Automatic Transmission Section

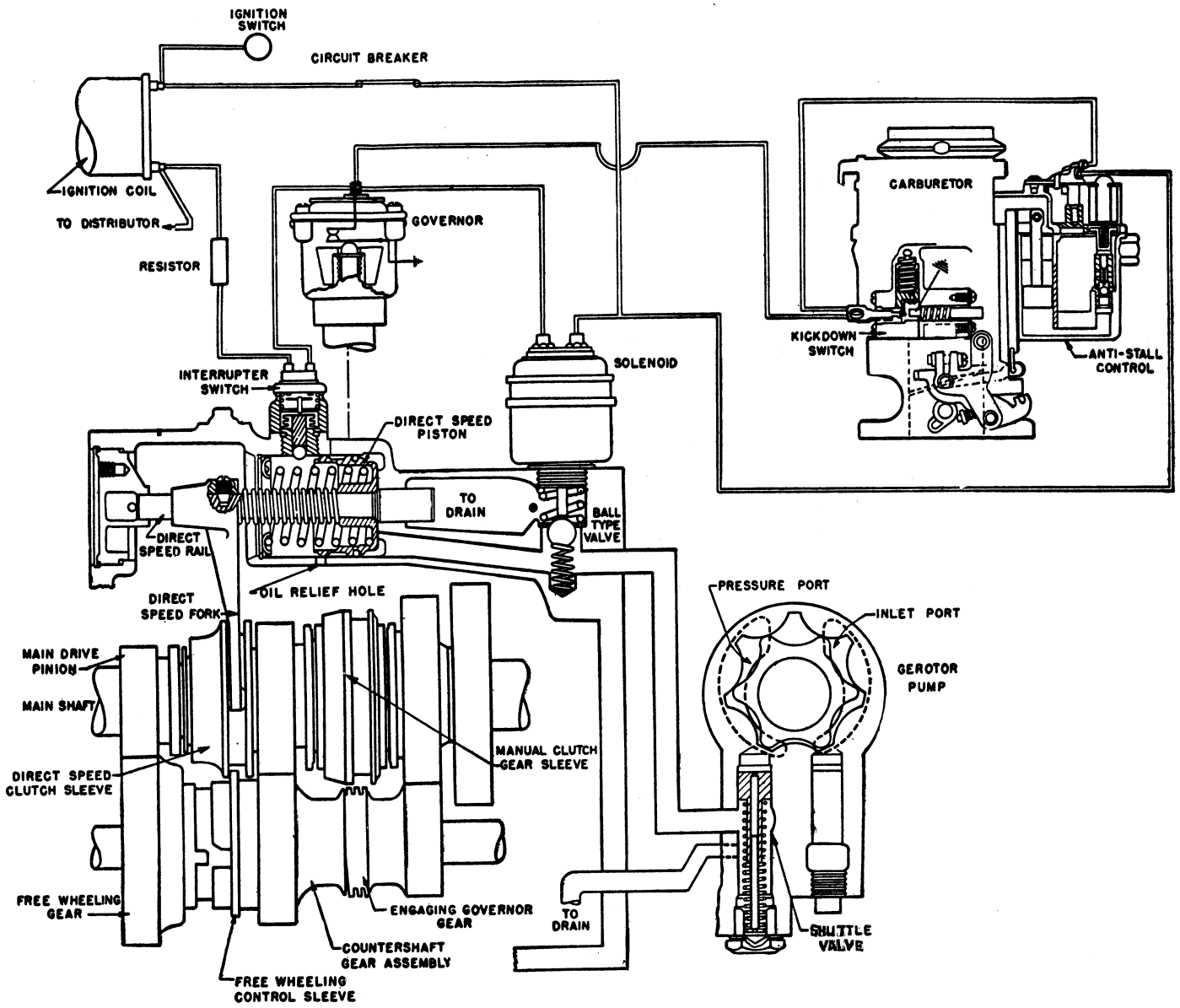

Fig. 1 Schematic layout of Truck-O-Matic transmission controls

LOADFLITE TRANSMISSION

Note—For a detailed service procedure on this transmission see the *Loadflite Chapter* elsewhere in this manual. The following material outlines the procedure for removing the transmission and adjusting the push button control cable.

TRANSMISSION, REPLACE

1. Drain fluid from transmission.
2. Disconnect vacuum line at vacuum unit.
3. Disconnect speedometer cable at transmission.
4. Disconnect hand brake cable at bracket and remove clevis pin.
5. Disconnect gearshift control cable at transmission.
6. Disconnect two oil cooler lines and bracket.
7. Disconnect propeller shaft at transmission flange. *Wire end of propeller shaft to frame to permit transmission removal.*
8. Support transmission with suitable transmission lift.
9. Remove upper transmission case-to-converter housing cap screws. Install two pilot studs. Then remove lower cap screws.
10. Pull transmission rearward to disengage it from torque converter and remove the assembly from the truck.
11. Reverse the foregoing procedure to install the transmission.

