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SECTION 13-F
HYDRO-LECTRIC POWER SYSTEM

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SERVICE BULLETIN REFERENCE

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13-28 GENERAL DESCRIPTION OF HYDRO-LECTRIC POWER SYSTEM

The Hydro-Lectric Power System built into the bodies of Models 56-C and 76-C provides power operation of the folding top, door windows and front seat. In *1949 Models 56-C and 76-C* it also provides power operation of the rear quarter windows.

The Hydro-Lectric Power System is a combination hydraulic and electric system in which hydraulic fluid pressure, generated by an electrically driven pump (the power unit) is piped to hydraulic cylinders which apply the fluid pressure in raising and lowering the top, raising windows, and moving the front seat forward, depending upon the controls being operated. Spring pressure is used to lower the windows and move the seat rearward.

Steel tubing is used for the pipes which conduct the hydraulic fluid between the power unit pump and the hydraulic cylinders which operate the folding top, windows and front seat. Rubber hoses are used at the power unit and where the lines enter the doors at hinge pillars, to provide the flexibility required at these points. The fluid pipes are formed in loops at the lower ends of folding top power cylinders to provide flexibility required by the slight hinging movement of cylinders during operation. See figure 13-64.

The pipe connected to the outlet or pressure side of the power unit pump is connected to the inlet port of the folding top control valve under the cowl. By means of tees, this pipe also connects with fluid pipes running to the cylinders in the window lifts and seat adjuster so that fluid can flow between these cylinders and the power unit independently of the top control valve.

Fluid pipes to the seat adjuster and folding top power cylinders run rearward from the dash panel on top of the body floor. The pipes as well as the seat adjuster wiring harness are enclosed and protected by pressed steel covers.

The car battery supplies the current used by the power unit motor. This current is controlled by a solenoid relay switch mounted on the motor. The solenoid relay switch, in turn, is controlled by the folding top, window and seat control switches located at convenient points in the body.

The ignition switch must be turned "ON" in order to operate any part of the Hydro-Lectric Power System since all controlling circuits pass through this switch. The controlling circuits also pass through a circuit breaker, mounted on dash under the cowl, which protects the circuit wiring and electrical units.

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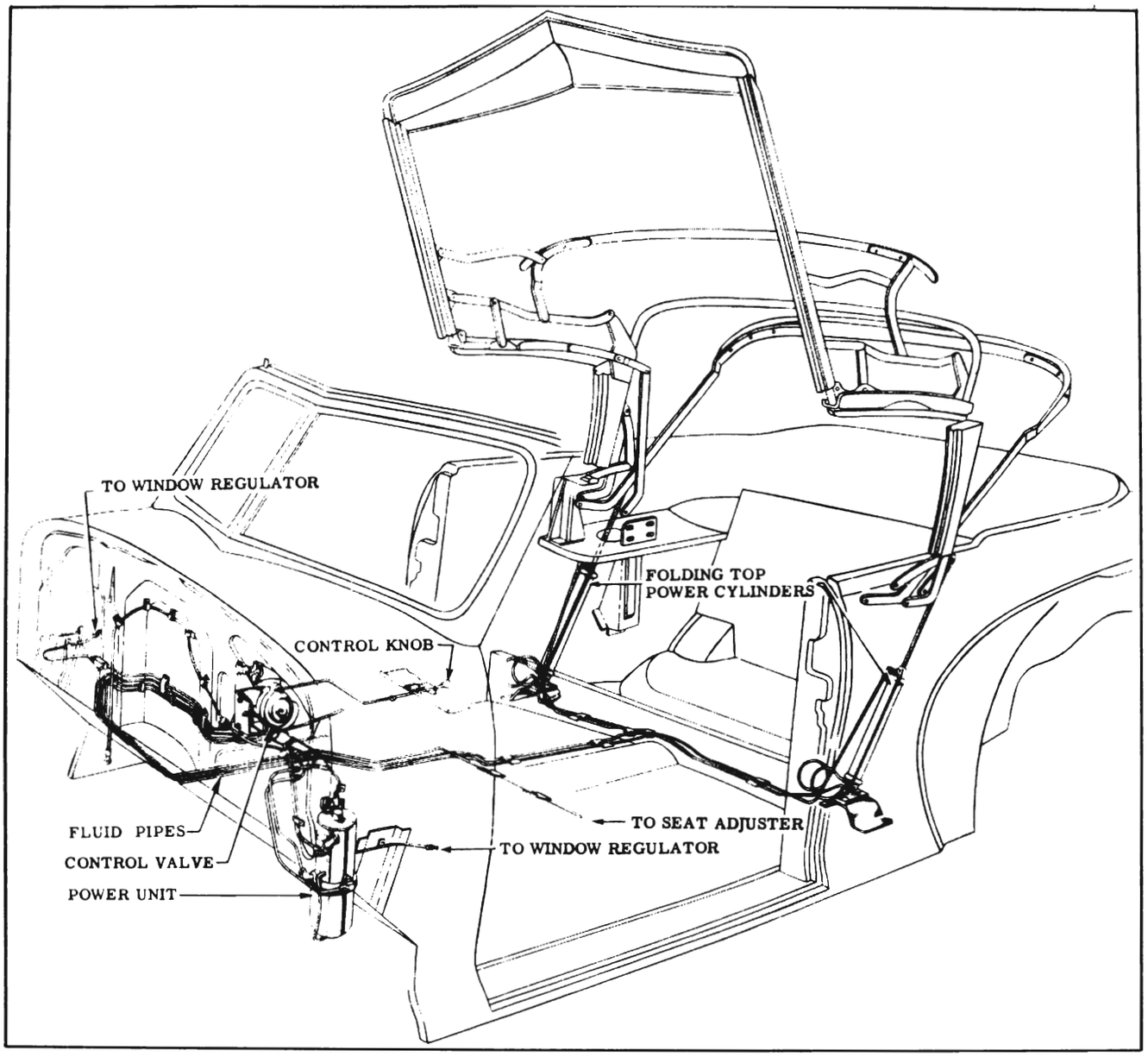

Figure 13-64—Hydraulic System Diagram—1948 Models

Current used by the power unit motor does not pass through the ignition switch and circuit breaker.

The electrical circuits and the hydraulic circuits are shown schematically in figures 13-74 and 13-76.

13-29 HYDRO-LECTRIC POWER UNIT ASSEMBLY

The power unit assembly provides hydraulic fluid pressure when required for operation of the folding top, windows and front seat. On *1948 models*, the power unit is mounted on the *left* side of the cowl, and in *1949 models* it is mounted on the *right* side of cowl. In both cases it is under the rear end of front fender and may be reached by raising the hood. The assembly is cushioned on rubber mountings, is connected to the hydraulic fluid pipes by rubber hoses, and the motor is electrically grounded to the body by a flexible ground strap. See figure 13-65.

The power unit assembly consists of an electric motor, a rotor type oil pump, and a fluid reservoir assembled vertically into a single unit. A solenoid relay switch is mounted on the motor frame and is connected to the motor terminal by a copper strap.

The solenoid relay switch closes the circuit between the battery and power unit motor whenever the solenoid is energized by current flowing through any closed control switch. The current passing through the solenoid windings to ground causes the solenoid plunger to move upward until a contact on plunger closes the battery-to-motor circuit, thereby starting the power unit motor so that the pump can deliver

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fluid pressure. When the control switch is returned to neutral position the energizing circuit is broken, the solenoid is demagnetized and the plunger drops to break battery-to-motor circuit.

The pump inner rotor is keyed to the motor armature shaft; a spring-loaded seal and a drain-back passage in pump body prevent leakage of fluid around the armature shaft. Pump intake and drainback pipes pressed into the pump body extend down to near the bottom of the reservoir and their lower ends are provided with a baffle to prevent turbulence of fluid in reservoir. The fluid reservoir is held to the lower side of pump by a snap-on spring wire bail, and a synthetic rubber gasket is installed between the pump and reservoir The reservoir is vented to atmosphere through a small hole in pump body.

