ELECTRICAL SYSTEM

STARTER OPERATION AND DESCRIPTION OF CIRCUITS (ALL SERIES)

The Buick Starter Control enables the engine to be started automatically, after the ignition has been turned on, by pressing down on the accelerator pedal.

The starter circuit is opened and the gears automatically disengaged as soon as the engine starts.

The units comprising the starter control mechanism consist of the following:

1. A switch mounted on the carburetor throttle body and operated by both the engine vacuum and throttle fly shaft.
2. A solenoid, mounted on the starting motor, for operating the pinion shifting mechanism and closing the starter switch.
3. A relay, mounted on the solenoid, for operating the solenoid.
4. The generator windings are used for completing the control circuit to ground.

Coincidental Operation of Throttle and Starter

After the ignition has been turned on, engine can be started by pressing down on the accelerator pedal. The movement of the controls causes the throttle to open and the vacuum switch contacts to close. This allows the current to flow from the battery through the ignition switch, vacuum switch, solenoid relay windings and the generator to ground. See Fig. 12-1.

Completion of this circuit causes the solenoid relay contacts to close; current from the battery then flows through the "closing" and "hold-in" coils of the solenoid, magnetizing the solenoid plunger, which shifts the pinion into engagement with flywheel gear and closes the starter switch.

The closing of the starter switch causes the starter to crank the engine and also cuts out the closing coil of the solenoid, the magnetic pull of the "hold-in" coil being sufficient to hold the pinion in mesh after the shifting has been performed. This reduces the current consumed by the solenoid while the starter is operating.

Automatic Disengagement of Gears by Vacuum Switch

Normally, as soon as the engine is running, the vacuum switch will be locked open by the manifold vacuum as throttle is returned to idle position. This causes the solenoid relay contacts to open, which breaks the solenoid circuit. A torsional spring on the starter shifter yoke first allows the starter switch to open and then disengages the starter gears.

Under conditions where the throttle does not return to idle position or engine vacuum is not sufficient to lock open the vacuum switch contacts, the increased speed of the generator results in generating a voltage which prevents current passing through the magnet coil of the solenoid relay from continuing its flow through the generator to ground.

Means of Preventing Engagement of Gears While Engine is Running

A. Manifold vacuum acting on vacuum switch.

B. Blocking effect of generator voltage.

C. Mechanical lockout in the vacuum switch.

Booster Action of Starter for Aiding Feeble Explosions in Cold Weather Starting

In cold weather the first explosions are often so feeble that the power developed is not sufficient in itself to keep the engine turning over. Under this condition the starter gears remain in mesh until the explosions are sufficiently regular to assure the continued running of the engine.

NOTE: *Always depress the clutch pedal when starting in cold weather to release load caused by heavy lubricant in transmission. Service stations should give this instruction to owners.*

The Over-Running Clutch

The starter is equipped with the Buick roller type over-running clutch. This protects the armature and bearings from the higher speeds that are attained after engine fires and before the gears are automatically disengaged. This clutch is identified by a groove cut in inner end of pinion. See Fig. 12-5.