PUSH BUTTON CONTROL CABLE, ADJUST

1. Rotate the transmission shift lever to reverse position.

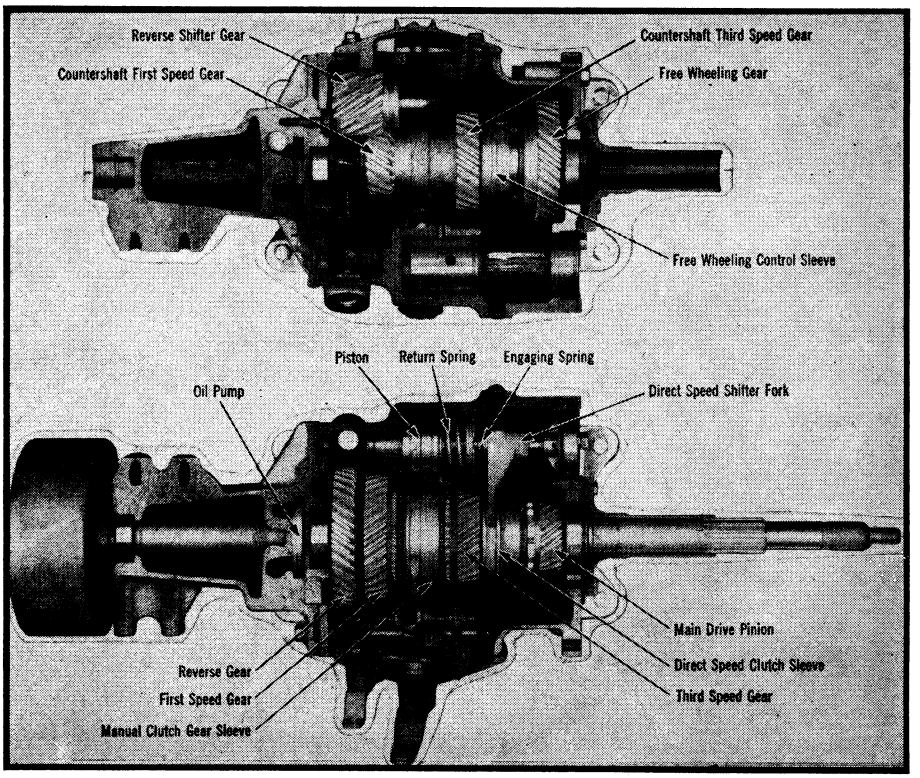

Fig. 2 Truck-O-Matic transmission sliced in half. Top half of gearbox shown at bottom

2. Push reverse button to its extreme travel position and hold in place.
3. Move cable adjusting bracket and "feel" backlash. Split the backlash and then lock the bracket in place.
4. Check the adjustment by lifting the cable lock spring arm. When released the lock spring arm should seat itself in the bottom of the cable adapter slot.
5. Operate the push button control through all positions and check for satisfactory adjustment by lifting the lock spring arm as noted above. A slight adjustment error can be corrected by minor bending of the adjusting bracket.

TRUCK-O-MATIC

1950-56 Light Duty Models

This transmission uses a manual control (shift lever) for reversing and for the selection of forward speed ranges. Two forward automatic speed ranges are provided. Shifts are automatic between first and second and between third and fourth ratios, but requires manual shifting between low and high ranges.

The gearshift lever has four positions: namely, High Range, Low Range, Reverse and Neutral. Reverse and neutral positions are conventional, while high and low-range positions occupy the places of high and second in conventional three-speed gearboxes. All designs use a fluid coupling or torque converter in conjunction with a pedal-operated clutch. Normally, 98 per cent of the driving, including starting, can be accomplished with the shift lever in high range.

With the shift lever in "high" or driving range, the vehicle starts in third, and at approximately 14 mph or more, momentary release (about one second) of the accelerator allows the transmission to shift automatically into high, or fourth speed. An automatic downshift from fourth to third occurs when the vehicle speed drops to about 12 mph or less.

Shifting is accomplished by springs and hydraulic pressure. Supplementary automatic controls include a speed-sensitive governor, kickdown and ignition interrupter switches, and a transmission-operated oil pump.

Mechanical aspects of these transmissions differ from conventional transmissions in that a free-wheeling feature is built into the front gear of the counter-

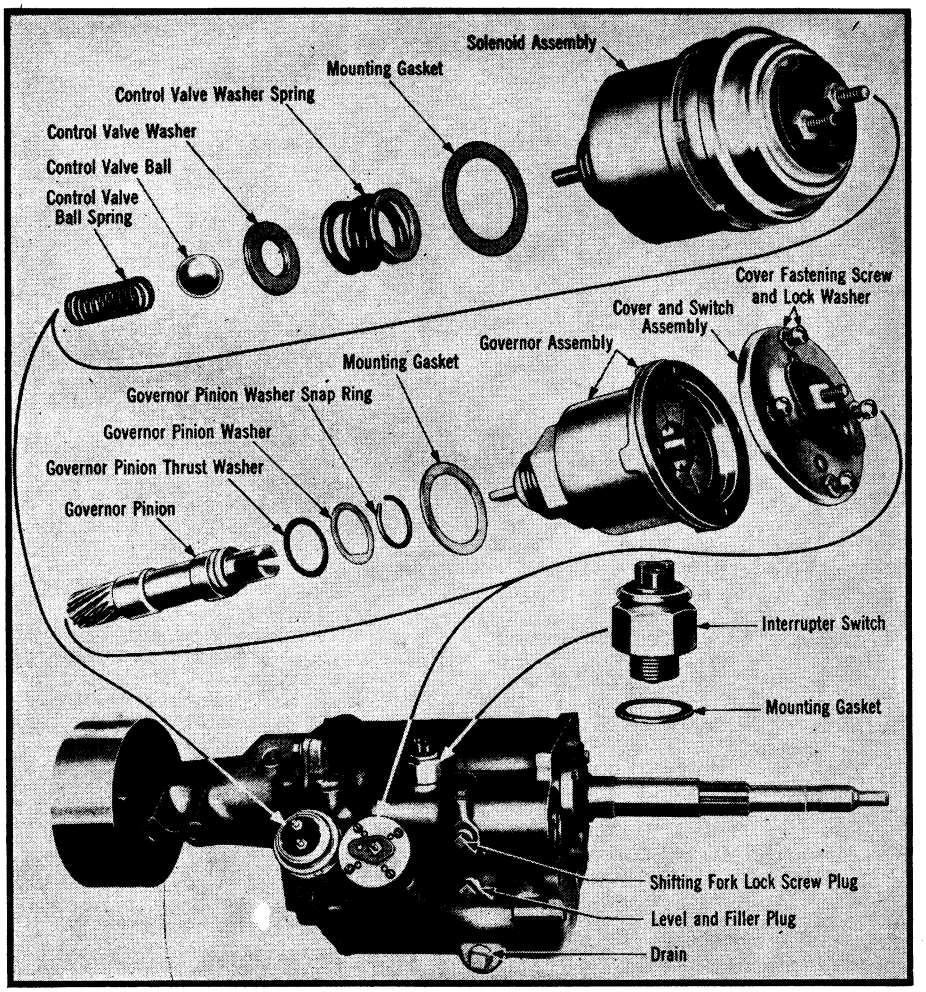

Fig. 3 Truck-O-Matic transmission controls. Transmission-driven, speed-sensitive governor and accelerator pedal manipulation determines speed at which shifts occur up or down. Solenoid operates hydraulic valve that controls action of shift cylinder. Interrupter switch momentarily shorts ignition to facilitate shifts down to a lower gear