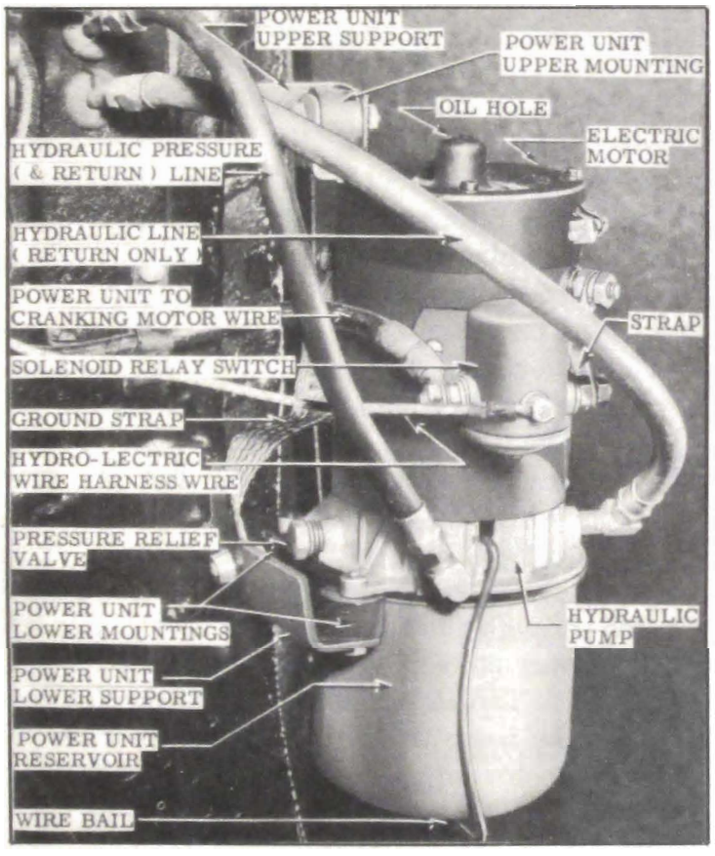

Figure 13-65—Power Unit Installation—1948 Models

A spring-loaded combination pressure-relief and drain-back valve is located in the outlet passage of the pump. When the pump is started, the valve opens against spring pressure to permit fluid to flow to any hydraulic cylinder requiring fluid pressure. As pump pressure increases, the valve opens farther to by-pass some fluid back into the reservoir; the valve spring is calibrated to regulate the fluid pressure at a maximum of 250-260 pounds per square inch.

When the pump stops running, the spring closes the valve, and in this position the pump outlet is connected to the by-pass passage leading to the reservoir. Whenever a window is lowered, or the front seat is moved rearward, a spring in the window lift or seat adjuster forces fluid out of the hydraulic cylinder and back into the reservoir through the pressure-relief valve. Fluid discharged from a folding top power cylinder does not drain back through the valve but returns to the reservoir through the pump intake pipe.

13-30 FOLDING TOP HYDRO-LECTRIC POWER SYSTEM

The power system which operates the folding top consists of the power unit assembly described in paragraph 13-29, a control valve and switch assembly, two folding top power cylinders, and connecting fluid pipes and control circuit wiring.

a. Folding Top Control Valve and Switch Assembly

The control valve and switch assembly which controls operation of the folding top is mounted on the left side of dash panel under the cowl. It is operated by a control rod and knob, marked "POWER TOP", at lower edge of instrument panel. With ignition switch turned "ON", pushing the control knob forward causes the folding top to raise; pulling knob rearward causes top to fold down.

The control valve and switch assembly is a combination directional selector valve and power unit control switch. The selector valve routes hydraulic fluid from the power unit pump to the upper or lower ends of the power cylinders as required, and also routes fluid forced from opposite ends of cylinders back into the power unit reservoir through the drain-back pipe. The switch controls the power unit motor through the solenoid relay switch, as explained in paragraph 13-29.

The fluid pipe from outlet side of power unit pump connects to the inlet port of the folding top control valve. The control valve has three other ports for fluid pipe connections. A fluid pipe connects one valve port to the lower ends of both folding top power cylinders. Another port is similarly connected to the upper ends

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of both power cylinders. The third port is connected by a drainback pipe to the power unit reservoir at intake side of pump. See figure 13-66.

The valve base plate is an aluminum die casting having four ⅛" pipe-thread holes for fluid pipe connections which lead to four port holes on the inner face. The inner face is lapped to provide a fluid-tight contact with the lapped face of a plastic rotary valve. The rotary valve is held against the base plate by a coil spring and also by the differential in fluid pressure on both sides of valve when pump is operating. The valve is housed by a plastic inner cover which forms a bearing for the valve operating shaft. The joint between cover and base plate is sealed by a synthetic rubber ring, and another rubber washer seals the valve operating shaft against leakage.

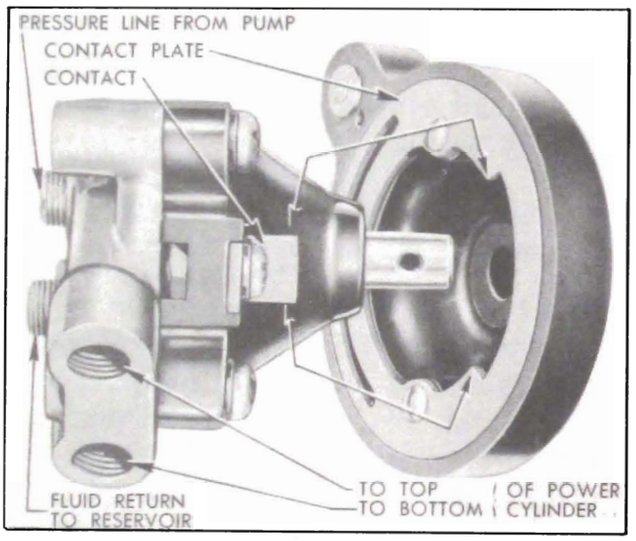

Figure 13-66—Control Valve and Switch Assembly, with Cover Removed

A plastic outer cover, which is locked to valve operating shaft by a screw, bears a trunnion to which the control rod is attached. When control knob is pushed or pulled to raise or lower the top, the rotary valve is turned to permit hydraulic fluid to flow between power unit and folding top power cylinders in the required directions. A centering spring in the outer cover returns the cover and valve to neutral position when the control knob is released.

A fluid by-pass feature is incorporated in the valve to eliminate the spilling of hydraulic fluid from the pump reservoir when the folding top is raised or lowered manually. It provides a fluid circuit between the top and bottom ends of the power cylinder through the valve when in neutral position.

A stationary L-shaped switch contact on the inner cover projects up into a recess in a switch contact plate on inner side of the outer cover. See figure 13-66. The "hot" wire from ignition switch is connected to the stationary contact and the contact plate is connected by a wire to the solenoid relay switch. When the outer cover is rotated to extreme position in either direction these contacts touch and close the energizing circuit to the solenoid relay switch, which starts the power unit. The switch contacts also serve as stops for the valve in the operating positions. When the control knob is released and the centering spring returns the switch cover to neutral, the contacts separate, thus stopping the power unit.

b. Folding Top Power Cylinders

Two hydraulic power cylinders are used to raise and lower the folding top. One cylinder is located vertically in each rear quarter of body below the top hinge.

Each power cylinder is a steel tube closed at each end by crimped-in die castings and enclosing a piston attached to a rod which extends through the upper end casting. The end castings have rubber seals to form fluid tight joints and have ⅛" pipe-thread holes for hydraulic fluid pipe connections.

The lower end casting of the cylinder forms a yoke which is hinged by a clevis pin to an anchor bracket on body floor. The upper end casting provides a bearing for the piston rod which is connected to the top linkage mechanism.

When fluid under pressure from the pump passes through the folding top control valve into the lower ends of both power cylinders, the pistons are forced upward to raise the folding top. At the same time, fluid on upper sides of pistons is forced out of cylinders and back through the control valve to the power unit reservoir. When fluid from the pump enters the upper ends of power cylinders, the reverse action takes place and the folding top is lowered.

c. Neutral Position, Top Stationary

When the top control knob is released, it is held in neutral position by the centering spring in the valve and switch assembly. In this position the electrical circuit is open so that power unit is stopped, and the control valve blocks all fluid flow to the folding top power cylinders