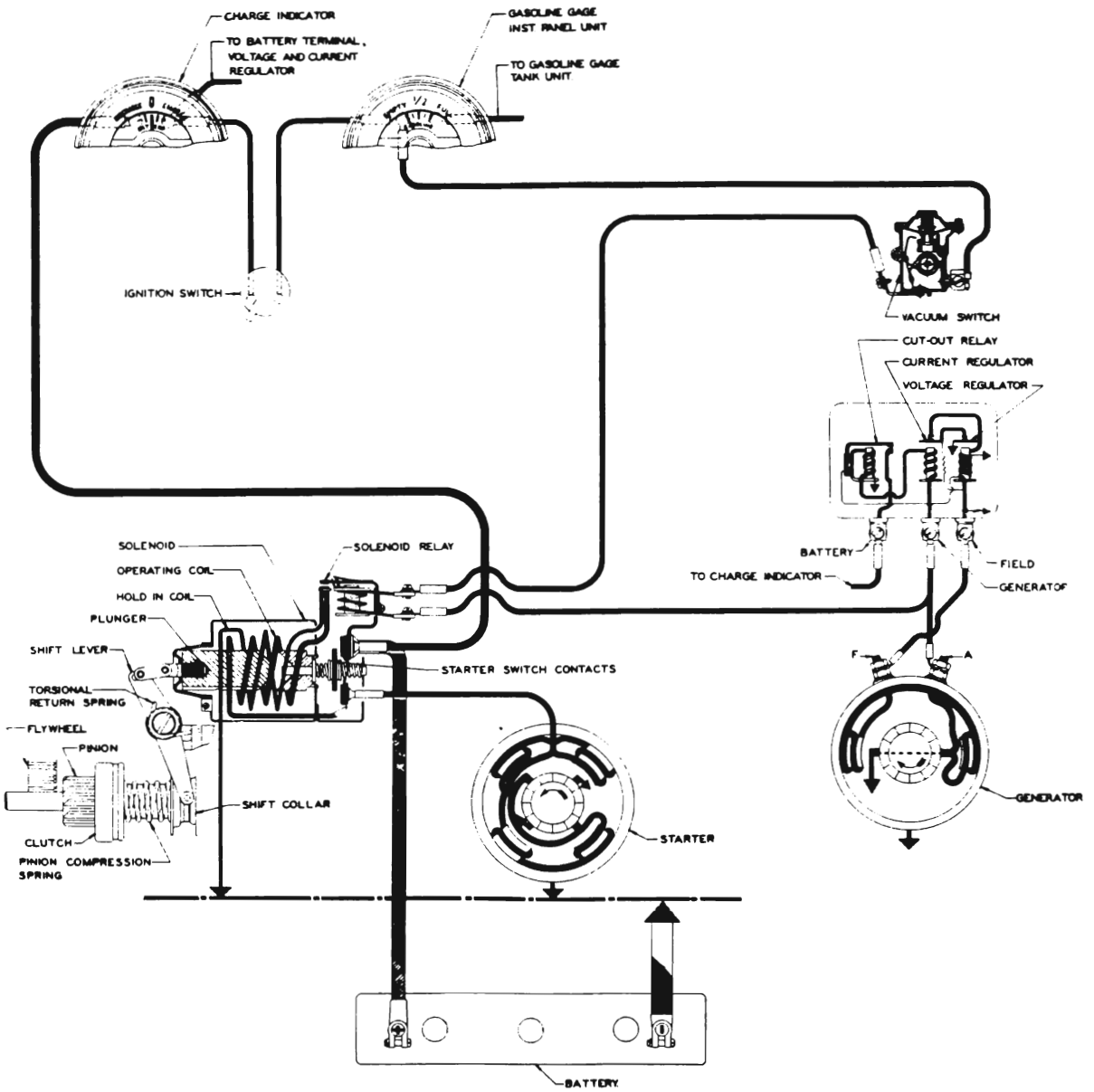


Fig. 12-1. Starter and Control Circuits

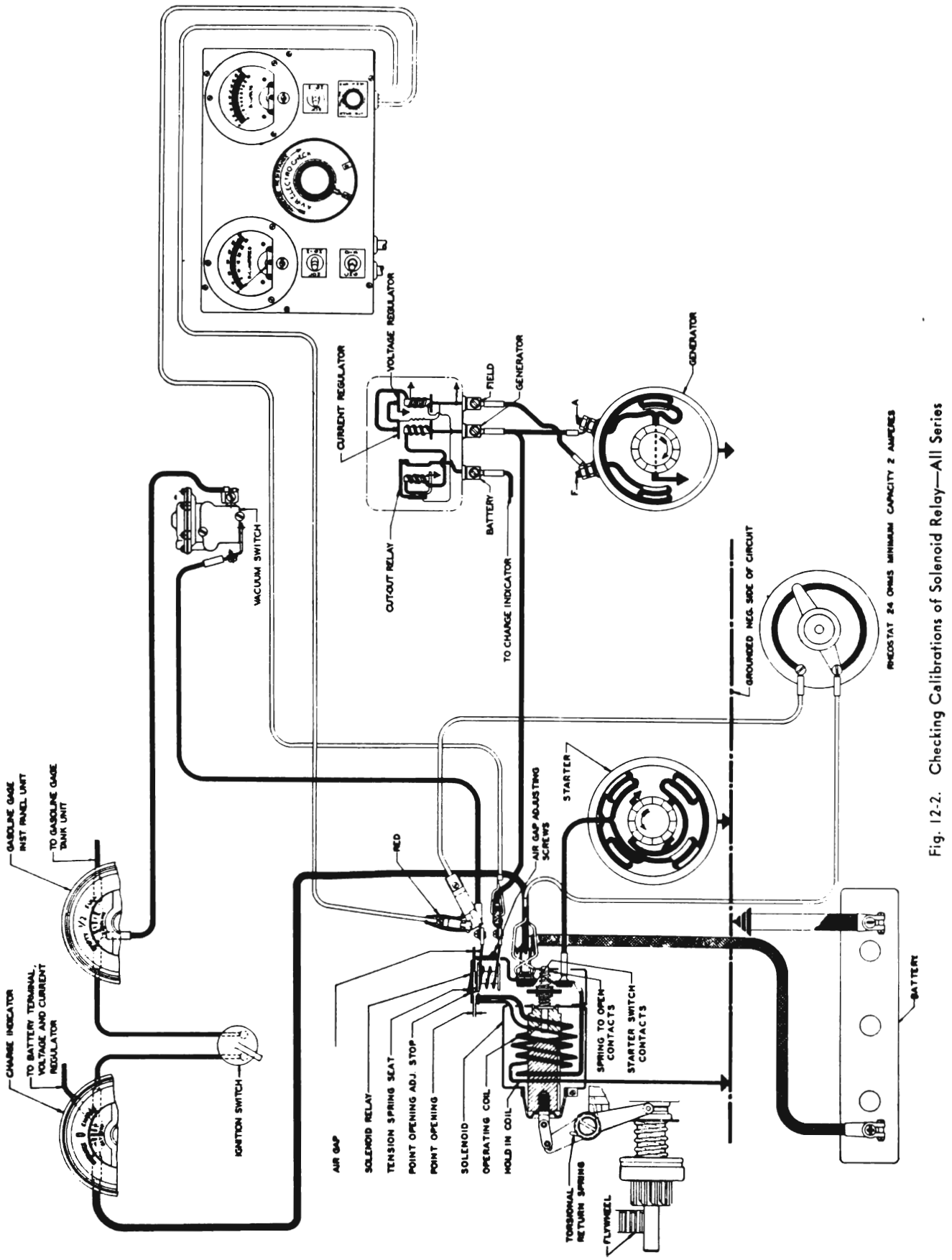


Fig. 12-2. Checking Calibrations of Solenoid Relay—All Series

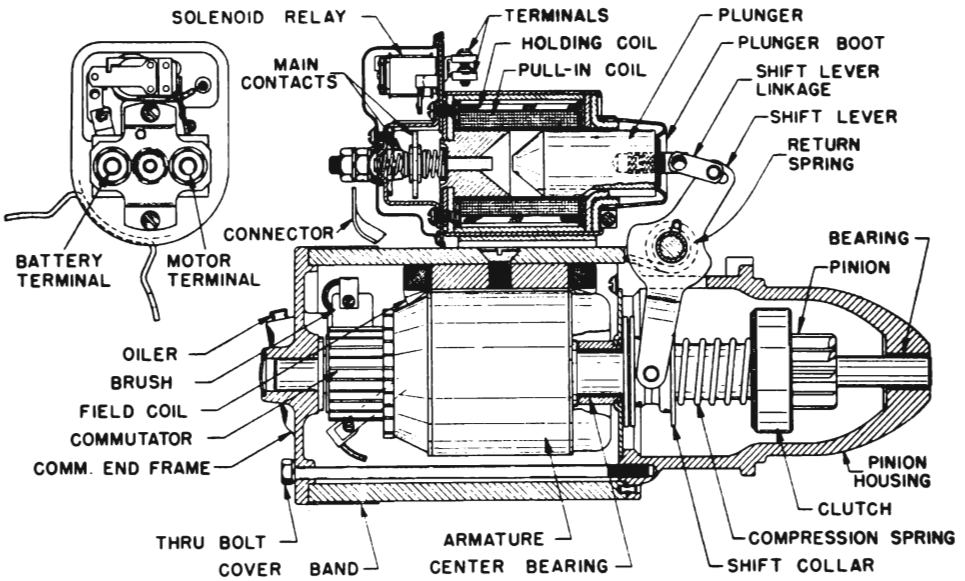


Fig. 12-3. Starting Motor—Series 60-70-90

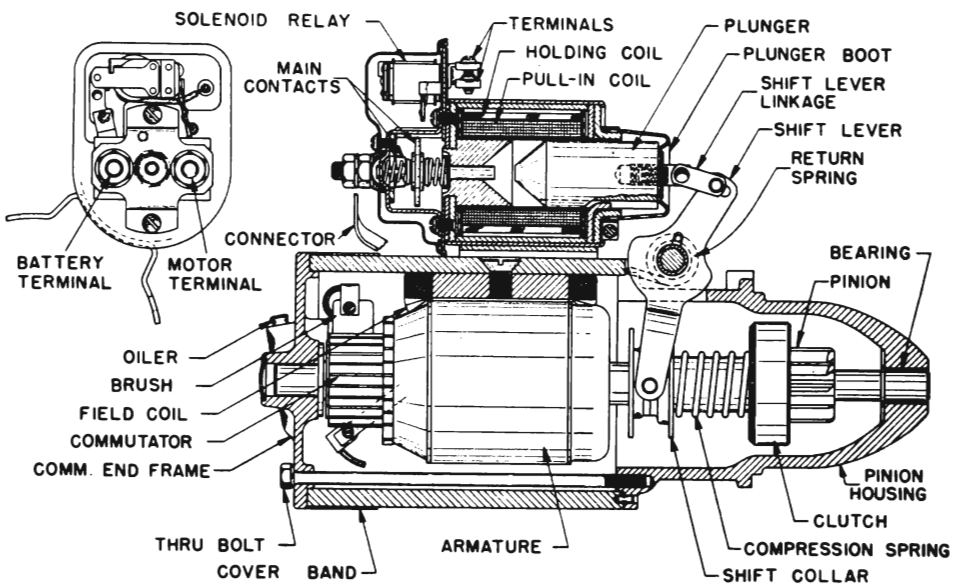


Fig. 12-4. Starting Motor—Series 40-50

STARTING MOTOR

Series 40-50

This motor is of the induced pole type having four poles but only two field coils. The bearing at front or commutator end is cast-iron, and is provided with an oil cup and wick oiler which should be lubricated every 1000 miles—the outboard and pinion bearings are provided with graphite bronze bushings which require no additional lubrication. See Fig. 12-4.

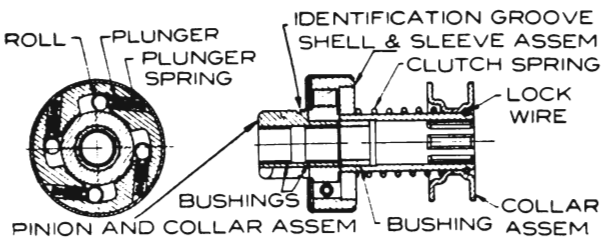


Fig. 12-5. Starter Clutch

Series 60-70-90

This is a four-pole motor with four field coils. The armature shaft of this motor is supported by three bearings. The bearing at the front or commutator end is cast-iron and is provided with an oil cup and wick oiler. The center, outboard and pinion bearings are graphite bronze and require no additional lubrication. See Fig. 12-3.

Solenoid Pull Test—*All Series*

With a ¾" bar placed between the pinion and end bearing, main starter switch should close at approximately 3.8 volts at a temperature of 80° Fahr.

FLYWHEEL AND PINION TEETH

Flywheel teeth are cut on a heat-treated steel ring which is shrunk against a shoulder on the flywheel. Starting motor pinion is made from heat-treated nickel alloy steel.

SOLENOID RELAY

NOTE: Use the Solenoid Relay Instructions and Specifications in this Manual for servicing Solenoid No. 1118019.

Use the Solenoid Relay Instructions and Specifications in the 1941 Manual for servicing Solenoid No. 1542.

Instructions for Testing

When solenoid relay is operating properly, points will just touch and make contact between 1.3 and 1.6 volts.

Armature will strike core between 1.8 and 2.4 volts.

Points will open between .7 and 1.5 volts, above check to be made with relay **cold** (at room temperature).

This calibration is made low so that relay will function on a low battery.

The relay adjustment should not be tampered with unless the proper test equipment is available. The following equipment is necessary to test the operation of the relay:

The A.V.R. Test Set or suitable test equipment which includes an ammeter, voltmeter and a 24-ohm variable rheostat having capacity of 2 amperes.

Procedure for checking calibration of the relay is as follows:

Determining Cut-In Voltage

(a) Make sure that ignition switch is turned off.

(b) Connect lead from one end of rheostat to battery cable terminal on solenoid. See Fig. 12-2.

(c) Connect wire from other side of rheostat to terminal on solenoid relay which is connected to the vacuum switch. This is the terminal having a white wire with black parallel tracers connected to it.

(d) Connect voltmeter leads to relay terminals.

(e) Move rheostat slowly, decreasing resistance until engine starts to crank. This indicates the "cutting in" of the relay without removing the cover. The voltage required should come within limits given above.

Determining Opening Voltage

(a) Continue to adjust rheostat until all resistance is cut out so that full voltage is applied to the relay. This fully saturates the magnet core.

(b) Gradually increase resistance until starter discontinues cranking. Voltage indicated at this instant will be that required for the relay points to open.

Instructions for Adjusting Solenoid Relay

See Fig. 12-6.

If relay does not operate within voltage limits specified above, the adjustment should be carefully checked. Point opening should measure between .020″ and .030″; the air gap between the armature and pole of magnet coil should measure .014″-.018″ with the points just closed.

The point opening can be varied by bending point gap adjustment stop.