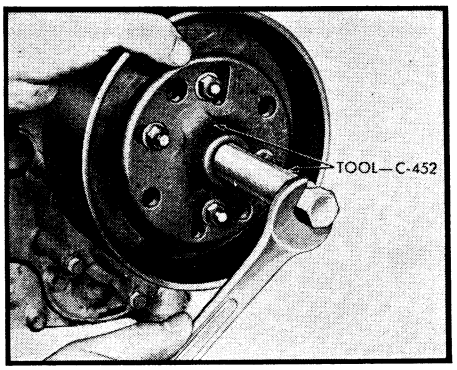

Fig. 4 Removing propeller shaft flange

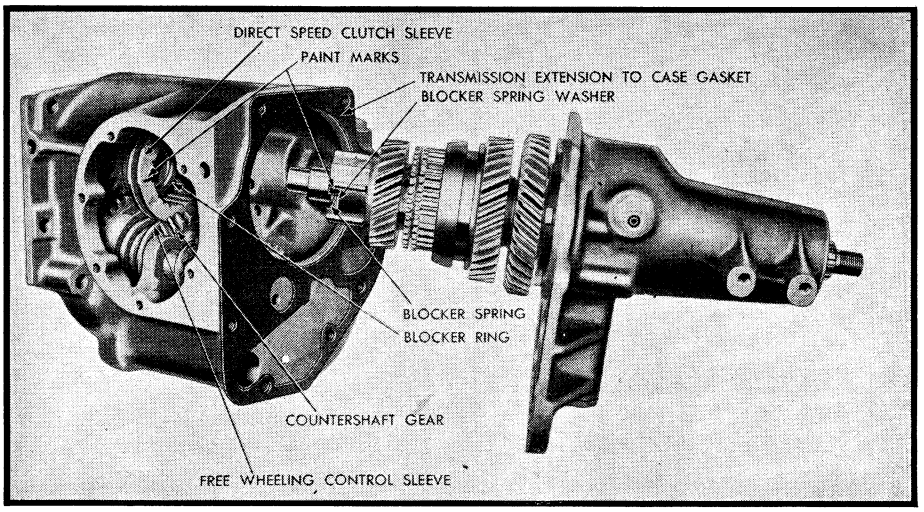

Fig. 5 Mainshaft and extension housing removed

shaft. The free-wheeling rollers cannot engage when the direct-speed clutch sleeve is moved forward or engaged with the main drive gear.

Control System

In describing the control system, the terms "upshift" and "downshift" are used to indicate the automatic engagement or disengagement of the direct speed clutch sleeve and main drive gear.

The force which actually moves the direct speed sleeve is supplied by the pressure of two springs. Hydraulic pressure is used to compress these springs.

Enclosed within the transmission is a chamber containing a piston and two springs. The piston slides on the direct speed shift rail which also moves and actuates the shift fork. When hydraulic pressure is applied, the piston moves forward on the shift rail until it is stopped by a retainer ring. The return spring is compressed and remains energized; it has no part whatever in the upshift.

The engaging spring is also compressed against the shift fork which causes the shift rail, fork and direct speed sleeve to move forward until the blocker ring contacts the main drive gear. As the accelerator is released and synchronization occurs, the continued pressure of the spring completes the engagement.

When the hydraulic pressure is relieved back of the piston, the return spring pushes the piston, shift rail and direct speed sleeve back to the downshift position.

The hydraulic pressure to operate the piston is provided by an oil pump inside the transmission, and the pressure is controlled by valves.

An electric solenoid operates a ball-type check valve to regulate hydraulic pressure and effect shifts (see Figs. 1, 2 and 3).

Figs. 2 and 3 illustrate the relative position of the gears in the gearbox. The mainshaft carries the main drive gear, direct-speed clutch sleeve, mainshaft third speed gear, manual clutch sleeve, first speed gear and a reverse gear. The countershaft carries a free-wheeling gear, a free-wheeling gear control sleeve, countershaft third gear, governor gear and countershaft first gear.

It should be borne in mind that the direct-speed clutch sleeve is the only unit that shifts back and forth automatically. When it is moved forward, as in second and high, a collar on the direct speed sleeve forces the free wheel control sleeve on the countershaft forward to effect free wheeling. Movement of the clutch sleeve and free wheel sleeve rearward, as in third and first speeds, results in the cam and roller type free wheel unit engaging its rollers to drive the countershaft.

The manual clutch sleeve is controlled by movement of the gearshift lever and selects either low or high-range operation.

Diagnosis & Tests

Owing to the closely coordinated action of controls, a complete check of the entire system is recommended. Any condition which may develop can usually be segregated into one of three classifications: Electrical, hydraulic, or mechanical.

Before attempting any diagnosis or tests, be sure the transmission has the correct quantity of No. 10-W engine oil, which is the recommended all-season lubricant. Since the oil pump is driven by the transmission mainshaft, there is hydraulic pressure only when the mainshaft is turning, such as when driving or running the car on a free-wheel lift with the transmission in a forward speed. There is no oil pressure in reverse gear.

For proper synchronization and shifting, it is also essential that the engine idle smoothly at approximately 450 to 475 rpm with the shift in neutral and the throttle linkage working smoothly. Each test should be repeated several times to make sure the result is consistent.

