be checked.

**CORRECTION C**

Disconnect the wire from the shift rail switch, with the RW wire still disconnected from the governor. Run the engine and check the clutch control for operation.

If no operation is obtained, the shift rail switch should be replaced.
CORRECTION D

If the clutch operates with the shift rail wire and governor RW wire disconnected, use a test lamp as shown to check for a short in either the Y or RW wire.

Disconnect the wire to be tested - "Y" shown here - touch the test lamp probe to the BK terminal - which is hot, with the VAC or HDM button on, and accelerator released - and to the Y or RW wire. If the lamp lights when connected to either wire, that wire is grounded and the chassis harness must be replaced.

The above test is made on the 1946 harness as shown. Here the #3 (RW) socket is "Hot".

CONDITION NO. 7

Clutch alternately disengages and engages, when coasting against engine in high gear above 20 M.P.H.

This condition is most likely to occur when coasting for a considerable distance as on a down grade or over rough roads.
When the transmission is in neutral, the diaphragm rod is in line with the power lever shaft but when the transmission is in high gear, the forward end of the diaphragm rod is above the center of the power lever shaft, giving a lever arm which tends to rotate the power lever back to neutral.

Since the clutch circuit is broken at the governor above 20 M.P.H. and at the shift rail switch in high gear, the HDM circuits are not energized. When the transmission shifts slightly toward neutral, the shift rail switch closes the clutch circuit. The clutch disengages, energizing the HDM circuits. The transmission is pushed back into high gear, the shift rail switch opened and the clutch reengages.

This condition is not experienced in second gear as the shift rail switch is always closed and the clutch will disengage and remain disengaged, as long as the foot is off the accelerator.

The correction for this condition is obvious - replace the broken or disconnected spring.

CAUSE B

In addition to the spring we should also check the position of the roller on the cam. In the illustration the transmission is in neutral. When shifting to high the portion of the lever on which the roller rests moves forward and the roller drops down the cam face to resist a tendency for the lever to return to neutral.

If the roller is not over the break in the cam face it is probably due to improper adjustment of the shift lever stop screw which is pointed out by the arrow on the illustration.

We have previously covered the adjustment of this screw so will omit the detail here, however, may point out a quick way of determining if an adjustment is necessary.
The central illustration shows the neutral switch lever in neutral position. Here the mark on the arm is in line with the mark on the housing.

To the left is the position of the neutral switch arm for second gear. Note here that the mark on the housing is just inside the right edge of lever window and in the high gear position on the right the mark on the housing is just inside the left edge of the lever. By checking the position of the lever in second and high to see that the movement is approximately equal, the need of adjustment of the shift stop screw can be determined.

**CONDITION NO. 8**

Throttle locks with car standing when either second or high gear is selected, but shifts normally from high to neutral or vice versa when car is moving from 15 to 20 M.P.H.

**CAUSE:**

Incomplete shift to second.

(a) Incorrect power cylinder shaft adjustment.

(b) Incorrect power lever stop screw adjustment.

When the car is standing, the normal shift is to second gear when either second or high is selected. Incomplete shift into second would, therefore, cause the throttle lock to come on, on both shifts when the car is standing.

If, however, the car is driven with manual shifting above 20 M.P.H. and then switch to HDM, shifts between neutral and high can be made normally but if second is selected, even at the higher speed, the throttle lock will come on.

**CORRECTION A**

The adjustment of the transmission power cylinder shaft has already been covered so it should suffice to repeat here that the proper adjustment calls for 4 inches from the rim of the cylinder cover to the end of the shaft.
CORRECTION B

The adjustment of the shift stop screw has also been covered so we will pass on.

CONDITION NO. 9

1. Clutch does not disengage with engine running and HDM button "on".

2. Transfer key does not operate when shift lever is moved through neutral.

3. Clutch disengages with "VAC" button on.

All three of the above conditions must exist for this diagnosis.

CAUSE:

HDM switch contacts not closing.

CORRECTION

Replace instrument panel switch.

CONDITION NO. 10

Vacuum unit does not disengage clutch, with "VAC" button pushed in, but operates when HDM button is in.

CAUSE

Vacuum switch contacts not closing.

CORRECTION

Replace switch.
CONDITION NO. 11

A. Vacuum unit does not disengage clutch with either VAC or HDM buttons pushed in.

B. Transfer key operates with HDM button pushed in when gear shift lever is moved through neutral.

CAUSE

Open circuit in the vacuum clutch harness. The points indicated on the illustration starting from the instrument panel switch must be checked.

Since these circuits were checked in detail under Condition No. 6, we will review the points only briefly.

CORRECTION A

See that the accelerator linkage returns solidly against the accelerator switch stop.

CORRECTION B

Check the black wire from the instrument panel switch to the dash plug by inserting the test lamp prong in socket #1 to ground.
CORRECTION C

Check the chassis harness to the clutch control solenoid by connecting the test lamp from the B.K.W. wire at the solenoid to ground, and the solenoid itself, by connecting test lamp from BW terminal of solenoid to ground.

CORRECTION D

Check wire from solenoid to accelerator by contacting test lamp terminals to Accelerator switch BW terminal and ground.

Or on 1946 units insert test lamp prod into #3 socket of plug at accelerator switch, to ground. Test the wire to the shift rail switch by putting prods of test lamp in accelerator switch plug sockets #3 and #2. Lamp should light when transmission is in neutral or second and go out when transmission is in high.

Likewise insert prongs in #3 and #1 sockets to check RW wire and governor. Lamp should light with car standing.
CORRECTION E

If lamp lights when testing Y wire at accelerator switch, when transmission is in high gear, replace the shift rail switch.

If lamp does not light when testing Y wire at accelerator switch, when transmission is in second or neutral, ground the shift rail switch as shown. If the lamp lights replace the switch. If it does not, replace the harness.

CORRECTION F

If the lamp does not light when checking the RW wire at the accelerator switch, ground the RW terminal at the governor. If the lamp lights the governor points are open. If the lamp does not light the chassis harness must be replaced.

To check the RW wire and governor on the 1946 units, remove the plug at the governor and insert a cotter key into socket #2 as shown.

If the lamp connected to sockets #3 and #1 at the accelerator switch lights when this cotter pin is grounded as shown, and did not light with the plug in place on the governor, the governor points are open.

If the lamp does not light with the cotter pin grounded, the chassis harness must be replaced.
CONDITION NO. 12

Starter will not operate with clutch depressed, ignition on and battery O.K.

CAUSE - OPEN CIRCUIT

The illustration shows the points which must be checked to locate the open circuit.

CORRECTION A

Insert prod of test lamp in body dash socket #3 and ground. If the lamp does not light the open circuit exists between the circuit (BBK wire) from the circuit breaker to the dash plug.

CORRECTION B

Insert the ends of a wire in body dash plug sockets #2 and #3 as shown. If the lamp lighted on the previous test and the starter operates with the wire in place as shown the open circuit is in the chassis harness or the clutch switch. If the starter does not operate, the trouble is in the starter switch or starter solenoid.

Just a note in passing, this connection permits use of the starter, if for any reason the transmission switch is removed or inoperative.
CORRECTION C

If the starter was operative with the jumper as shown, reinsert the body dash plug.

Inspect the link to the clutch switch to see that it is in place and operates the clutch switch when the clutch pedal is depressed.

To test the circuit from the body dash plug to the transmission switch, connect the test lamp to transmission switch plug prong #3 and ground. If the lamp does not light the chassis harness is at fault. If the lamp lights the clutch switch is not closing.

If a recheck of the clutch switch linkage does not reveal the trouble, the transmission switch must be replaced.