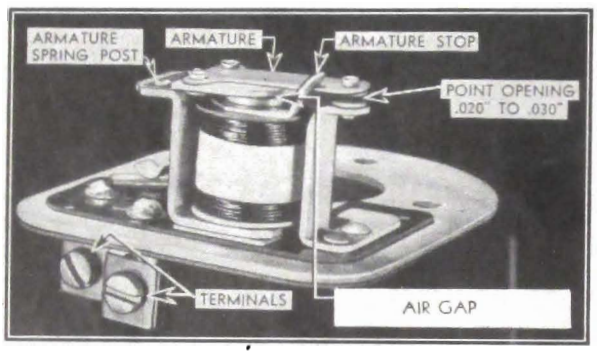


Fig. 12-6. Solenoid Relay—All Series

After the point opening adjustment has been corrected, it may be necessary to also regulate the spring tension, which can be done by bending the tension spring seat up or down until the relay operates within the prescribed voltage limits.

Replacement of Solenoid and Adjusting Pinion Travel

If it is necessary to remove the solenoid for repairs, **starter assembly should be removed** because it is important to see that the pinion

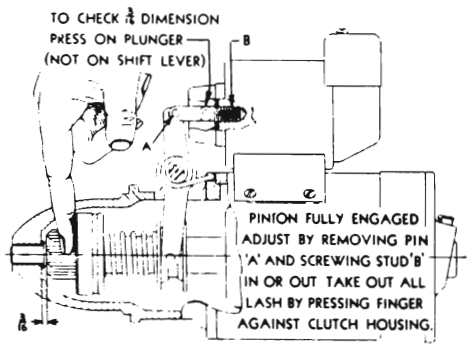


Fig. 12-7. Adjusting Pinion Travel

travel is properly adjusted when the solenoid is reinstalled. See Fig. 12-7.

Remove pin "A" and push solenoid plunger all the way forward. Take lash out of the shift mechanism by pressing finger on the clutch shell. Adjust stud "B" until pin "A" can just be inserted at the forward end of the slot with pinion 3/16″ from machined surface on casting.

Shift Lever Return Spring

The torsional return spring tension on the shift lever pivot, measured at "A," see Fig. 12-7, should be as follows:

Start of travel ..... 9 to 12 lbs.
End of travel .....28 to 35 lbs.

A weak return spring may cause the pinion disengagement to be sluggish in cold weather particularly if the shaft is gummed up.

Cleaning Commutator

Starting motor brushes are of a special composition having sufficient abrasive action to ordinarily keep the commutator clean. If cleaning becomes necessary, as a result of the excessive use of oil in lubricating the bearings, remove the starting motor cover band.

See that the ignition is turned off and close the relay contacts by placing jumper wire between battery terminal on starter and solenoid relay terminal to which wire with black parallel tracer is connected. This will cause starting motor to operate.

Commutator can then be cleaned by holding #0 sandpaper against it, moving sandpaper to and fro as armature revolves. Any excessive grease or oil should be cleaned from commutator surface and brushes with a clean cloth.

CAUTION

If the mica insulation between the bars is high, causing arcing, the armature should be removed and placed in a lathe, and a light cut taken off the commutator surface; usually from .005″ to .010″ is sufficient. Polish with light sandpaper and oil, after turning, then wipe commutator surface with a clean cloth.

Starting Motor Lubrication

A few drops of engine oil should be placed in the oil cup on commutator end bearing approximately every 1000 miles.

The solenoid plunger is protected by a rubber cover and must not be lubricated, as oil will gum up in cold weather and cause the plunger to stick.

The shift lever pivot pin, clutch shift collar and shift lever linkage bearings should be lubricated occasionally with a few drops of light engine oil.

SUGGESTIONS FOR SERVICING THE STARTING SYSTEM

Starting Motor Fails to Crank Engine When Accelerator Pedal is Pressed

1. *Low Battery.*

   This will be indicated usually by the solenoid producing a clattering noise. This is because the battery will not, when nearly discharged, sustain the voltage required to hold the solenoid "*in*" after starter switch has been closed.

2. *Defective linkage or incomplete control circuit.*

   Ordinarily if the control circuit is operating satisfactorily, the solenoid will produce a loud click when the accelerator pedal is pressed with ignition turned on. If the click is heard, but starter does not operate, look for trouble in starter switch (dirty contacts). **Poor contact at starter brushes —short circuited or open circuited winding.** If click is not heard, linkage or control circuit is defective and should be checked as follows:

3. *Accelerator does not return completely, preventing vacuum switch from unlatching.*

   (a) See that rod connecting to accelerator pedal does not bind on floor boards or mat; also see that connecting linkage works freely.

   (b) See that throttle rod return spring has not become broken or disengaged, or out of adjustment.

4. *Open circuit prevents closing of solenoid relay.*

   (a) See that gear shift lever is in neutral. NOTE: Pull out high tension coil to distributor wire and ground distributor end—to prevent the engine from starting if it should crank during this test.

   (b) Turn on ignition and open throttle until the vacuum switch is in contact position. Check as follows until open circuit is located:

   (c) If gasoline gauge registers, starter circuit through ignition switch is complete.

   (d) Next check vacuum switch by bridging switch terminals. If this causes starter to operate, switch is defective. Refer to vacuum switch operation.

   (e) Check ground circuit through generator by bridging between "A" terminal on generator and ground. If starter operates look for burn-out field coils, worn-out brushes on generator and defective contacts on voltage and current regulator.

   (f) Check solenoid relay ground circuit by grounding solenoid relay terminal to which wire with green crossing tracers connects. This can be done with screwdriver.

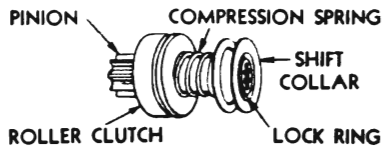
   If starter operates, look for open circuit in wiring between solenoid relay and "A" terminal on generator.

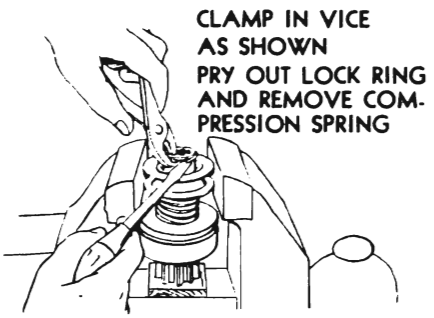
   (g) Remove cover from solenoid relay. Note if relay contacts are closed when ignition is on and throttle open. If not, trouble may be caused by defective magnet coil. Complete relay should be replaced.

   If relay contacts close, but solenoid and starter do not operate, press finger on relay armature, moving contact to and fro. If this causes starter

to operate, clean contacts with fine sandpaper and wipe with clean cloth. Make certain that particles of foreign material have not become lodged in air gap underneath the armature. Check air gap and relay calibration.

(h) Remove the rubber boot which covers solenoid plunger. If the plunger seems sticky, plunger and plunger cylinder should be thoroughly cleaned with gasoline. Do not lubricate this surface, as oil will cause plunger to stick in cold weather.





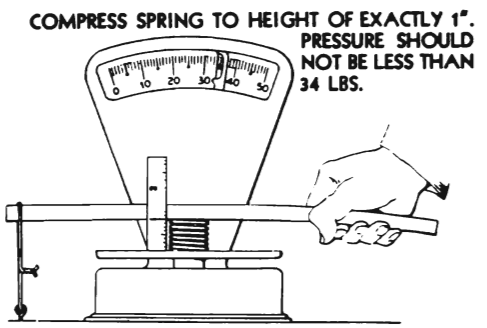


Fig. 12-8. Checking Starter Pinion Compression Spring Pressure

Starting Motor Revolves, but Starter Pinion Does Not Engage with Flywheel

1. Examine shaft on which clutch and pinion assembly slide. If shaft is gummy it should be thoroughly cleaned with gasoline and lubricated with 10-W oil so that the pinion assembly moves freely on the shaft.

2. This trouble may also be caused by weak pinion compression spring. This will usually be indicated by a loud grinding noise when the pinion butts with the flywheel teeth. Use method for removing and checking the compression of this spring as shown. See Fig. 12-8. Spring pressure should be checked very carefully, as it is essential to have a pressure of *at least 34 pounds* when the spring is compressed to a height of exactly 1". If the pressure is questionable, replace with new spring.

Starter Pinion Clash

To check starter pinion clash which occurs after engine has started running and immediately following starter disengagement, try starting engine by holding accelerator pedal to the floor until engine has reached a speed of from 15 to 20 M.P.H. If clash occurs proceed as follows:

1. A low battery will cause starter pinion to clash because the generator voltage which builds up quickly to maximum will cause a momentary voltage between generator and battery great enough to cause solenoid relay to close, causing pinion to clash. If battery registers less than 1.200 specific gravity at 75° F. it should be replaced and the above test repeated.

2. If cut-out relay calibration is set too high it will cause starter pinion to clash. Check and correct calibration. The relay points should close between voltages of 6.2 and 6.7. This adjustment must be maintained in order to prevent clashing of starter pinion.

3. Improper calibration of the solenoid relay will cause starter pinion to clash. Check and correct calibrations.

4. **Vacuum Switch Timing.** Pinion clash may be caused by faulty operation or improper timing of the vacuum switch which is mounted on the carburetor. Check switch timing and adjust if necessary. **This trouble usually occurs while driving at low speed rather than at initial start.**

Delayed Disengagement of Starter Pinion

Delayed disengagement of starter pinion which can be identified by a "zooming" sound as starter is speeded up by engine will usually be found to be caused by dirty generator commutator and brushes or by oxidized voltage regulator contact points. Inspect generator armature and clean if necessary. Brushes must also be in good condition and free to move in brush holders. Voltage regulator contact points must be clean and regulator must be operating correctly.