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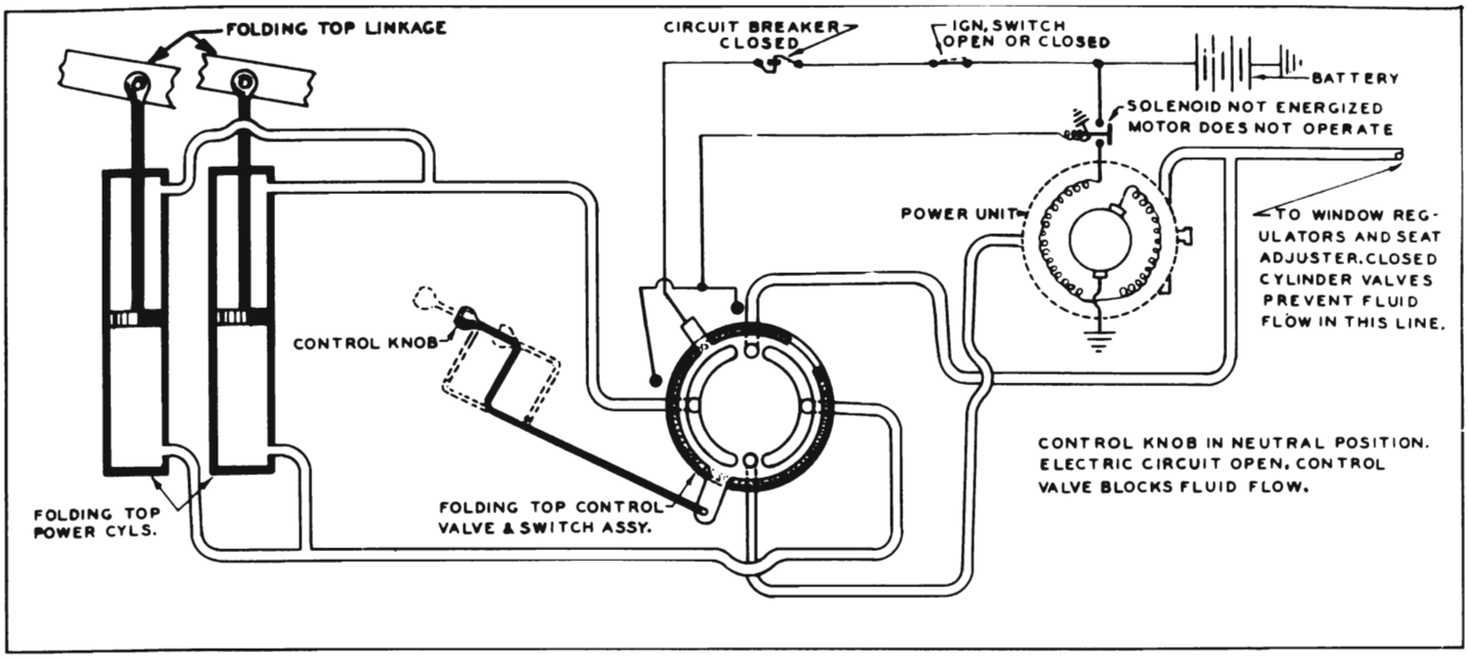

Figure 13-67—Top Circuit Diagram, Neutral Position, Top Stationary

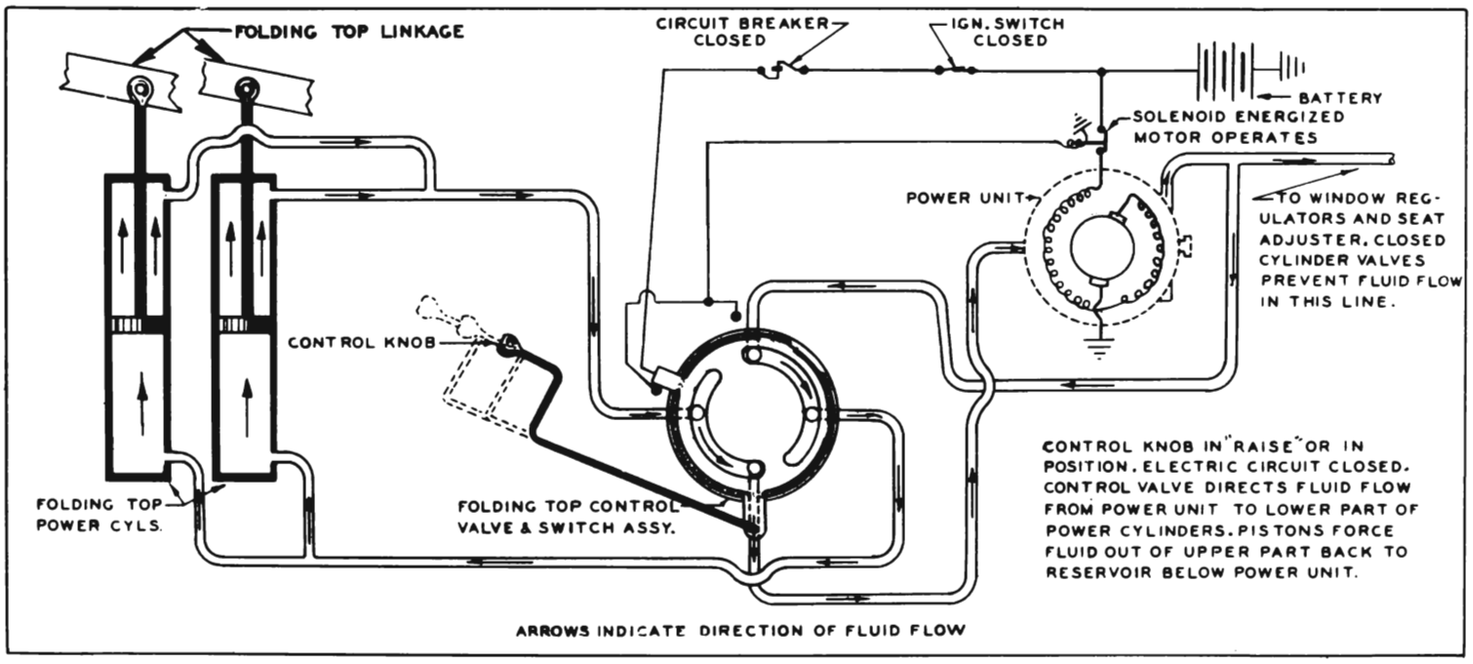

Figure 13-68—Top Circuit Diagram, Control Knob Pushed Forward, Raising Top

so that the top remains stationary. The top may be fully raised, fully lowered, or held at any point in between. See figure 13-67.

Since flow to the power cylinders is blocked, the top is not affected by operation of power unit when raising windows or moving the seat.

d. Operation When Raising Top

When the top control knob is pushed forward to raise the top, the control valve is turned to a position to allow fluid flow from the pressure side of the power unit pump to the lower ends of folding top power cylinders, and also to allow fluid flow from the top of power cylinders to the power unit reservoir. The final 1/8" of travel of control knob closes the switch in valve assembly and if the ignition switch is turned "ON", current will flow through the solenoid windings of relay switch on power unit motor. The energized solenoid closes the relay switch to start the power unit motor and pump. Pressure generated by the pump causes fluid to flow from power unit reservoir, through the control valve and into lower ends of power

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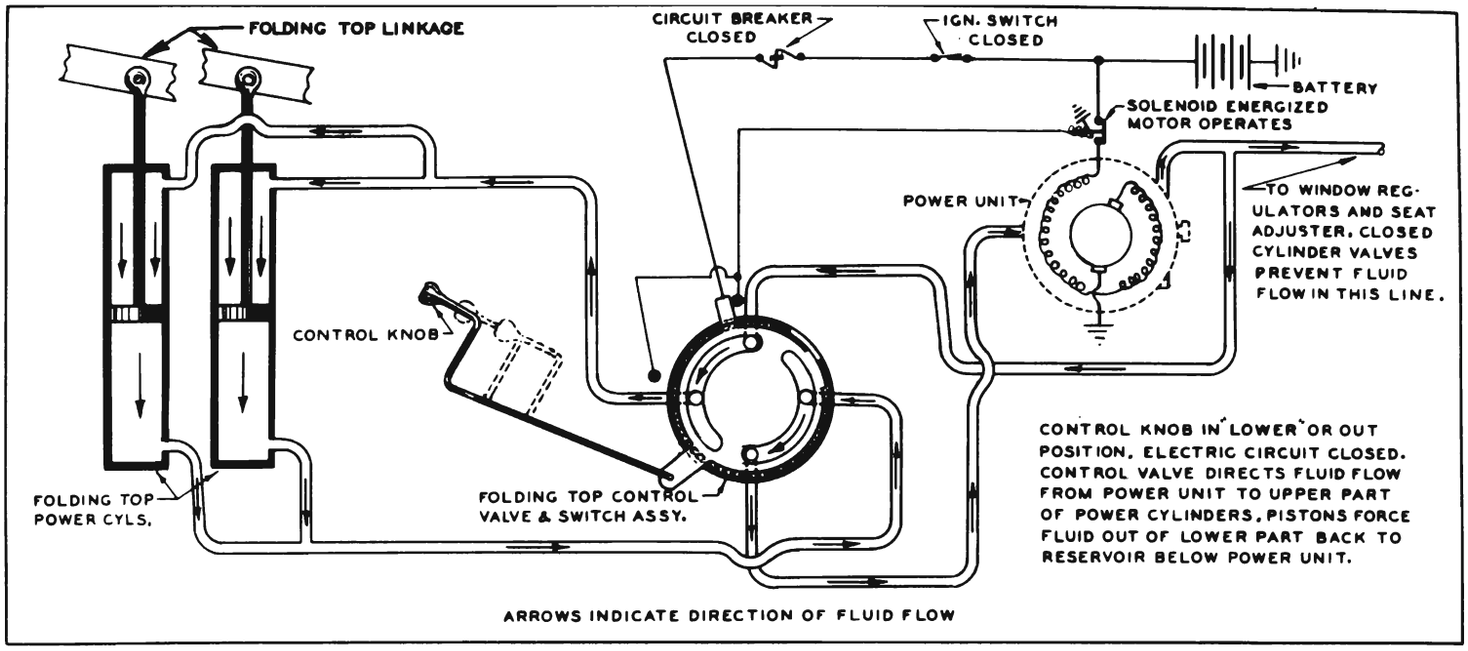