Electrical Tests

All electrical tests should be made with a double-lead test light and insulated socket. The lead should, of course, be long enough to reach from the engine compartment to the driver's seat to allow observation of results while road testing. Then raise the right side front floor mat and remove floor-panel access cover over the transmission and inspect wiring and tighten connections.

The tests on the semi-automatic transmission electrical circuit are much the same as those on other circuits. There are about 13 or 14 steps. First check the wire or circuit from the ignition switch to circuit-breaker coil. To do this, connect the test light to the coil side of the circuit breaker, ground the other wire of test light and turn on ignition key. The test bulb should light. If it fails to light, the wire or connections are faulty.

Checking Circuit Breaker—The circuit breaker can be tested by connecting the test lamp to the solenoid side of the circuit breaker and grounding other lead while ignition switch is on. Failure of the lamp to light indicates a fault in the circuit breaker. However, if the circuit breaker clicks when test lamp is placed in circuit, it indicates a short in red solenoid or brown anti-stall wire or a short in circuit breaker, solenoid or anti-stall unit. Check cause and correct condition.

The next step is to check from the circuit breaker to solenoid. Here the test light is connected to the red wire terminal of the solenoid, the other lead grounded and the ignition switch on. If the bulb fails to light, the wire or connections are at fault.

The circuit is further traced from circuit breaker to anti-stall device. Hook test lamp to brown wire terminal of anti-stall control and ground second lead. Here again failure of the test lamp to light points to faulty wire or connections.

Anti-stall control is then checked by turning on ignition and placing a steel screwdriver on peened rivet head on top of the anti-stall cover of carburetor. In this instance, a magnetic pull should be felt on the screwdriver. (Be sure the screwdriver has not been previously magnetized.) Failure to feel magnetic pull indicates a faulty anti-stall control which should be replaced.

Solenoid Checks—Solenoid checks include connecting the test light across solenoid terminals with ignition on. If test lamp lights, it indicates that the circuit to and from the solenoid is complete and operating. Next hold a soft steel tool to the solenoid body and turn

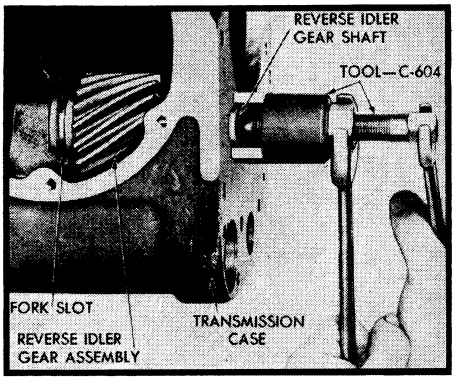

Fig. 6 Removing reverse idler gear shaft

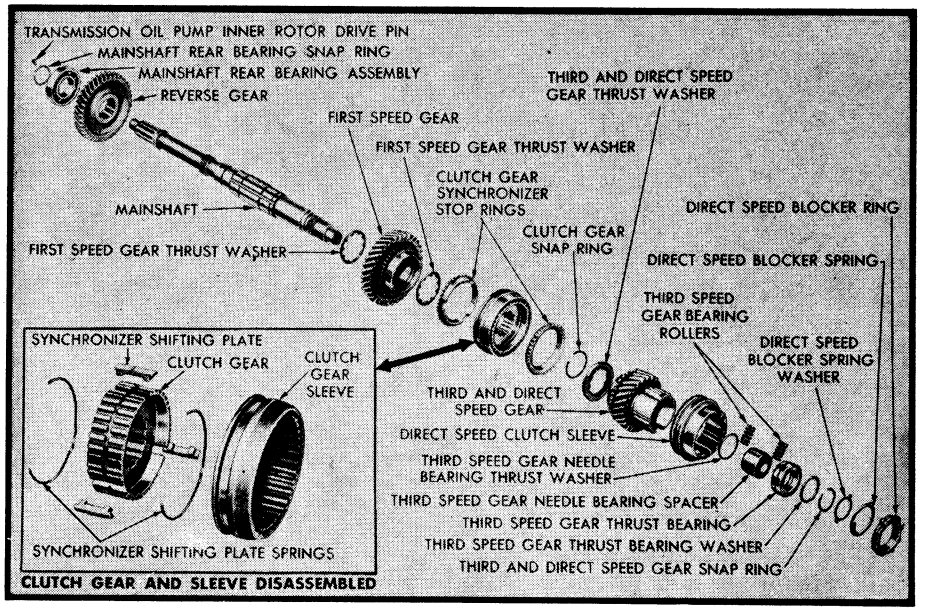

Fig. 7 Layout of mainshaft parts

the ignition switch on and off. A definite magnetic pull should be felt when the ignition switch is on. Here again make sure the tool has not been previouly magnetized. The solenoid should be removed if no pull is felt when the switch is on. When the unit is off, it should be energized by connecting it to a battery independent of the circuit being tested. If functioning properly, the solenoid plunger when energized should move outward and require a 25-lb. push to force it back into the solenoid.

Governor & Kickdown Switch—The governor and kickdown switch should be the next units tested. Attach test lamp to terminal on top of governor and hook other test lead to red wire terminal of solenoid. If the ignition is on, the lamp should light to indicate the governor points are closed.

Additional governor and kickdown tests require that both rear wheels be off the ground, engine running and transmission in high gear. Then accelerate vehicle speed to approximately 14 mph. At this point, the light should go out and light again when speed is dropped to about 12 mph. This will indicate a satisfactory operating governor. While the wheels are still off the floor accelerate to between 15 and 40 mph and push in the kickdown switch by hand. Here again, the light will go on if the switch is operating satisfactorily.