Delayed disengagement can also be caused by sticky and gummed solenoid plunger or by sticky or gummed starter pinion shaft. Clean parts with gasoline and apply a few drops of 10-W oil to starter pinion shaft. **Never oil solenoid plunger as this would cause plunger to gum and stick in cold weather.** A weak shifter lever return spring may also cause the pinion disengagement to be sluggish in cold weather. See "Shifter Lever Return Spring."

STARTER VACUUM SWITCH

(DELCO-REMY)

(Used on Stromberg equipped cars)

The vacuum switch is mounted on the throttle body by two screws located underneath the cover plate. A gasket is used between the switch and the throttle body to seal against loss of vacuum. The switch is operated by the throttle shaft and engine vacuum. See Fig. 12-9.

The diaphragm is located at the top of the assembly and held in place by a cover which is screwed to switch housing. This cover also forms the vacuum chamber and positions the diaphragm return spring. The function of the diaphragm is to operate the Guide Pin and Lock-Out which prevents the contacts from closing when the engine is running with the throttle open. The electrical circuit is opened and closed by means of a Contact Rotor on the Throttle Shaft and two Contact Springs one of which is combined with the Lock-Out Lever.

In wiring switch always connect the wire having red crossing tracers to the terminal on front of switch. This is the "hot" wire and when so connected protects Lock-Out Lever from being accidentally short-circuited if it is bent back against the housing during the timing operation.

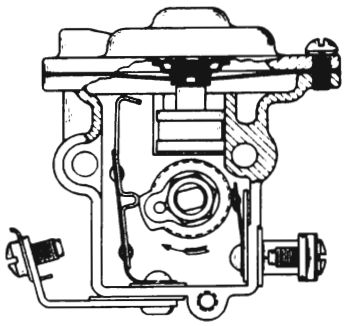
All electrical contacts and movable parts are located on the opposite side of the diaphragm from the vacuum chamber and are thus protected from gasoline fumes, gum deposits, etc. Protection against the entrance of dust is provided for by a felt gasket located underneath the Cover Plate. This gasket is sufficiently porous to allow breathing caused by movement of diaphragm. *Do not substitute any other material for this gasket.*

The switch requires no timing other than to compensate for manufacturing tolerances in switch, rotor, and throttle shaft. This is taken care of by the carburetor manufacturer by the use of special timing washers. These washers vary the position of the rotor on the throttle shaft, hence, establish relationship of throttle shaft and lock-out lever.

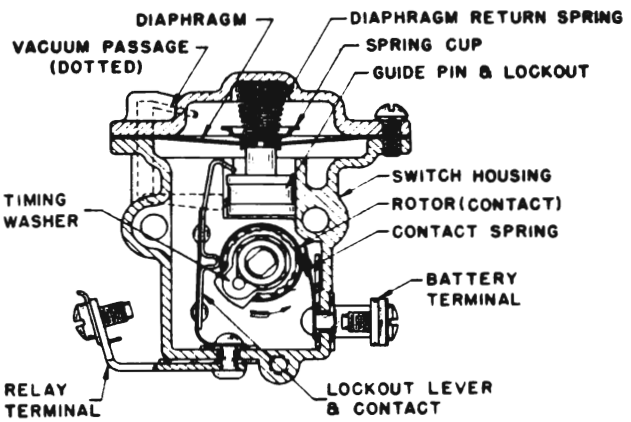
The washers are numbered, each number representing a difference of three angular degrees in throttle shaft rotation. The manufacturer selects the washer needed for holding the limits shown.

Should any of the parts effecting this assembly be replaced, it will be necessary to check the timing and possibly substitute one of the other washers to obtain the limits shown. See Fig. 12-10.

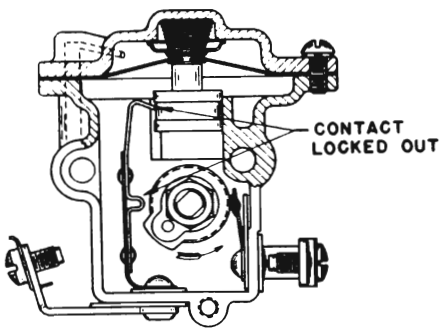
Less clearance than $\frac{3}{64}$" may result in failure to establish contact in cold weather. More clearance than $\frac{1}{32}$" may result in clashing of gears during acceleration at low speed.



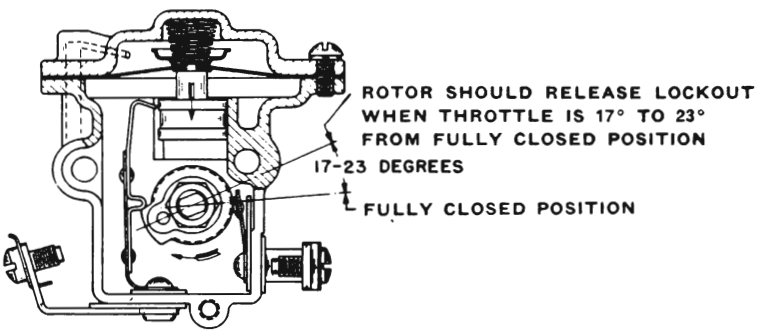
CLOSED THROTTLE (ENGINE NOT RUNNING)
LOCKOUT RELEASED



CRANKING POSITION
WITH OPEN THROTTLE



RUNNING POSITION
PART THROTTLE



POSITION OF ROTOR IN RELATION TO FULLY
CLOSED THROTTLE AS LOCKOUT RELEASES

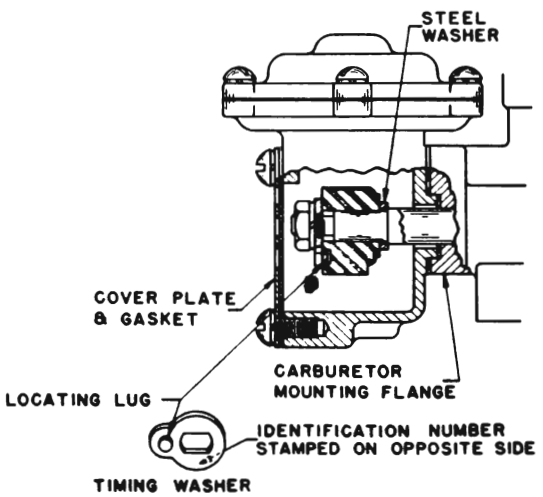


Fig. 12-9. Starter Vacuum Switch

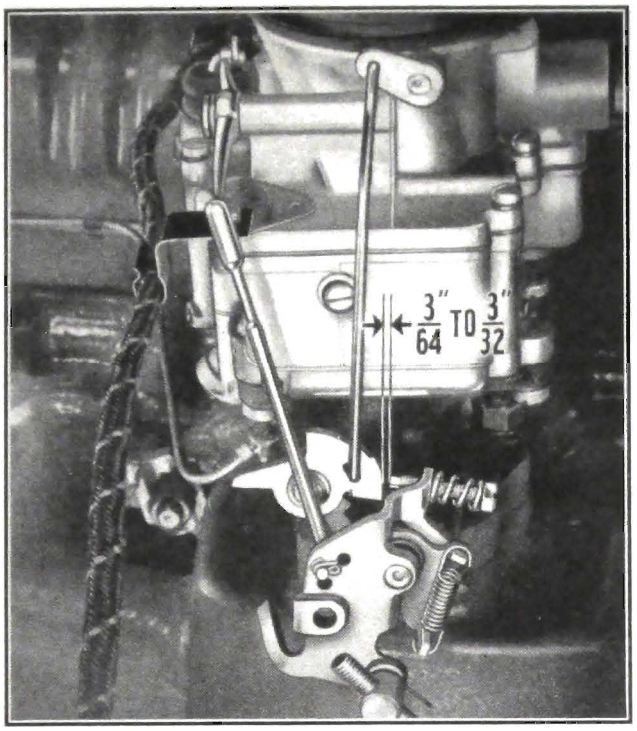


Fig. 12-10. Vacuum Switch Setting

Inspection of Vacuum Switch Timing

1. Set idle adjusting screw for 8 M.P.H. (Hot idle.)
2. Remove switch cover plate and gasket. Place mirror so that guide pin and lock-out is visible from left side of car.
3. Start engine and open throttle until clearance between idle screw and cold idle cam when cam is held in fast idle position is approximately ¼".
4. Shut off engine.
5. Slowly close throttle until guide pin and lock-out releases.
6. With throttle in this position, measure the clearance between idle screw and cold idle cam when cam is held in fast idle position. This clearance should be not less than $\frac{3}{64}$" or more than $\frac{3}{32}$".

If clearance is less than $\frac{3}{64}$", replace timing washer with a higher numbered washer. If more than $\frac{3}{32}$" replace washer with one having a lower number. Always re-check timing after replacing washers.