Figure 13-69—Top Circuit Diagram, Control Knob Pulled Rearward, Lowering Top

cylinders. This forces the pistons up to raise the top, and also forces fluid out of the top ends of cylinders, through the control valve to the power unit reservoir. See figure 13-68. The raising operation can be stopped at any point by releasing the control knob.

e. Operation When Lowering Top

When the top control knob is pulled rearward to lower the top the same action takes place as described above for raising the top, except that the flow of fluid between control valve and power cylinders is in the reverse direction. This is because the control valve is turned in the opposite direction to allow fluid flow into the top end of power cylinders and flow out of lower end of cylinders. See figure 13-69.

13-31 WINDOW AND SEAT HYDRO-LECTRIC POWER SYSTEMS

The power systems which operate the windows and the front seat are identical in principle, therefore both systems are covered in this paragraph. The power systems consist of the power unit assembly described in paragraph 13-29, control switches, window lifts or a seat adjuster, connecting fluid pipes and control circuit wiring.

a. Door Window Hydraulic Lifts

A window hydraulic lift is installed vertically between the inner and outer panels of each door. The lift consists of a frame, cylinder, and two springs. The lower end of frame is anchored to the door and operating arms on the upper end engage a cam attached to the window lower sash channel. The cylinder is installed in the frame so that its piston rod pushes upward on the operating arms to raise the window glass when fluid is admitted to the cylinder. The springs pull the operating arms downward to lower the window glass when the valve in cylinder is opened to allow fluid to escape.

The lift cylinder is a steel tube inclosing a piston attached to a rod which extends through the upper cap. The upper cap is crimped in place and sealed to prevent escape of fluid. It houses a saturated felt which excludes foreign matter and acts as a permanent lubricant for the piston rod. The piston rod is rounded at the outer end to fit a formed seat in one window operating arm of the frame assembly.

The solenoid valve which closes the lower end of lift cylinder consists of a solenoid winding and stationary core inclosing a spring-loaded plunger. The plunger contains a disk which is normally pressed against the valve seat by the spring pressure. When the solenoid is energized by current flowing through the closed control switch, the plunger is pulled upward to open the valve and permit the passage of fluid. When the control switch is in neutral position the solenoid is de-magnetized and the spring pushes the plunger down to close the valve.

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b. Rear Quarter Window Hydraulic Lifts—1949 Models 56-C and 76-C

1949 convertible coupes are equipped with hydraulic lifts for power operation of the rear quarter windows. The lifts are similar in construction to the door window lifts (subpar. *a)*, except that only one spring is used. The lifts are installed in a vertical position in the rear quarter section of body.

c. Hydraulic Seat Adjuster

A hydraulic seat adjuster assembly is installed below the front seat to provide power operation of the seat. The seat adjuster assembly consists of a frame, cylinder and one spring.

Except for size, the internal construction of the cylinder assembly is identical with the door window lift cylinder assembly (subpar. *a)*. The seat is moved forward by fluid pressure and moved rearward by spring pressure. To prevent forward movement of the seat during an emergency stop, a ratchet mechanism is built into the frame assembly.

d. Control Switches

The switches which control operation of window lifts and seat adjuster are identical in design and operation. Each is a toggle switch which normally stays in neutral or open position. When the switch knob is pushed up for raising a window, or forward for moving seat forward, the switch closes the circuits to operate the power unit and the solenoid valve in the power cylinder in lift or seat adjuster. When switch is moved in the opposite direction, the circuit to the cylinder solenoid valve is closed to operate the valve, but the circuit to power unit remains open so that power unit does not operate.

On *1948 Models*, one switch is mounted on the right door for controlling operation of the right door window, and two switches are mounted on the left door for controlling both door windows. The forward switch controls the right door window and the rearward switch controls the left door window.

On *1949 Models*, one switch is mounted on the right door for controlling operation of the right door window, and four switches are mounted in a cluster on the left door for controlling all door and rear quarter windows. Starting at the forward (No. 1) switch, this switch controls:

1. Right rear quarter window
2. Left rear quarter window
3. Right door window
4. Left door window

In addition to the switches on the left door, each rear quarter window is controlled by a single switch on the adjacent rear quarter trim panel.

A single switch is mounted on the left end of the front seat frame for control of the seat adjuster.

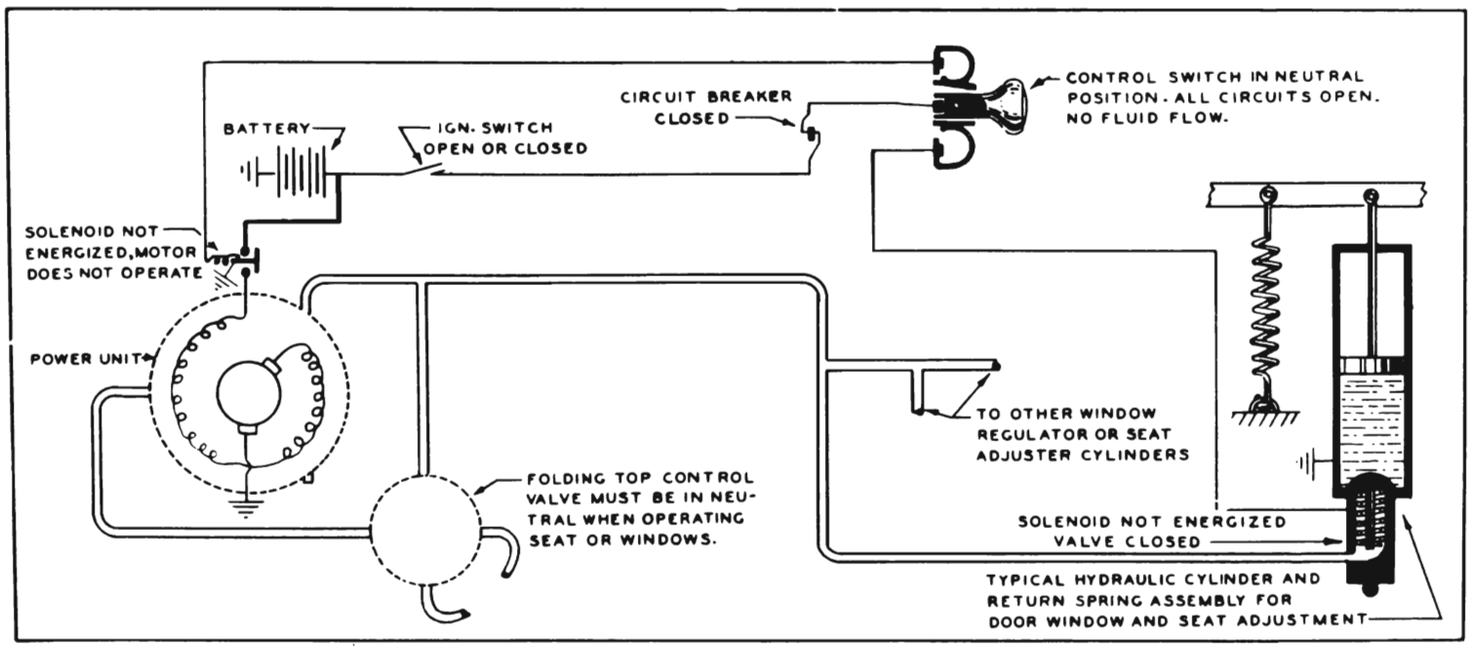

Figure 13-70—Window or Seat Circuit Diagram, Neutral or Stationary Position

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e. Neutral Position, Window or Seat Stationary

When the window (or seat) control switch is released it is in neutral position so that all electrical circuits are open. The power unit is stopped and the solenoid valve in power cylinder is closed, thus blocking movement of the window (or seat). Since the valve is closed, no movement of window (or seat) can take place when the power unit is operated to move the folding top. See figure 13-70, which shows the power cylinder partially filled, indicating that window is part way up (or seat part way forward).

f. Operation When Raising Window or Moving Seat Forward

Before attempting to move windows or seat, the folding top control knob must be in neutral position so there is no fluid flow in the folding top power system.