Additional Tests—While the wheels are off the ground, the engine running and transmission in high range, make these additional tests as required: First check interrupter switch. To do this remove the blue or green (whichever is present) wire from the interrupter switch and connect one wire of the test lamp to the switch. Attach the other wire of lamp to red wire terminal of solenoid. Then accelerate and decelerate between 8 and 15 mph. During deceleration from about 12 to 10 mph, the test lamp should glow faintly. This can best be seen by hooding test bulb with the hand.

The final electrical check is that of testing the ignition interrupter resistor. While the engine is running, ground the blue wire on the resistor or at the interrupter switch. This should stall the engine. If the engine continues to run, the blue wire from interrupter switch to resistor, the resistor itself or the blue wire from the resistor to the coil is at fault.

If the test light check of the circuit has shown correct indications and the electrical functions have proved satisfactory proceed to test hydraulic system.

Hydraulic Tests

It should again be pointed out that it is necessary to make certain the transmission has the correct amount of 10-W oil before testing action of hydraulic piston.

To check hydraulic pressure, remove floorboard access cover and disconnect the two wires at the interrupter switch. Take off the interrupter switch and jack up the car so that both rear wheels are off the floor. Then start the engine and engage the transmission in the low range.

Accelerate the engine to about 8 mph and watch the piston through the interrupter-switch hole. The piston should move forward just enough to cover the hole completely at 8 mph in low range, indicating the correct 38 to 40 lb. per sq. in. hydraulic pressure. Failure of the piston to move forward at 8 mph in low range, indicates that the piston is either stuck or worn or that the pump is faulty.

TRANSMISSION REPAIRS

Remove & Install

1. Remove floorboard access cover.
2. Remove wires from governor, solenoid and interrupter switch.
3. Remove governor, solenoid and interrupter switch and install plugs in the holes to prevent dirt entering transmission case.
4. Disconnect speedometer cable at transmission.
5. Disconnect hand brake cable at brake band and remove cable anchor bracket.
6. Disconnect front universal joint and push back yoke.
7. Remove brake support, brake band, brake adjusting bolt bracket and lever as a unit.
8. Disconnect gearshift operating and selector rods at transmission.
9. Drain oil from transmission. Be sure to reinstall plug.
10. Remove transmission - to - clutch housing attaching stud nuts.
11. Remove transmission.
12. With long nose pliers, remove governor drive pinion gear.
13. Reverse the order of the above procedure to install the transmission.

Remove & Install Gearshift Housing

1. Position gearshift controls in neutral and remove capscrews and housing assembly.
2. To install, slide reverse idler gear forward and position main clutch gear sleeve in neutral. Install cover and gasket. Tighten capscrews with a torque wrench to 10-15 lbs. ft.

Remove & Install Brake Drum and Propeller Shaft Flange

1. Remove gearshift control cover as outlined above.
2. Slide reverse idler gear and manual clutch gear sleeve back. This will lock mainshaft so it cannot be turned.
3. Remove nut, external tooth lock washer and flat washer from hand brake drum and propeller shaft flange.
4. Using a suitable puller, remove propeller shaft flange and brake drum as shown in Fig. 4.
5. To install, first see that reverse idler gear and manual clutch gear sleeve is back. Install brake drum and flange on mainshaft. Install flat washer, lock washer and nut. Torque tighten nut to 95-105 lbs. ft.
6. Install gearshift cover as already outlined.

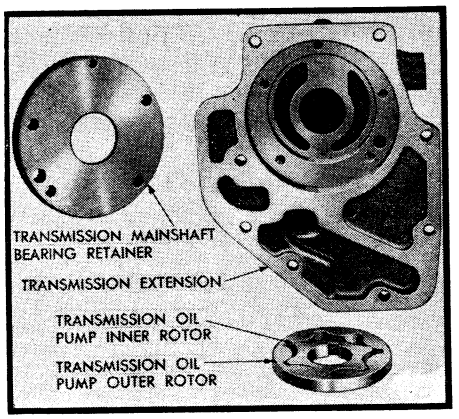

Fig. 8 Oil pump rotors and mainshaft rear bearing retainer

Remove & Install Mainshaft

1. Remove brake drum as outlined above.
2. Unfasten extension housing from transmission case and remove housing and mainshaft as a unit, Fig. 5.
3. Remove extension housing-to-case gasket.
4. To install, first be certain that free wheeling control sleeve is back toward rear of case, Fig. 5.
5. Position blocker ring in direct speed clutch sleeve with large end of taper forward and anchor lugs back.
6. Apply a light coating of grease to both the direct speed blocker spring and spring washer, Fig. 5; this will assist in holding both in place when installing mainshaft.

Caution—It will be noted in Fig. 5 that the direct speed blocker sleeve and third and direct speed gear each have a dye or paint mark. Should it be necessary to replace one or both of these gears, the gears should be marked with paint after selecting the proper position that will allow approximately .005" minimum backlash and install as shown in Fig. 5. Be sure that the teeth of the third speed gear are indexed in the center tooth of the speed clutch sleeve.

7. After mainshaft and extension housing have been installed, torque tighten capscrews to 30-35 lbs. ft.
8. Install remaining component parts.