If carburetor and vacuum switch assembly have been removed from car, proper (8 m.p.h.) setting of the idle screw cannot be determined. Fig. 12-9 therefore illustrates correct angular relationship of the rotor to the throttle in the fully closed position when lockout releases.

Inasmuch as it is difficult to measure the angle without a special protractor it is advisable to check the timing on the car as described above and illustrated in Fig. 12-10.

STARTER VACUUM SWITCH

(CARTER)

(Used on Carter Equipped Cars)

Operation

The vacuum switch is incorporated in the carbureter. When the accelerator is depressed with engine stopped, see Fig. 12-11, a special stainless steel ball, which rests on a flat spot on the throttle shaft, is forced against a plunger which raises a W-shaped copper contact spring

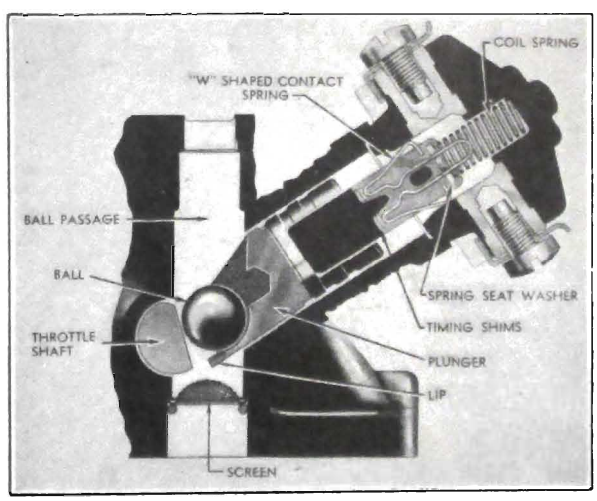


Fig. 12-11. Starter Vacuum Switch—Engine not running

Accelerator pedal in idle position coil spring holds W-shaped contact spring and plunger down against stop. Switch open. Because there is no engine vacuum the ball is at rest on the shaft and plunger.

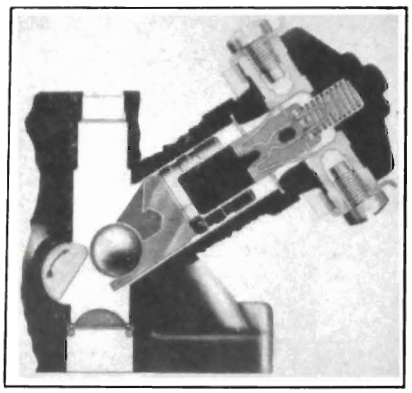


Fig. 12-12. Starter Vacuum Switch—Engine starting
Accelerator depressed, causing ball to push plunger and W-shaped contact spring up, thus closing the switch.

until it makes an electrical connection between two brass blocks in the bakelite top of the switch. This closes the solenoid relay circuit. See Fig. 12-12.

As soon as the engine starts, the manifold vacuum raises the steel ball up away from the shaft and plunger to a seat in the casting and it remains there as long as the engine is running. See Fig. 12-13.

As soon as the ball is raised, a coil spring pushing down on the W-shaped contact, forces the contact and plunger down and breaks the connection, opening the solenoid relay circuit. The ball cannot return to starting position until the engine stops and throttle is returned to idle position.

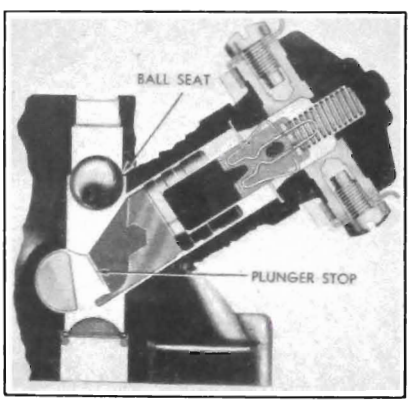


Fig. 12-13. Starter Vacuum Switch—Engine running

Engine vacuum raises the ball up away from shaft and plunger to seat in casting. Coil spring pushes W-shaped contact spring and plunger down against stop, opening switch.

The W-shaped contact spring rests on two or more brass shims having square holes. These shims determine the point at which the switch contact is made. Contact should be made when the throttle valve is opened between 30 and 40 degrees.

If total thickness of shims is not enough, contact will be made too late and throttle will be opened too far (more than 40°). This may cause starter gear clash as well as hard starting, due to deloading of the carbureter choke valve by throttle mechanism.

If total thickness of shims is too great, contact will be made too early (less than 30°) and the throttle will not be opened sufficient to give a good cold start.

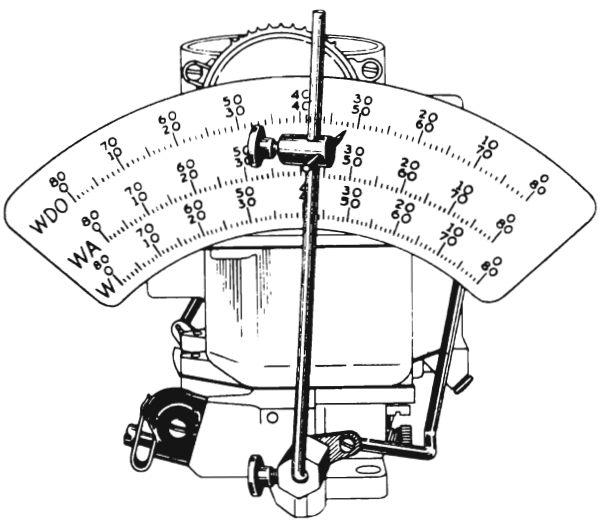


Fig. 12-14. Tool T109-121S

Checking Vacuum Switch Timing (Carter)

If clashing of starter gears or hard starting occurs, vacuum switch timing may be checked by using Carter Tool No. T109-121S. See Fig. 12-14.

This tool consists of a protractor scale which clamps to the choke cover and an indicating arm which fastens to the throttle lever.

To set arm, back off idle speed adjusting screw, rotate cold idle cam, until throttle is fully closed, move indicator to zero on W.D.O. scale and lock in this position.

Switch should make contact when the throttle

is opened between 30° and 40°. If too early, total thickness of shims under W-shaped contact spring is too great. If too late, total thickness of shims is not enough.

A test lamp can be used in series with switch to determine point of contact.

Optional Method for Rough Check on Car

Where Carter Tool No. T109-121S is not available, switch timing may be checked by measuring clearance between machined surface of stop on carbureter throttle base and open throttle stop arm.

Switch should make contact when this dimension is not more than $\frac{27}{64}$" or less than $\frac{23}{64}$". See Fig. 12-16.

CAUTION

If this method is used for checking with the carbureter removed, carbureter must be held in same position as on the manifold when check is made, otherwise ball may not be in starting position.

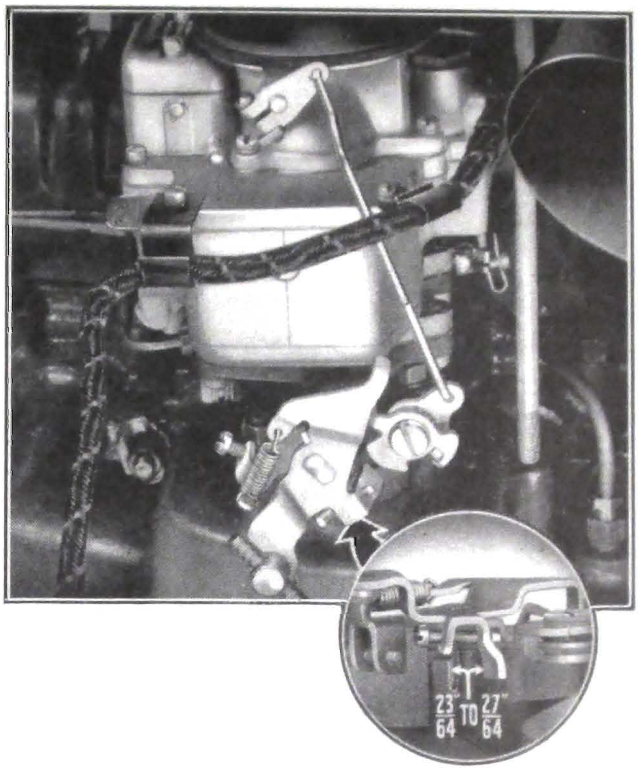


Fig. 12-16. Vacuum Switch Setting

Service Suggestions

Above the W-shaped contact spring will be found a cylindrical spring. Between these two there is a round washer with a square hole which must not be confused with the shims which go beneath the contact spring. See Fig. 12-15.

In order to remove the throttle shaft from the carbureter, it is necessary to first remove the vacuum switch complete. In returning it to position, in addition to the above caution, be sure that the small lip on the end of the plunger is placed down, that is, nearest to the manifold flange. If the plunger is installed with the lip up, the switch will not function.

Never put any lubricant on the plunger as it will collect dust, become gummy and eventually stick.

If ball is replaced, use only stainless steel ball supplied by Carter Carbureter dealers.