When the control switch knob is moved up to raise the window (or forward to move seat forward) the circuits to the solenoid relay switch on power unit motor and to the solenoid valve in the power cylinder are closed. The solenoid valve opens to allow fluid to enter the cylinder and the power unit motor and pump start operating. Fluid entering the power cylinder causes the piston to raise the window (or move seat forward) against the action of the return spring in window lift (or seat adjuster). See figure 13-71.

When switch knob is released the circuits are broken, the power unit stops, the solenoid valve closes and the window (or seat) is held stationary by the oil trapped in power cylinder.

g. Operation When Lowering Window or Moving Seat Rearward

Before attempting to move windows or seats the folding top control knob must be in neutral position so there is no fluid flow in the folding top power system.

When the control switch knob is moved down to lower the window (or rearward to move seat rearward) the circuit to the solenoid valve is closed, causing the valve to open. The circuit to the power unit solenoid relay switch remains open, thus eliminating action of the power unit pump. When the solenoid valve opens, the pressure of the return spring in window lift (or seat adjuster) forces fluid out of power cylinder, back through the fluid pipe to the power unit reservoir through the power unit pressure relief valve. This spring action also moves the window down (or seat rearward). See figure 13-72.

When switch knob is released it returns to neutral position. The solenoid valve circuit is broken, the valve closes, and the fluid trapped in power cylinder holds the window (or seat) stationary.

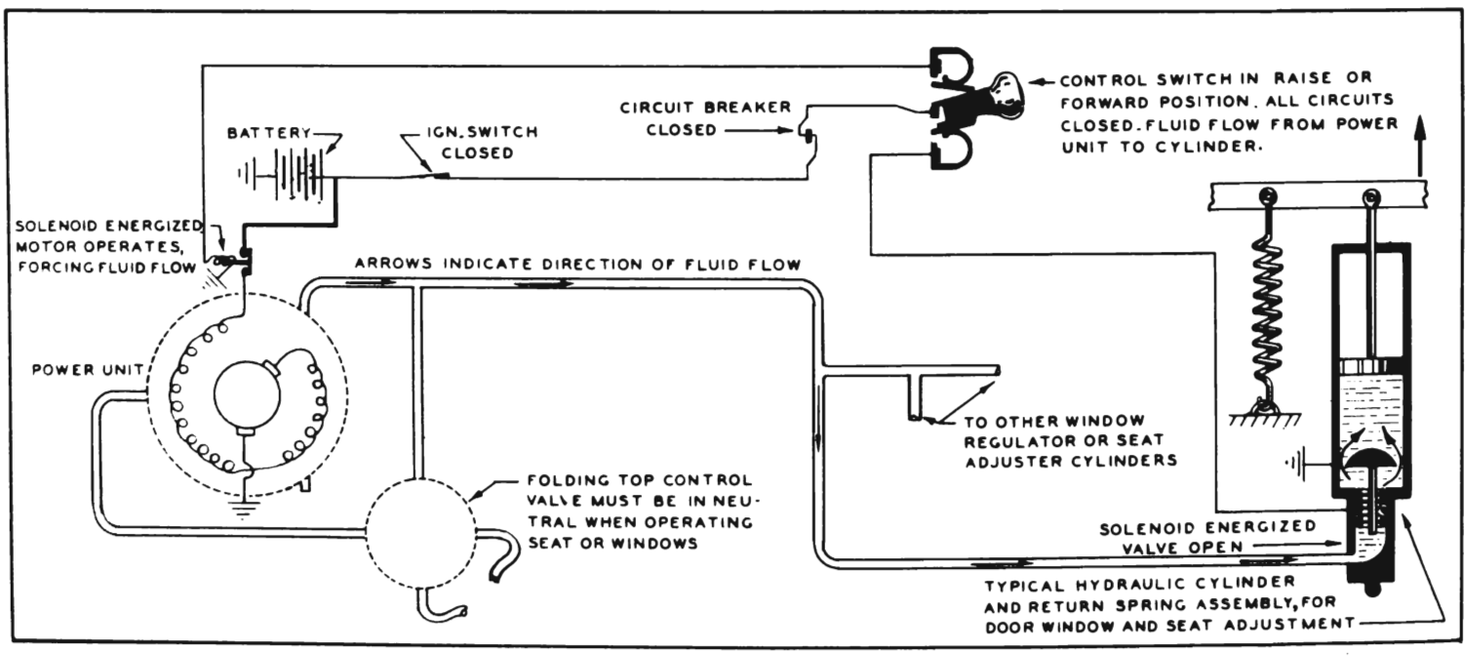

Figure 13-71—Window or Seat Circuit Diagram, Raising Window or Moving Seat Forward

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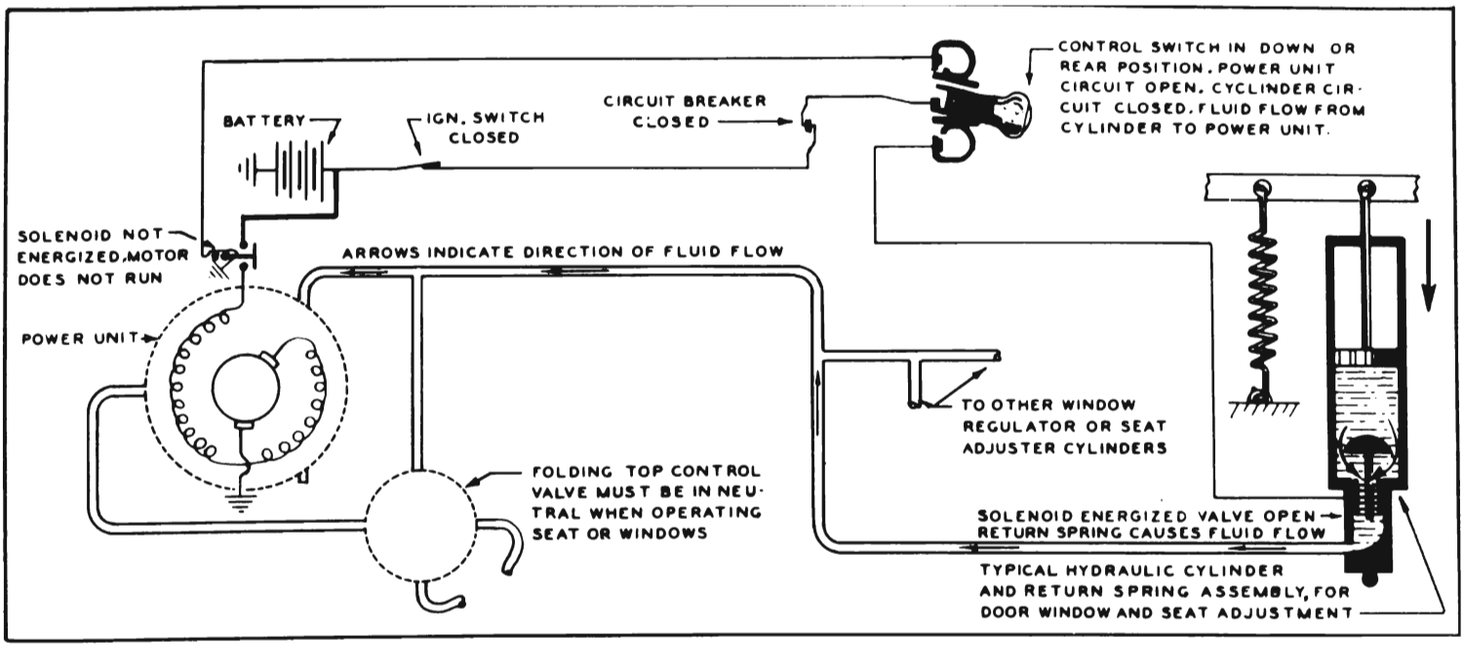

Figure 13-72—Window or Seat Circuit Diagram, Lowering Window or Moving Seat Rearward

13-32 SERVICE RECOMMENDATIONS

IMPORTANT: *Every precaution must be taken to avoid entrance of dirt, water, or any trace of mineral oil into the hydraulic system. To guard against contamination make certain that containers used for fluid are absolutely clean and have not been used for mineral oil.*

Before working on hydraulic system be sure to cover adjacent trim and painted surfaces. Hydraulic fluid is injurious to car finish and damage is almost instantaneous.