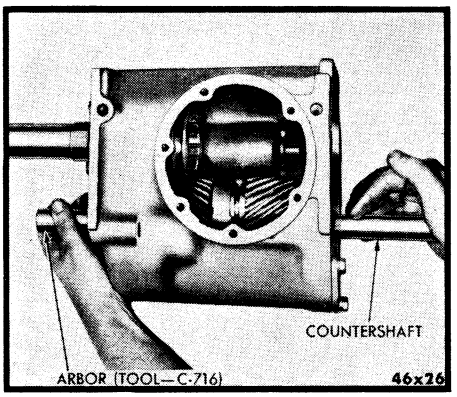

Fig. 10 Special arbor in use for removing and installing countershaft

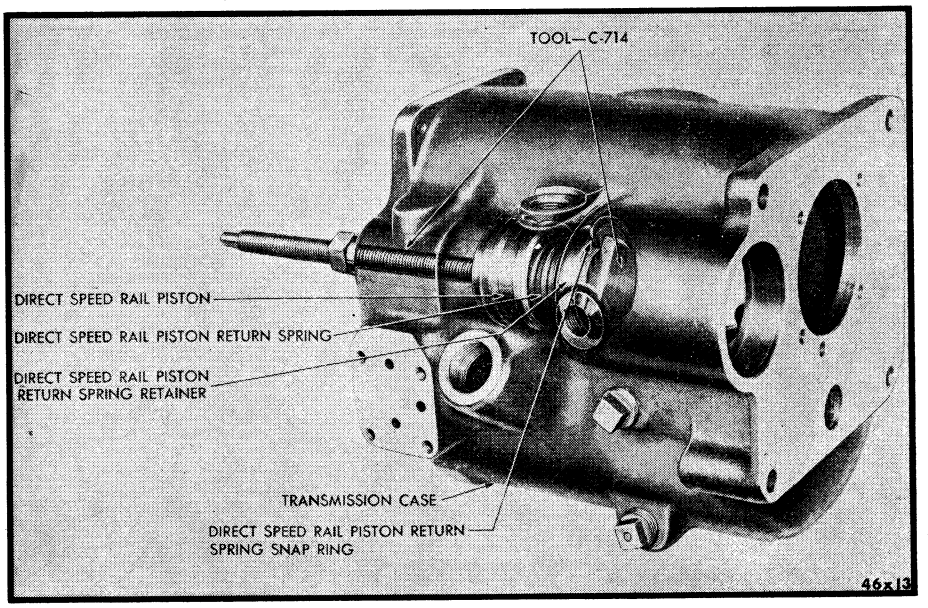

Fig. 9 Compressing tool installed to remove direct speed gearshift rail and piston

Remove & Install Reverse Idler Gear

1. Remove mainshaft and extension housing as outlined above.
2. Using a suitable puller, Fig. 6, remove reverse idler gear shaft and gear, being careful not to lose shaft key.
3. To install, position reverse idler gear in case. Align shaft and key with cutout in case and drive shaft in place, using a soft mallet.
4. Reinstall mainshaft as already outlined.

NOTE—Reverse idler gear shaft may be removed any time after the mainshaft has been removed.

Disassembly of Mainshaft. Fig. 7

1. Remove speedometer driven gear.
2. Press mainshaft out of extension housing.
3. Remove direct speed blocker spring and washer.
4. Clamp mainshaft upright in a vise, holding it by the rear and just below the speedometer drive gear.
5. Remove third and direct speed gear snap ring.
6. Remove third and direct speed gear, being careful not to lose third speed gear bearing rollers, spacer, bearing front thrust washer and third speed gear needle bearing washer.
7. Remove third and direct speed gear rear thrust washer and clutch gear synchronizer snap ring.
8. Remove clutch gear synchronizer stop ring.
9. Remove clutch gear sleeve as a unit.
10. Remove clutch gear rear synchronizer stop ring.
11. Remove first speed gear front thrust washer, first gear and rear thrust washer.
12. Reverse mainshaft in the vise and remove inner oil pump rotor pin (1949-51 units) and rear bearing snap ring.
13. Press rear bearing and reverse gear off mainshaft.

Assembly of Mainshaft

1. Install reverse gear and press on rear mainshaft bearing. The rear bearing snap ring should be the thickest that can be used to obtain minimum end play. These snap rings are available in thicknesses of .087", .093" and .098".
2. Place mainshaft in vise, front end up, and assemble mainshaft parts in the reverse order of removal, referring to Fig. 7. Measure end play between third speed gear bearing thrust washer and snap ring. The end play should be .003-.008" and is controlled by snap rings of various thicknesses (.087", .092", 097", .101").

Disassembly & Assembly of Oil Pump

1. Remove capscrews attaching rear bearing retainer.
2. Remove bearing retainer and oil pump inner and outer rotors, Fig. 8.
3. Remove shuttle valve retainer plug and valve assembly from transmission extension. The mainshaft rear bearing and snap ring may be removed from the extension housing at this time.
4. To assemble, reverse the order of the above procedure, first making sure that the small hole in the top of the shuttle valve is open.

Caution—When assembling the mainshaft in the extension housing, extreme care must be exercised to see that the mainshaft rotor pump drive pin is properly aligned with the slot in the oil pump inner rotor. When properly assembled,

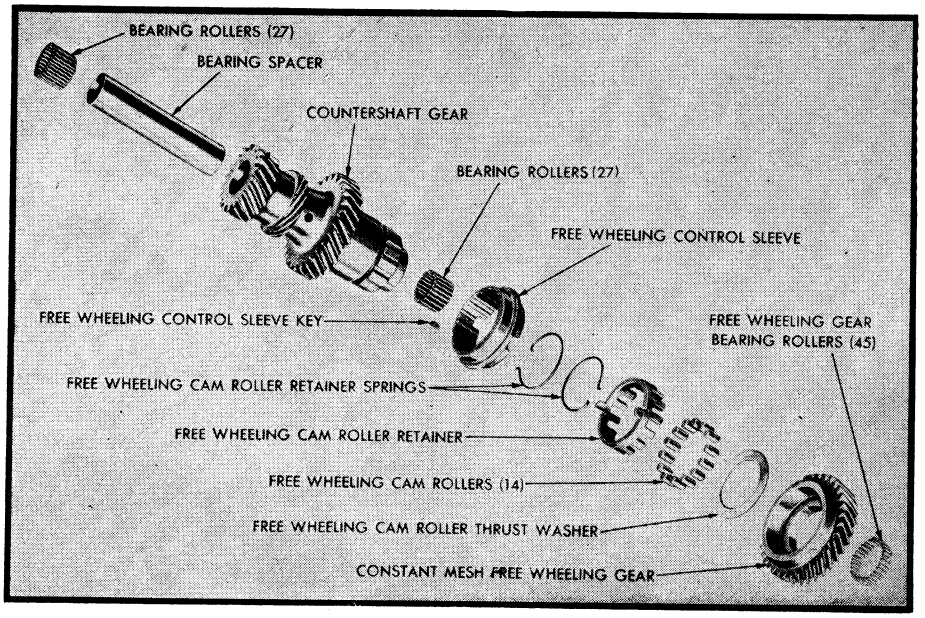

Fig. 11 Layout of countershaft gear and free wheeling parts

press the bearing on the mainshaft in the extension housing bearing retainer.