Switch Contacts Fail to Open or Close

Dirt, gum, etc., on ball, plunger, movable member of switch or screen, can cause switch to stick. These parts, including the throttle shaft flat and ball passage, should be cleaned with new white gasoline. Insufficient tension on

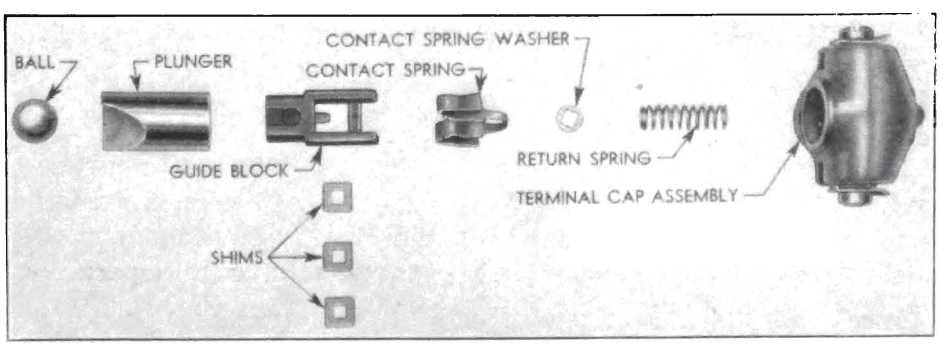


Fig. 12-15. Vacuum Switch, Disassembled

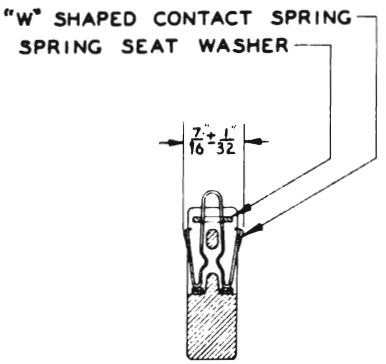
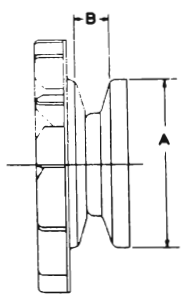


Fig. 12-17. Contact Spring Dimension

coil spring or improper width of W-shaped spring can cause faulty operation. The free length of coil spring is $1\frac{1}{16}$" to $\frac{3}{4}$". Pressure of 32 oz. should be required to compress spring to height of $\frac{3}{8}$". Free width of W-shaped spring at widest point is $\frac{7}{16}$" with round spring seat washer in place. See Fig. 12-17.

GENERATORS

Generators on all series are suspended from a mounting bracket located on the cylinder block and are easily accessible for adjusting belt tension. Generators are interchangeable on all series if drive pulley is of correct dimension. See Fig. 12-18.



GENERATOR	SERIES	A	B
1102679	40-50	3 13/32	11/16
1102668	60-70-90	3 17/32	15/16

Fig. 12-18. Generator Pulley Dimensions

Generators on engines equipped with compound carburetion have a combination air scoop and heat deflector attached at rear end of generator. See Fig. 12-19. This shield protects generator from heat of front exhaust heat valve.

Generators are shunt wound and capable of

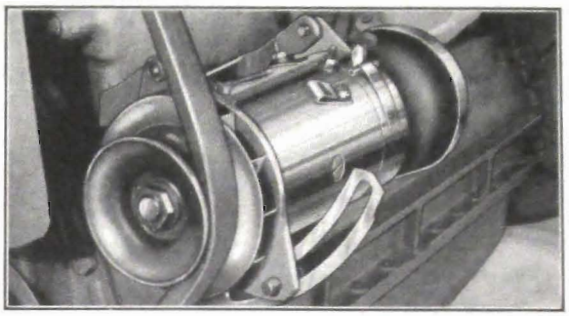


Fig. 12-19. Generator (Compound Carburetion Equipment)

delivering 32 to 34 amperes hot. See Fig. 12-86. This maximum output is controlled by a current regulator, which eliminates the necessity of a third brush. Generators do not normally deliver the maximum output because of a voltage regulator. When the battery is fully charged, the generator seldom delivers more than 10 amperes. However, if battery is low or when lights, radio, heater or other accessories are turned on, the action of voltage regulator is such as to increase the amount of current produced in proportions to the requirements.

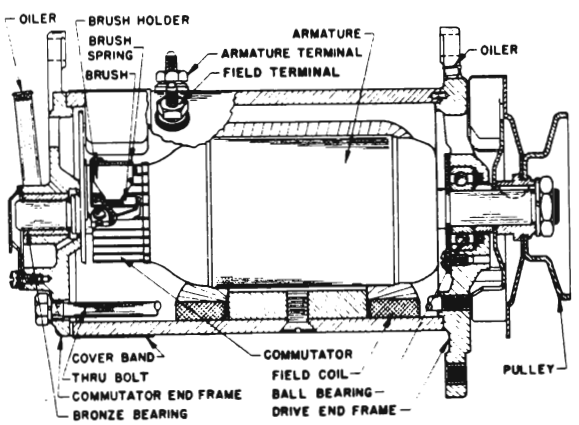


Fig. 12-20. Generator—All Series

To check the maximum output of generator to determine if it is functioning correctly, it is, therefore, necessary to make the current and voltage regulator inoperative. This is done as follows: (See Fig. 12-22)

1. Ground "F" terminal on regulator.

2. Disconnect battery lead from "BAT" terminal and connect large or ammeter leads of test set in series with wire and terminal.
3. Start motor and slowly increase speed until ammeter registers 32 to 34 amperes. This output should be reached at approximately 2500 generator R.P.M.

CAUTION

Higher speeds than 2500 R.P.M. may cause serious damage to the generator winding, when the field is grounded as in this test.

If the above results cannot be obtained at the approximate speed, the generator is at fault and should be inspected for worn-out brushes, burned-out field coils or shorted armature.

After making above test be sure and reconnect wire to regulator and remove ground from field, otherwise damage to generator will result.

Generator Fan, Pulley and Mounting

Fan

The fan is stamped from sheet metal.

Pulley Balance

All generator pulleys are balanced to within 1/8" oz. Unbalanced pulleys tend to cause generators to loosen at the mounting.

End-Play

Maximum, .005".

Belt Adjustment

See description and illustrations in the Engine Cooling System.

Generator Bearings and Lubrication

Armature shaft is supported by an annular ball bearing at the drive end and a bronze bearing at the commutator end. Each bearing is provided with a hinge cap oiler and should be lubricated with a few drops of light engine oil (S.A.E. 20 or 30) approximately every 1000 miles.

Generator equipped with air scoops and heat deflector have commutator end bearing packed with lubricant but requires engine oil lubrications as described for every 1000 miles. In service if the generator (equipped with scoop) is disassembled, the commutator end bearing should be well cleaned and all traces of lubricant removed, then well oiled with S.A.E. 20 and packed with a generous amount of wheel bearing lubricant before assembling. After assembly fill oiler with S.A.E. 20 and follow the regular lubrication instructions.

Service Generator

The improved generator performance eliminates the need for special service generators except for certain police installations where unusual low speed performance is required.

Delco-Remy has available through United Motors Service, a generator package suitable for this kind of installation.

CURRENT AND VOLTAGE REGULATOR

The current and voltage regulator unit consists of a cut-out relay, current regulator and voltage regulator, all of which are assembled to the same base and mounted to the front of dash. It is mounted on rubber to dampen the noise which is caused when the regulators operate. This current and voltage regulator is designed to operate with shunt wound generators. **Other types of regulators should never be substituted for this unit.** See Fig. 12-21.

Current and voltage regulators will have the manufacturer's seal on all units calibrated at the

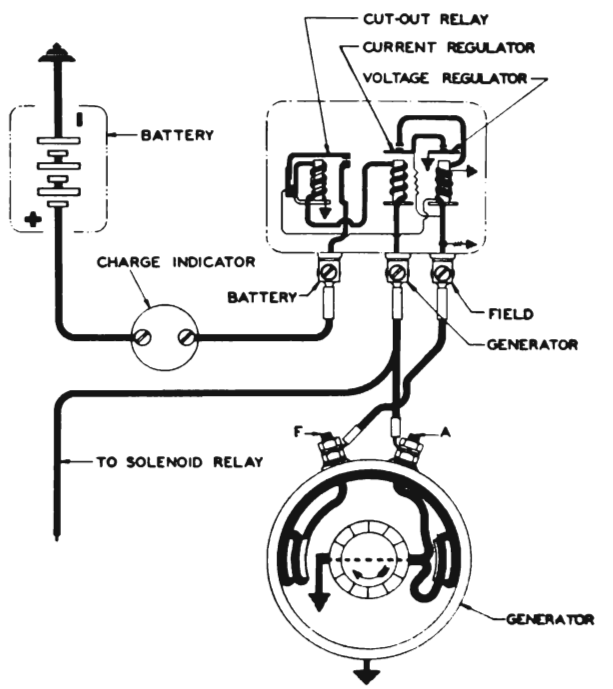


Fig. 12-21. Current and Voltage Regulator Unit—All Series

factory. Breaking the seal does not void the warranty but the seal is intended to caution mechanics that they should be thoroughly familiar with the adjustments before opening the unit.

Regulator cover must be in place when checking calibrations of cut-out relay, current and voltage regulator. Unit must be tested in conjunction with type generator with which it is to operate and in same position as when mounted in car.

The cut-out relay automatically closes and opens the circuit between the generator and battery.

The current regulator automatically controls the maximum output of the shunt generator.