Hydraulic fluid is inflammable; be careful to avoid dropping fluid on hot manifold or exhaust pipe.

a. Checking Fluid Level and Adding Fluid

Cars equipped with the Hydro-Lectric Power System have the power unit reservoir partially drained when shipped from the factory by rail or truck. A tag attached to steering wheel gives notice that reservoir must be filled before car is delivered to customer. Since the tag may become detached in handling it is always advisable to check fluid level before delivering any car.

The following procedure must be used whenever it becomes necessary to check fluid level and add fluid.

1. Lower the top, move front seat to rearward position, and fully lower all windows.

2. Remove fluid reservoir and fill to the fluid level line (½" below top), using Delco Super No. 9 or 11 Brake Fluid. Install reservoir.

NOTE: *Brake fluid heavier than No. 11 should not be used in extremely cold climates as it will cause sluggish operation of Hydro-Lectric system.*

3. Operate the top, all windows and front seat several times each until all air has left the fluid system. If air is present, a chattering noise will be produced when top, windows, or seat are operated. After all air has been expelled, lower the top, move seat back, and fully lower all windows.

4. Again remove reservoir and adjust fluid level to the fluid line (½" below top).

5. Install reservoir, making certain that gasket is in good condition and that reservoir makes full contact all around. CAUTION: *Any leakage of dirt or water into reservoir will cause serious damage in Hydro-Lectric Power System.*

b. Seasonal Change of Fluid

Hydraulic fluid should be changed once a year, preferably in the Fall. Since the power unit pump reservoir is vented to atmosphere a certain amount of air is drawn into and expelled from the reservoir during operation of the system. Incoming air may bring in a certain amount of fine dust which will accumulate as sludge in the bottom of the reservoir. Normally, a seasonal change of fluid in the reservoir is sufficient, however, if there is very much accumulation of sludge in the reservoir it is im-

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portant to change fluid in the complete hydraulic system, as follows:

1. Lower the top, move seat fully rearward, and fully lower all windows.
2. Disconnect battery to avoid accidental operation of power system when pump reservoir is removed.
3. Remove and empty pump reservoir. Place a receptacle under pump to catch fluid, then manually raise and lower the top several times while holding the control knob in proper positions. This operation will drain fluid from both ends of the power cylinders.
4. Thoroughly clean all sludge from reservoir, using Declene (Group 4.683) or 99% methyl alcohol.
5. Fill reservoir to the fluid line (½" from top) with Delco Super No. 9 or 11 Brake Fluid and install on pump.
6. Connect battery, using care to properly wind clock (par. 10-66, *c)*.
7. Operate the top up and down to pump the fluid into the power cylinders. Additional filling of reservoir will be necessary as the capacity of the two power cylinders is almost double that of the reservoir.
8. With reservoir filled to level line, operate top up and down until all air has been expelled from this part of system. If air is present a chattering noise will be produced during operation of top.
9. After all air has been expelled from top hydraulic system, operate the front seat and all windows until all air has been expelled from these systems.
10. Remove reservoir and adjust fluid level to the fluid line (½" below top). Install reservoir making certain that gasket is in good condition and that reservoir makes full contact all around.

13-33 TROUBLE DIAGNOSIS

Failure of any part of the Hydro-Lectric Power System can result from three major classes of faults, namely: (1) Mechanical, (2) Electrical, (3) Hydraulic. Before doing any work on the electrical or hydraulic systems it is always advisable to make sure that the fault is not mechanical.

a. Top Will Not Operate

1. *Mechanical* interference due to luggage or other objects; hold-down strap not removed, or top not free from windshield header studs.
2. *Electrical* shorts or loose connections in control switch circuit (par. 13-34); dirty control switch contacts; inoperative power unit motor (subpar. *k)*.
3. *Hydraulic* fluid low; power unit pump inoperative; stoppage in fluid pipes (par. 13-34); faulty control valve; broken port plate in pump.

b. Top Operates in One Direction only

1. *Mechanical interference,* same as in subparagraph *a.*
2. *Electrical* shorts or loose connections in control switch circuit (par. 13-34); dirty control switch contact; improperly adjusted control rod (par. 13-35).
3. *Hydraulic* power cylinder faulty; stoppage in fluid pipes; faulty control valve.

c. Window Lift Inoperative

1. *Mechanical* interference from door arm rest screw; misaligned glass run channel or window guide (par. 13-27); window lift not connected to lower sash channel.
2. *Electrical* short or loose connection in "BAT", "MOT" or "CYL" circuit (par. 13-34); cylinder solenoid inoperative (par. 13-34); power unit motor inoperative (subpar. *k)*.
3. *Hydraulic* fluid low; hoses crimped or stoppage in fluid pipes (par. 13-34); pump pressure relief valve stuck; cylinder piston rod disconnected; broken port plate in pump.

d. Windows Operate Slowly Upward

1. *Mechanical* binding due to misalignment; glass run channels excessively wet. If window does not fully close, stops are improperly adjusted (par. 13-27, *c.)* or there is insufficient hydraulic fluid.
2. *Electrical* failure due to low battery (par. 10-17).
3. *Hydraulic* failure due to stuck pump pressure relief valve; top control rod improperly adjusted so that control valve is held partially open to allow fluid to enter top lines (par. 13-35).

e. Windows Operate Slowly Downward

If a window moves slowly downward when control switch is in neutral position, the solenoid valve in window lift cylinder is leaking.

1. *Mechanical* binding due to misalignment; glass run channels excessively wet; window lift return spring broken.
2. *Hydraulic* fluid old, congealed, or too

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heavy for prevailing temperatures; pump pressure relief valve stuck.

f. Window Raises When Top or Seat Is Operated

1. *Electrical* control circuit crossed due to switch "CYL" terminal touching "BAT" terminal.
2. *Hydraulic* pressure too high if more than one window raises.

g. Two Windows Operate from One Switch

1. *Electrical* control circuit crossed due to switch "CYL" terminals touching.
2. *Hydraulic* pressure too high (par. 13-34).

h. Seat Adjuster Inoperative

1. *Mechanical* interference from object under seat; seat adjuster misaligned; seat adjuster not attached to seat frame or floor.
2. *Electrical* fault same as for window (subpar. *c)*.
3. *Hydraulic* fault same as for window (subpar. *c)*.

i. Seat Operates Slowly Forward or Rearward

Same as for windows operating slowly upward (subpar. *d)* or downward (subpar. *e)*.

j. All Units Operate Slowly Forward or Rearward

1. *Mechanical* interference due to misalignment.
2. *Electrical* fault due to low battery (par. 10-17).
3. *Hydraulic* fluid too heavy; pump pressure relief valve stuck; crimped fluid hoses or stoppage in fluid pipes (par. 13-34).

k. Power Unit Inoperative on Any Control Switch

When running, the power unit has a clearly audible whirring sound.

1. Battery low (par. 10-17).
2. Wiring connections between ignition switch and solenoid relay switch loose, dirty or disconnected (par. 13-34).
3. Circuit breaker inoperative.
4. Solenoid relay switch inoperative.
5. Power unit motor inoperative.

13-34 TESTS OF HYDRO-LECTRIC POWER SYSTEM

When the Hydro-Lectric Power System fails to operate properly, two important service inspections should be made before making any other inspections and tests.

1. Check the battery and cables as described in paragraph 10-17. If battery specific gravity is below 1.200 the voltage may be sufficient to run the power unit motor but may not be sufficient to operate power cylinder solenoid valves also.
2. Check the level of fluid in pump reservoir as described in paragraph 13-32.

a. Tests of Electrical Circuits

Aside from low battery, failure in the electrical system may be due to circuit faults such as loose or dirty wiring terminals, shorted or grounded wires, inoperative circuit breaker, inoperative switches or solenoids, or inoperative power unit motor. It is necessary to test each part of the affected circuit to determine the cause of failure.