Remove & Install Direct Speed Gearshift Rail & Piston

1. Remove mainshaft as already described.
2. Remove direct speed blocker ring.
3. Remove plug from upper right hand side of transmission. Insert a screwdriver in the hole and pry the fork back just far enough to remove direct speed clutch sleeve.
4. Loosen direct speed gearshift fork locking screw until fork is forced ahead by the engaging spring. Cock fork on shaft and pull fork toward rear of case; this will work direct speed gearshift rail back.
5. Holding rear of shaft, move fork forward again, cock it and pull toward rear of case again.
6. Repeat until fork, spring and rail can be removed from case.
7. Remove direct speed gearshift rail guide snap ring and guide from front of case.
8. Using a suitable compressing tool, Fig. 9, compress direct speed rail piston return spring and remove snap ring with long nosed pliers.
9. Remove tool, releasing slowly, and remove return spring retainer, spring, piston and rail ring from front of case.
10. Install in reverse manner. It should be noted that the screwdriver slot in rear of direct speed shift rail is off center. This slot must be horizontal in the case with the smallest shoulder toward the side of case. In this way, it is possible to locate the set screw hole in the gearshift rail with the hole in the case.

Remove & Install Drive Pinion

1. Remove mainshaft as already described.
2. Remove governor drive pinion gear.
3. Drive countershaft out through rear of case, using arbor C-716, and drop gear set to bottom of case.
4. Remove drive pinion bearing retainer and gasket.
5. Pull drive pinion and bearing assembly out of case.
6. To install, assemble driven pinion if it has been disassembled, and position it in transmission case.
7. Install bearing retainer (without gasket) and secure with capscrews.
8. Insert feeler gauge between bearing retainer flange and case to determine clearance at this point.
9. Select a gasket of same thickness as indicated by feeler gauge (or nearest oversize), remove retainer, install gasket and reinstall retainer.

Note—Use rubber gaskets on bearing retainer bolts and tighten securely to prevent oil leaks at this point.

Remove & Install Countershaft

1. Before removal of the countershaft gear set is possible, the drive pinion must be removed as outlined above.
2. The countershaft gear set and arbor can now be removed by lifting the complete assembly straight up and out through opening in rear of case. Care must be exercised so as not to lose the bronze washers on either end.
3. Install countershaft gear set in bottom of case. Then after inserting the drive pinion and bearing, position countershaft assembly, Fig. 10, and install shaft in same manner as when removed.
4. Measure end play between thrust washer and rear end of case. This end play should oe .005-.011″ and is controlled by various thickness bronze washers for the rear end of the assembly. Washers of .087″, .090″, .093″ and .097″ thicknesses are available.
5. Secure drive pinion as outlined previously.

Disassemble Countershaft. Fig. 11

1. Place countershaft gear set on end in a clean pan, constant mesh free wheeling gear up.
2. Remove bronze thrust washer and bearing washer.
3. Slide free wheeling control sleeve up and remove constant mesh free wheeling gear.
4. Remove free wheeling cam roller thrust washer.
5. Remove free wheeling gear bearing

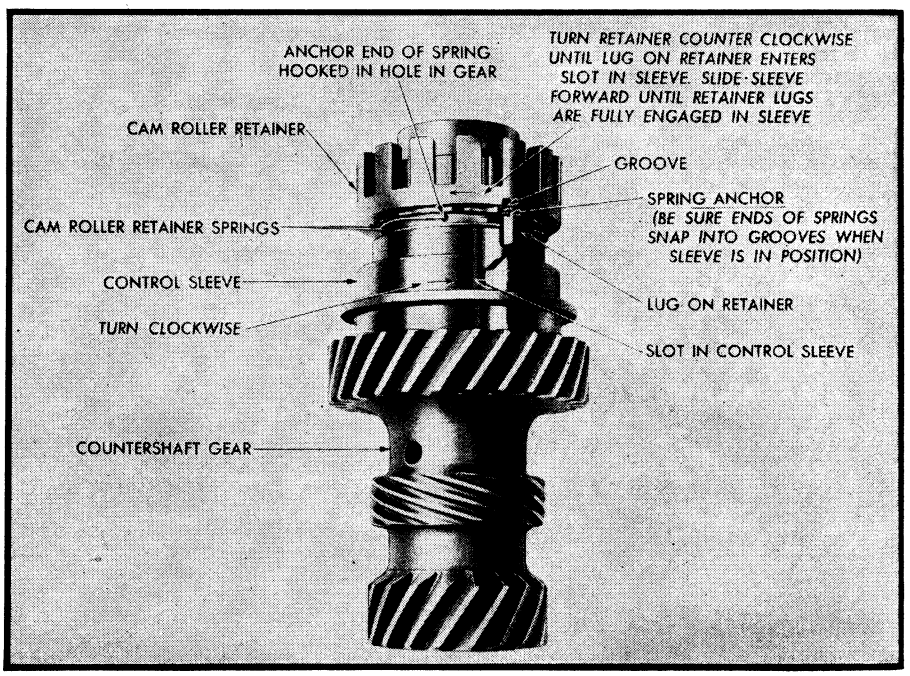

Fig. 12 Installing free wheel cam roller springs

rollers and cam rollers.
6. Remove cam roller retainer and springs. Use extreme care when removing springs so as not to distort them.
7. Remove free wheeling control sleeve and key.
8. Remove arbor (C-716), front and rear roller bearings and spacer from countershaft gear.