The voltage regulator automatically decreases the charging rate of the generator when the battery reaches a given state of charge.

Testing and Adjusting Cut-Out Relay (Inside Unit)

To check the cut-out relay calibration proceed as follows: (See Fig. 12-22)

1. Disconnect wire from regulator terminal marked "BAT" and connect ammeter or large leads on test set in series with wire and terminal.
2. Connect voltmeter small leads on test set, to terminal marked "GEN" and ground. (Metal portion of regulator unit.)
3. Connect jumper from "F" terminal on regulator to ground. This makes current and voltage regulator inoperative.
4. Start engine and slowly increase speed until cut-out relay contacts close. The voltage at which they close should be between 6.2 to 6.7.
5. Increase speed until generator is charging approximately 20 amperes, then slowly decrease speed until contacts open. Contacts should open on discharge current only of from 0 to 4 amperes. Relay should never open when the ammeter shows charge.

Whenever "F" terminal of regulator is grounded direct never exceed a generator speed of 2500 R.P.M.

If adjustment is required remove regulator from car. See Fig. 12-23.

1. Inspect condition of the contact points. If

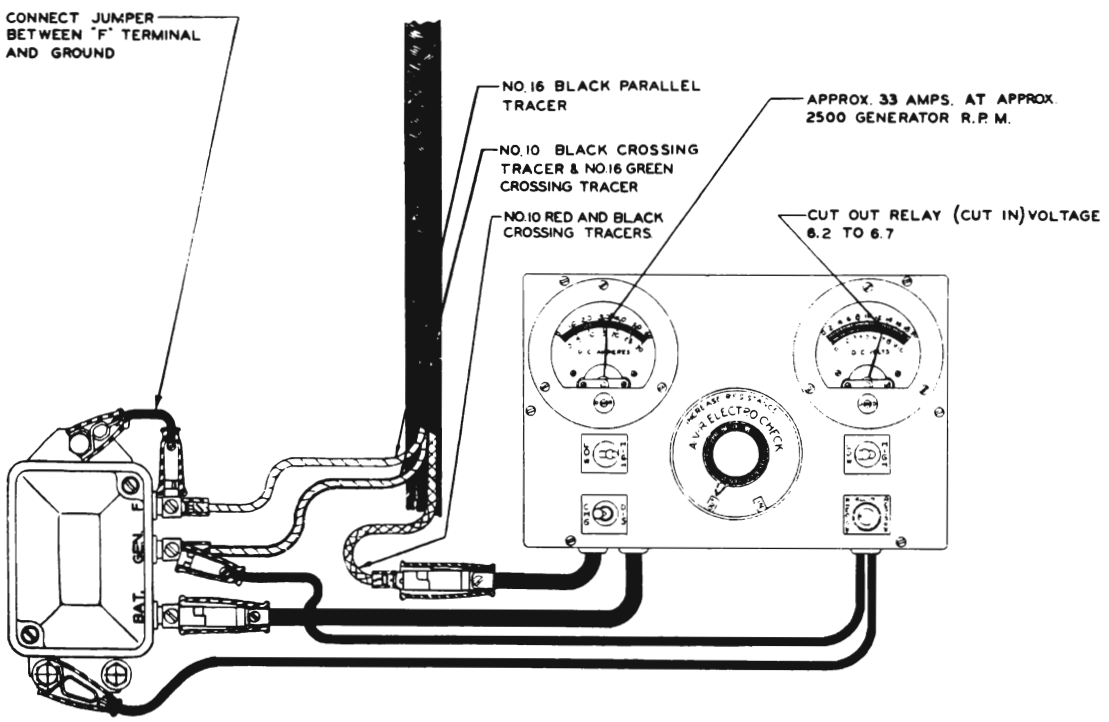


Fig. 12-22. Checking Cut-Out Relay Calibration and Generator Output—All Series

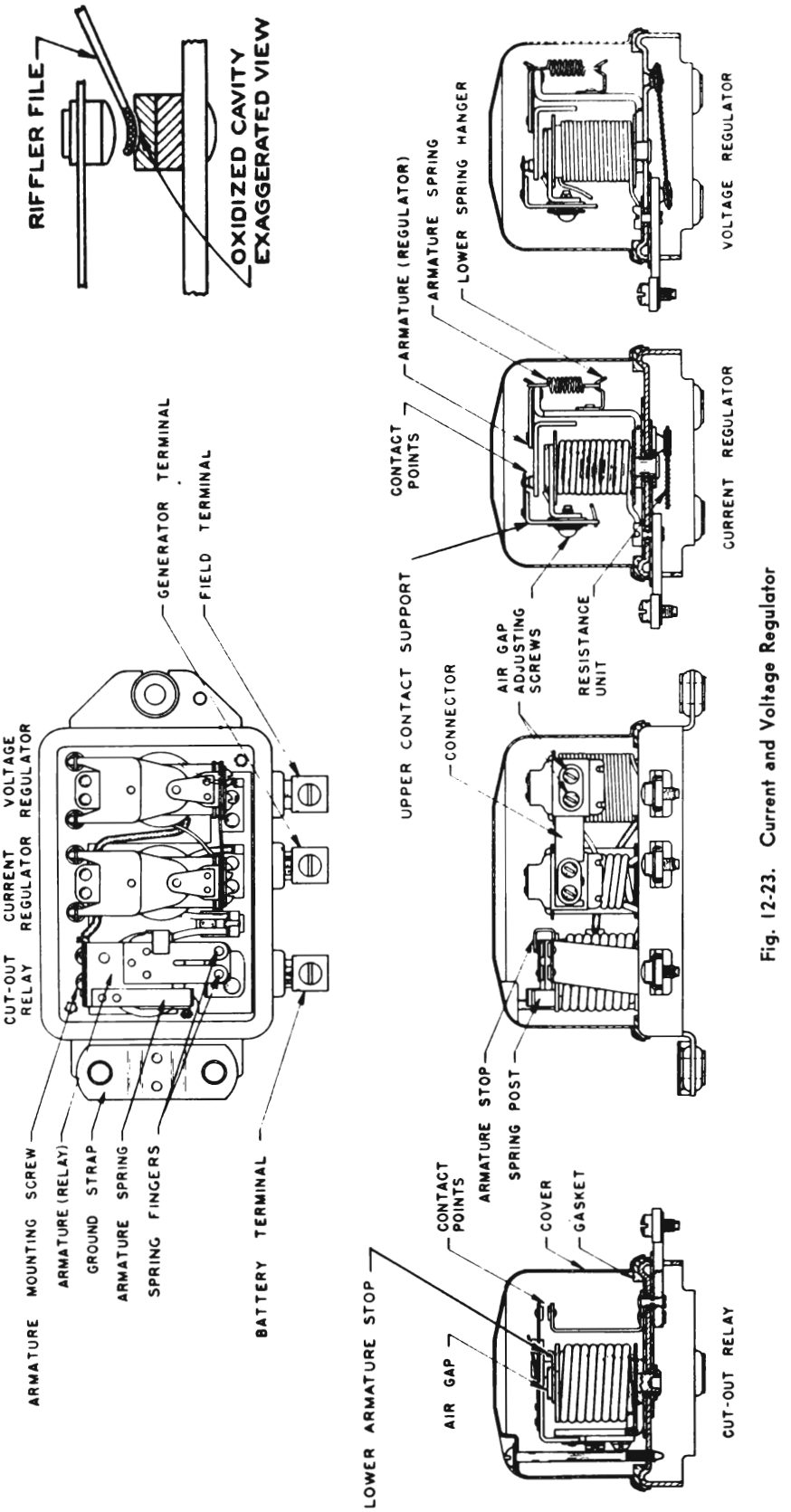


Fig. 12-23. Current and Voltage Regulator

necessary, clean as per instruction of "Cleaning Contact Points," in "Regulator Service Information."

2. If both sets of contact points do not close at the same instant, bend spring fingers so that both sets do meet simultaneously.

3. With points *just closed*, air gap between armature and center of core should be .018" to .022". To adjust air gap loosen armature mounting screws and raise or lower armature as required. Tighten screws securely after adjustment.

4. Contact point opening should be .015" to .025". Increase point opening by prying between armature and relay core with a screwdriver. Decrease point opening by tapping lightly on the upper armature stop. Use this procedure to prevent warping of contact spring fingers.

5. Reinstall regulator and connect test set as described in paragraphs 1, 2 and 3 under "Testing and Adjusting Cut-Out Relay."

6. Adjust spring post to obtain the specified closing voltage. Bend post up to increase and down to decrease voltage.

Testing and Adjusting Current Regulator (Center Unit)

The current regulator is compensated for temperature. This is accomplished by using a bi-metal hinge between the armature and armature support. Therefore, it is necessary that **all checks are made with the regulator at operating temperature** (150° or very hot to the hand).

To check the current regulator calibration proceed as follows: (See Fig. 12-24)

1. Remove cover and install small jumper wire between upper contact points and armature of *voltage regulator unit*. This is to prevent the voltage regulator from operating and reducing the charging rate. (A short piece of insulated wire with small clips on each end should be used.)

2. Disconnect wire from regulator terminal marked "BAT" and connect ammeter or large leads of test set in series with wire and terminal.