In general, tests may be made in the same manner as for other electrical circuits in the car. A jumper wire may be used to bridge around a wire or unit, or to provide a positive ground. A 6-volt test lamp or a voltmeter may be used to determine whether current is flowing or is available at a given unit. In applying these methods of test refer to the circuit diagrams given in figure 13-74 or 13-76 and pay particular attention to color codes specified for wires and terminal markings on the units.

When it is necessary to remove a window or seat control switch for test, use a screw

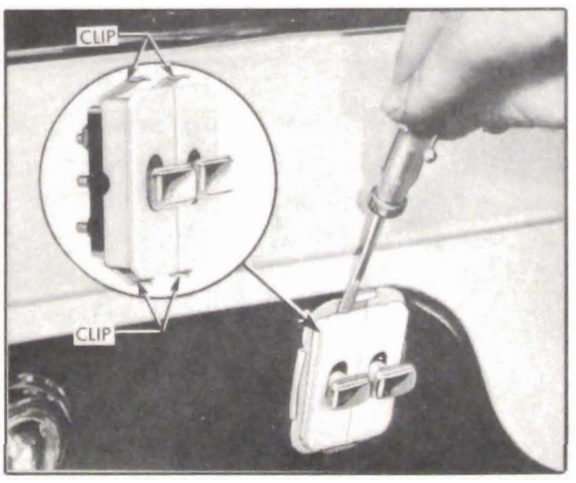

Figure 13-73—Removing Door Window Control Switch, Escutcheon Removed—1948 Models

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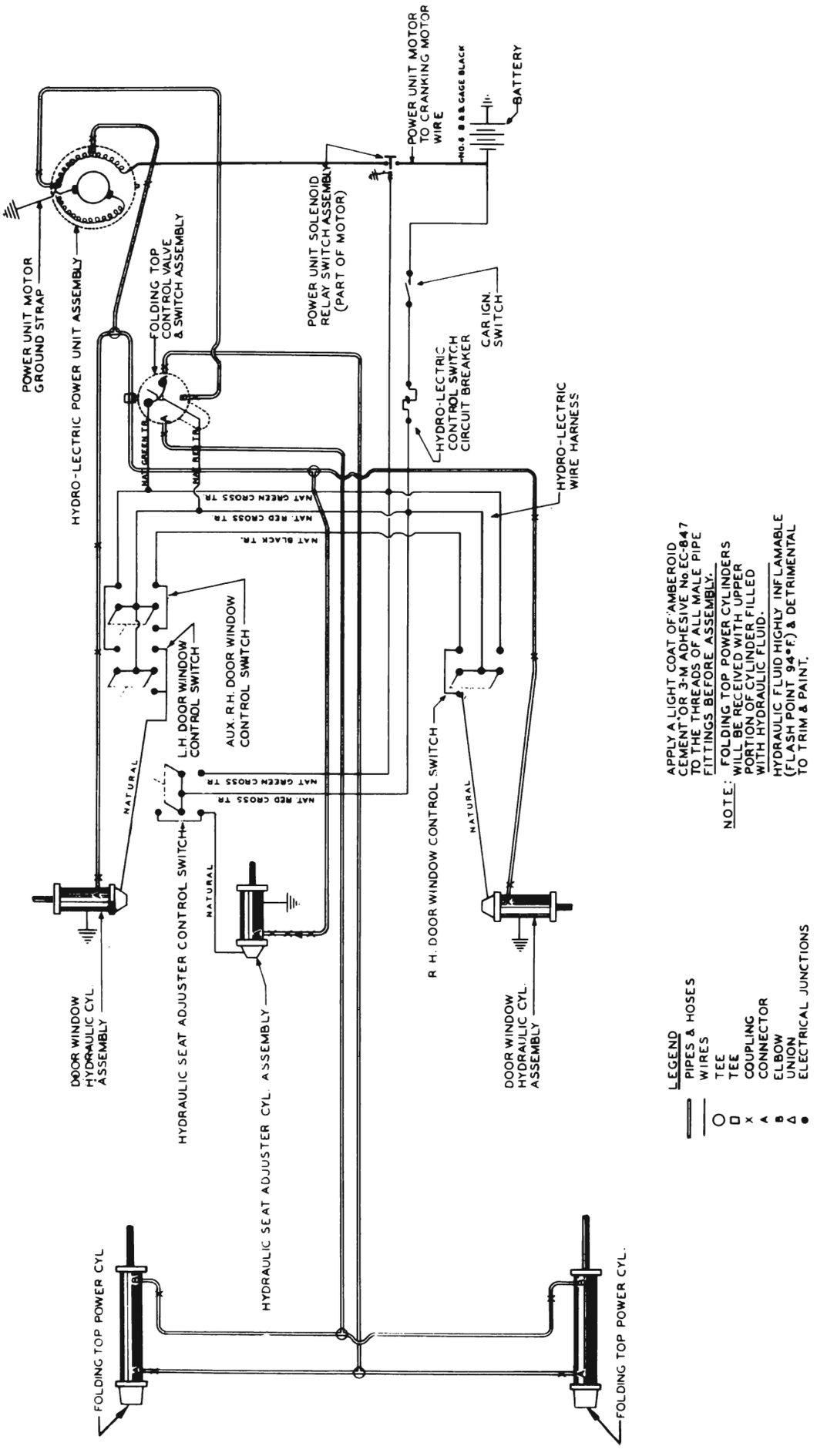

Figure 13-74—Electrical and Hydraulic Circuit Diagram—1948 Models

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driver to depress the spring clips at each end of switch and to start the switch out, as shown in figure 13-73. On the door window switches, the escutcheon must be pried off before removing switch; on seat adjuster switch this is not necessary.

To check operation of switch, wiring and solenoid valve in cylinder of window lift (or seat adjuster) without removing trim pad, turn ignition switch "ON" and push control switch knob up or down. A sharp "click" will be heard when contact is made. If no "click" is heard either the switch, wiring, or solenoid is at fault and each part should be tested individually.

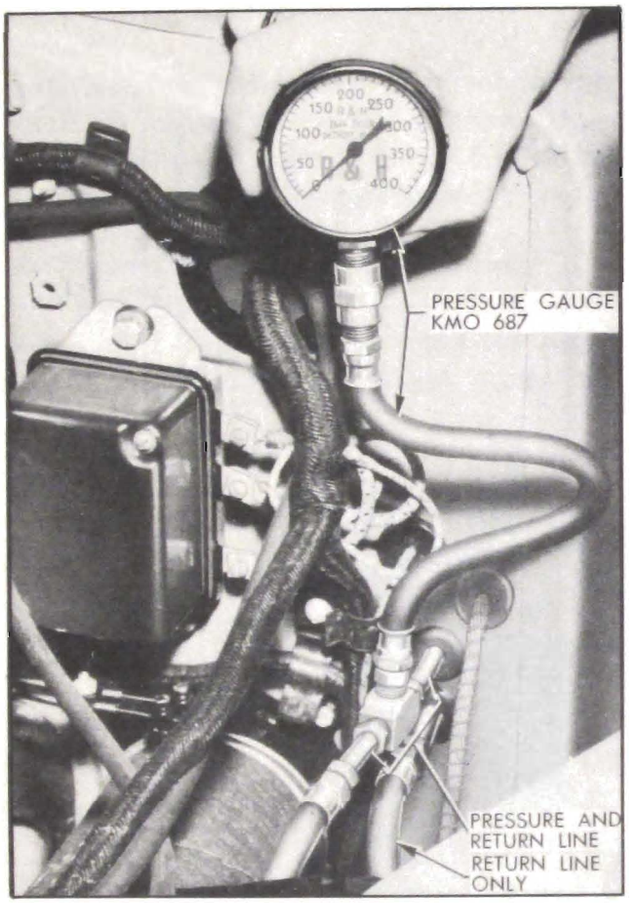

Figure 13-75—Pressure Gauge Installed in Power Unit Pressure Line

b. Tests of Hydraulic Circuits

The fluid pressure of the power unit pump is controlled by the pressure relief valve to maintain a maximum pressure of 250 to 260 pounds per square inch. Under no circumstance should the valve be changed to provide a higher pressure. In conjunction with the spring on the valve, washers are also added under the head of valve plug to adjust for the specified pressure. When valve is removed for cleaning be sure to reinstall the same number of washers.

After making certain that the hydraulic system is properly filled with fluid, the system may be checked for proper pressure at the various units by disconnecting the fluid pipe or hose and inserting pressure gauge KMO 637. See figure 13-75. Start at the power unit pressure line to make certain that the pump is delivering the required pressure, then connect to the top control valve and finally at the affected power cylinder.