Assemble Countershaft

1. Install key and free wheeling control sleeve.
2. Hook anchor end of two springs in holes in cluster gear so they wrap in a right-hand direction from anchor end, Fig. 12.
3. Place roller cage over gear with lugs over spring anchors and rotate clockwise until cage lugs are over slots in control sleeve. Be sure ends of springs have snapped into grooves in cage.
4. Slide control sleeve forward until cage lugs are fully engaged in sleeve.
5. Place free wheeling rollers in place, using cup grease to hold them in position, and install thrust washer over rollers.
6. Place free wheeling gear on countershaft gear.
7. Install set of 45 roller bearings between free wheeling and countershaft gear.

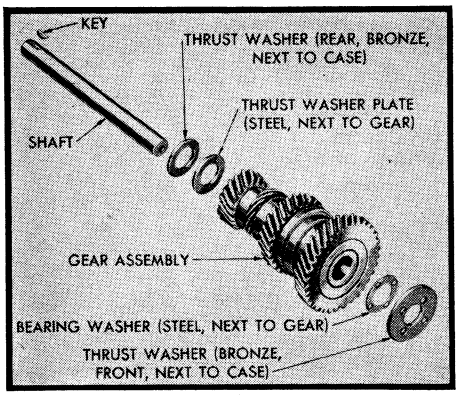

Fig. 13 Countershaft gear assembly and thrust washers

8. If countershaft roller bearings have been removed, place special arbor through countershaft gear set and stand assembly on bench with free wheeling gear up.
9. Place 3 or 4 rollers in bottom of the hole. Install countershaft bearing spacer and set of 27 roller bearings in front end of countershaft. Then install countershaft gear bearing thrust washer and front thrust washer.
10. Turn countershaft assembly over and stand it on its forward end.
11. Install set of 27 rollers in rear end of gear. Then place steel thrust plate next to cluster gear.
12. Place countershaft assembly in bottom of case, being sure to keep thrust washers in place, Fig. 13.
13. Do not install countershaft until drive pinion has been installed in case. Allow arbor to enter front hole, Fig. 10, and slide rear bronze thrust washer between steel washer and case.
14. The cluster gear end play should be .002" to .008", measured with a feeler gauge between thrust washer and case at the rear. Different thickness bronze washers are available (.087", .090", .093" and .096") for obtaining proper end play.

Lubrication

Drain and refill to the bottom of the filler plug hole every 10,000 miles or once a year. Use No. 10-W engine oil regardless of climatic conditions.

The capacity of the transmission for an oil change is 3 pints. However, if the transmission extension housing has been removed and drained for any reason, add an additional ½ pint to the 3 pints previously specified. The additional ½ pint will work its way back to the extension housing after the transmission has been in operation for approximately 5 minutes.

Transfer Case Section

MODEL 91000

Linkage Adjust, Fig. 1

All adjustments must be made with the front axle disengaged and transfer case in high range.

1. Disconnect de-clutch and shift rods at shift lever (do not remove or use stabilizer rod for adjustment purposes).
2. The correct assembled length of each rod and yoke must be as follows:
   De-clutch rod ..... 25.16"
   Shift rod ..... 21.62"
   Stabilizer rod ..... 24.62"
   Measurements are taken in a straight line from center of adjusting yoke clevis pin hole to center of rod end.
3. Position shift lever so that knob lies approximately one inch forward of lower portion of instrument panel. With knob in this position, lower portion of shift lever should be positioned as far forward in slot as transfer case control shift lever bolt (extending from stabilizer bracket) will permit. *The lever bolt nut should be no more than finger tight at all times and shift lever must move freely in slot.*
4. Make sure transfer case is fully *retracted* and the de-clutch shift rail is fully *extended.*
5. If after above steps have been taken de-clutch rod end is not in alignment with hole, adjust by loosening lock nut at yoke end of rod and turning rod as required to obtain correct alignment.
6. Adjust shift rod in same manner as de-clutched rod except that shift rod must be *shortened* $\frac{1}{16}$" after obtaining correct rod-to-hole alignment.

Transfer Case Removal

1. Drain lubricant.
2. Disconnect stabilizer, shift and de-clutch rods at transfer case end. *Do not lose stabilizer rod yoke spacer.*
3. Disconnect both propeller shafts at transfer case.
4. If equipped with power take-off, disconnect PTO output shaft (or shafts).
5. Disconnect control cable at top of PTO housing by loosening lock nut where cable enters shift plug on PTO.
6. Turn PTO control handle *(at instrument panel)* counter-clockwise to unscrew cable from PTO shift plug.
7. Remove speedometer cable.
8. Disconnect hand brake cable at brake cam levers.
9. Support transfer case with suitable jacks.
10. Unfasten and lower transfer case from vehicle.

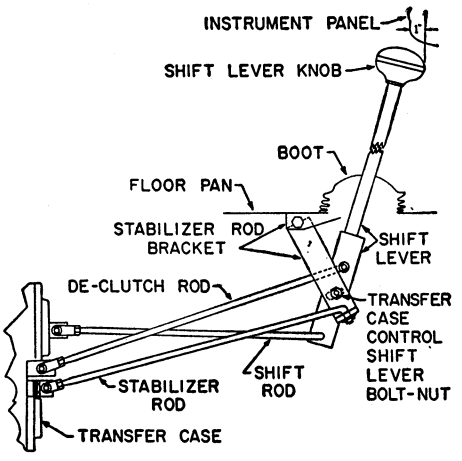

Fig. 1 Linkage adjustments. Transfer case 91000

Transfer Case Install

For installation purposes it is preferable to use a jack for guiding the transfer case into proper mounting position. If power take-off was removed, reinstall and align. Then install the transfer case by reversing the order of removal.

To adjust the power take-off control cable (if equipped), first push PTO shift plug into its housing until ball is fully seated in detent. If a helper is available the control handle can be turned clockwise to thread the cable into the shift plug at the PTO unit. If an assistant is not available, turn the cable with suit-