With test gauge installed in power unit pressure line and ignition switch turned "ON", test output pressure of pump. If top is raised, push control knob forward (if down, pull knob rearward), hold for 10 or 15 seconds and then note gauge reading. This should be 250 to 260 pounds. If pressure is below normal, the pump must be inspected and the trouble corrected.

When installing test gauge at top control valve, connect at port leading to top end of power cylinder if test is made with top raised; if top is down connect at port leading to bottom of power cylinder. See figure 13-77. Make test as previously described. If pressure is below normal, the trouble is either in the hose or pipes leading to control valve, or in the valve itself.

When installing test gauge at top power cylinder, connect at top end if test is made with top raised; if top is down, connect to bottom end. If pressure is not normal, the trouble is either in the fluid pipes or fitting between the control valve and cylinder or in the cylinder itself.

When test gauge is installed at power cylinder of window lift or seat adjuster, subnormal pressure indicates trouble in the fluid pipes, fittings or hoses between power unit and cylinder or a leak in the cylinder itself.

13-35 ADJUSTMENT OR REPLACEMENT OF HYDRO-LECTRIC UNITS

a. Adjustment of Top Control Rod

The top control rod must be adjusted so that the control switch makes positive contact in both directions. When installing control valve and switch assembly, or when switch is not making positive contact, adjust control rod as follows:

1. Before putting rod into trunnion on switch cover, loosen knob lock nut and align the rod with hole in trunnion, then tighten lock nut.
2. Make sure control valve and switch assembly is in neutral (center) position. Insert

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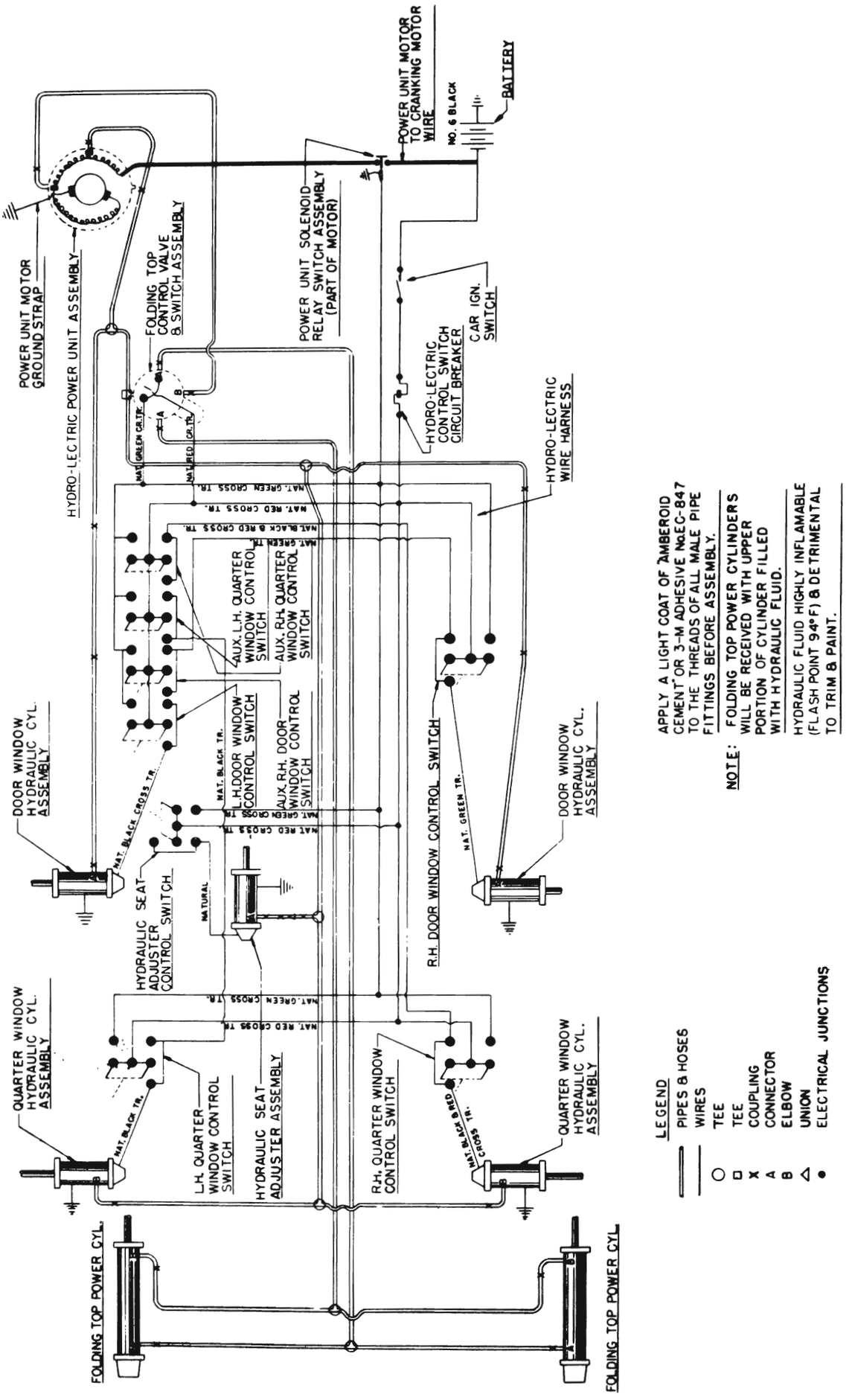

Figure 13-76—Electrical and Hydraulic Circuit Diagram—1949 Models

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rod in trunnion hole far enough so that distance from plastic knob to face of knob bushing is 1" to 1 1/32", then tighten trunnion set screw. See figure 13-77.

3. Operate control knob in both directions several times to make sure there is no binding and that centering spring in switch returns valve and switch to neutral position when control knob is released.

b. Replacement of Units

The top control valve and switch assembly, control switches, solenoid relay switch, circuit breaker, and power cylinders are serviced as complete assemblies only. Parts are furnished for servicing the power unit motor and pump in case minor repairs or replacements become necessary.

Replacement procedure for each unit is obvious on inspection. When disconnecting hydraulic fluid pipes attention must be given to precautions given in subparagraph *c*, below.

c. Precautions When Disconnecting Fluid Pipes

If fluid pipes are disconnected for any reason, the following precautions must be observed:

1. Do not disconnect any fluid pipe without first disconnecting the battery to prevent accidental pumping of hydraulic fluid on finished surfaces or upholstery. Hydraulic fluid will damage lacquer finishes.

2. When a fluid pipe is disconnected, there will be a certain loss of fluid and, under certain conditions, the fluid may be pressurized in the line. Always have ample rags or a suitable receptacle to catch this fluid and prevent damage or possible fire; *hydraulic fluid is inflammable.*

3. When a fluid pipe is disconnected, be sure to plug or cap open end of pipe to avoid entrance of dirt, and in case the battery has to be connected for any reason. Also tape ends of any wires that may be disconnected.

4. The top must not be operated manually while the pump is disconnected except while cleaning system.

5. Before connecting fittings or pipes, sparingly apply a coating of "Amberoid Cement" or "3-M Adhesive #EC-847" to threaded areas to prevent possible seepage of fluid.

6. After pipes are connected, operate the top, seat, and windows through several cycles to expel all air and fill reservoir to fluid line (par. 13-32).

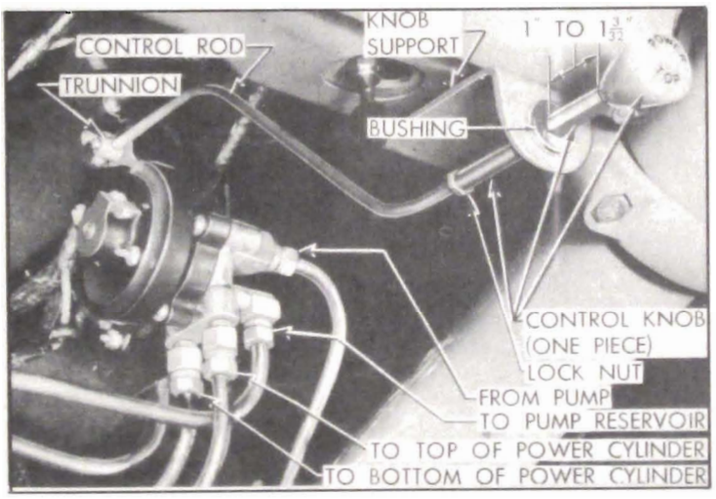

Figure 13-77—Top Control Rod Adjustment and Fluid Pipe Connections to Control Valve