3. Start engine and increase speed (approximately 3000 Generator R.P.M.) until output remains constant. This should be 32 to 34 amperes with regulator hot.

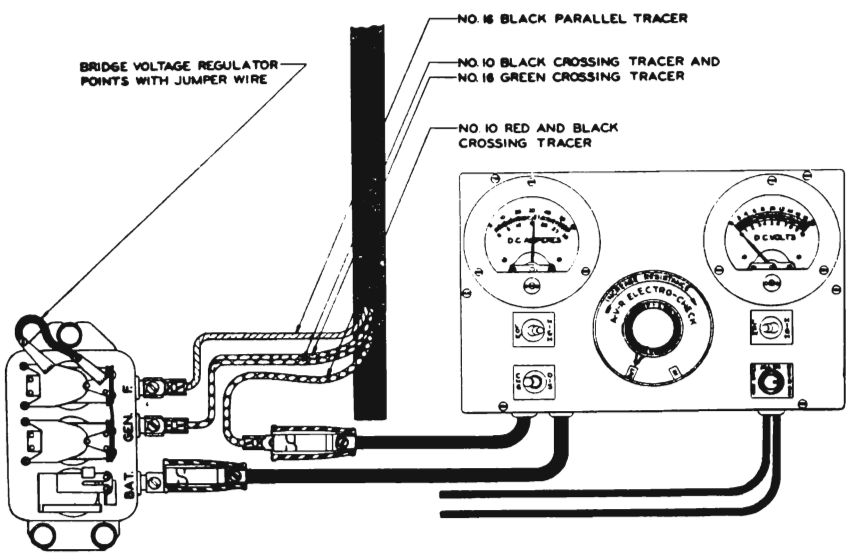


Fig. 12-24. Checking Calibration of Current Regulator

If adjustment is required, remove regulator from car and proceed as follows: See Fig. 12-23.

1. Air gap should be .075"-.085" and is measured between the center of the core and the armature, with the armature pushed down slightly by hand so the points are *just separating*. Adjust by loosening the two adjusting screws and moving upper contact support up or down as required. Be sure points are lined up and tighten screws down well after adjustment. Install regulator.

2. **Current setting** should be 32 to 34 amperes hot and is adjusted by bending the lower spiral spring hanger down to increase the current setting, or up to decrease spring tension and lower the current setting.

   Normally all adjustments should be made on one spring *and the other spring should not be touched.* If the unit is badly out of adjustment, or new springs are required, refer to "Spring Replacement," Regulator Service Information. Remove the jumper wire and replace cover.

Testing and Adjusting Voltage Regulator (Outside Unit)

To check the voltage at which the voltage regulator is operating, proceed as follows: (See Fig. 12-25)

1. Disconnect wire from terminal marked "BAT" and connect ammeter or large leads on test set in series with wire and terminal.
2. Connect voltmeter leads, small leads on test set to the "BAT" terminal and ground. (Metal portion of regulator unit.)
3. Start the engine and increase speed until generator is revolving approximately 2800 R.P.M.
4. Adjust rheostat until charging rate is 8-10 amperes.
5. After the regulator has become hot (150° or very hot to the hand) retard the speed of the generator until the cut-out relay points open.
6. Again increase the speed of the generator to 2800 R.P.M. and with a charging rate of 8 to 10 amperes, check the voltage at which

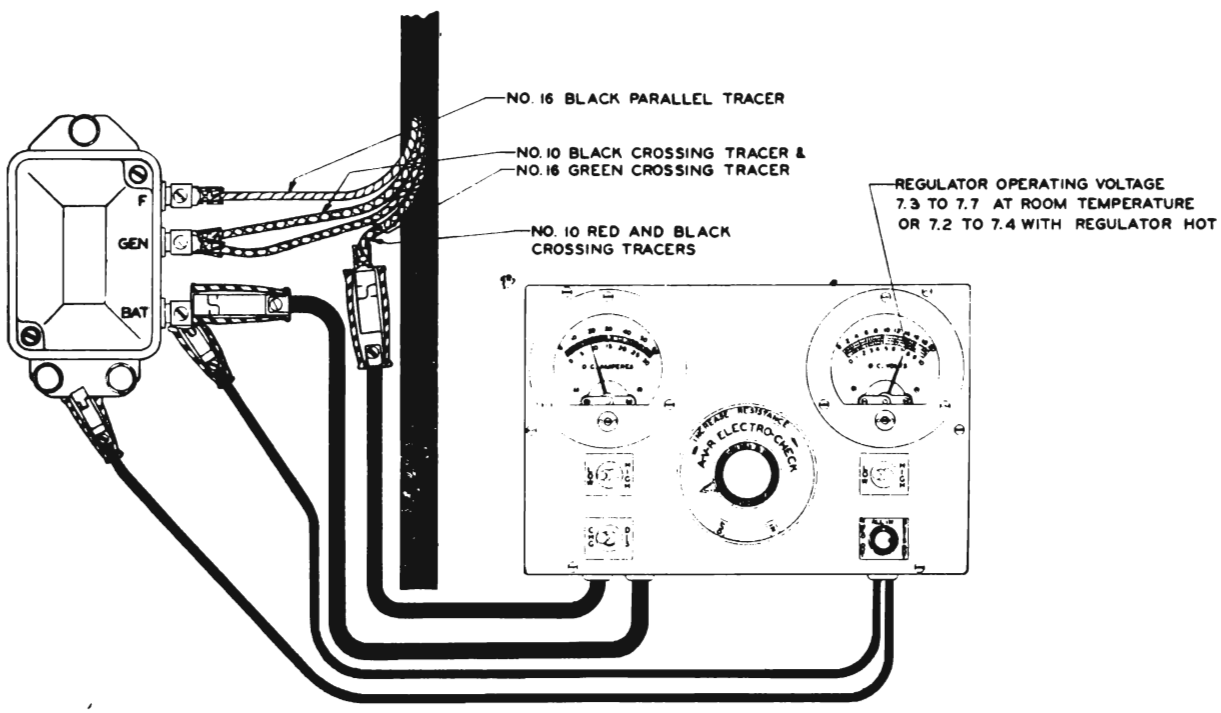


Fig. 12-25. Checking Calibration of Voltage Regulator—All Series

the regulator is operating. This voltage indicated by the voltmeter should be 7.2 to 7.4 volts hot (150° F.)

Regulator cover must be in place when making the above test.

If the charging rate is less than 8 amperes, with all resistance out of the circuit, turn on the lights in order to maintain this output while making the test. If this condition exists, the charging circuit should be inspected for loose connections.

If adjustment is required remove the regulator from the car and proceed as follows: (See Fig. 12-23)

1. Air gap should be .067″-.073″ and is measured between the center of the core and the armature, with the armature pushed down slightly by hand so the points are *just separating*. Adjust by loosening the two adjusting screws and moving the upper contact support up or down as required. Be sure the points are lined up and tighten screws down well after adjustment. Install on car.

   Voltage setting should be 7.2 to 7.4 volts hot and is adjusted by bending the lower spiral spring hanger down to increase the spring tension and increase the voltage setting, or up to decrease the spring tension and lower the voltage setting. Normally all adjustments should be made on one spring *and the other spring should not be touched.*

If the unit is badly out of adjustment, or new springs are required, refer to "Spring Replacement," under Regulator Service Information.

After each adjustment, and before taking voltage reading, replace regulator cover, reduce generator speed until points open and then bring generator back to speed.

REGULATOR SERVICE INFORMATION

Cleaning Contact Points

(Fig. 12-23)

Poor battery connection may cause voltage regulator contact points to become oxidized.

The current and voltage regulator unit contact points should be cleaned occasionally. Dirty or oxidized points arc and burn, causing reduced generator output and rundown batteries. Remove the upper contact support, so that each point may be cleaned separately. Attempts to clean the contact points without disassembly may result in bending the upper contact spring. Use a thin, fine-cut file, and *file each point separately.* If a cavity has formed in the flat point, it may be cleaned out with a "spoon" or riffler file. (Riffler file, Part No. 17, can be obtained from United Motors Service.) *Never use sandpaper or emery cloth to clean contact points.*

Replacing upper contact supports of the voltage or current regulator unit can be done by removing the two adjusting screws. It is important, however, that in reassembly, the insulators and bushings be replaced in the correct order. Note particularly that connector strap is insulated from the voltage regulator adjusting screws, while it is in electrical contact with the current regulator adjusting screws.

Replacing regulator springs. Whenever either regulator unit is badly out of adjustment or requires new spiral springs, it is necessary to follow the procedure below to insure that each spring of the regulator unit, when adjusted, will carry half the tension on the regulator armature. Improper operation may result if adjustment is such that one spring carries most or all the tension. The regulator must be correctly connected to the type generator and battery with which it is to operate, before this adjustment can be made.

All four regulator springs are the same.

On the current regulator unit install one spring only, and with the generator operating at 2000 R.P.M. adjust its tension by bending the hanger up or down until the current regulator unit operates at approximately 17 amperes. Next install the other spring, and complete adjustment to 33 amperes *hot* entirely on this spring, *without again touching the first spring.*

On the voltage regulator unit install one spring only, as explained in last paragraph, and connect voltmeter from the "GEN" *terminal to ground.* Hold finger-tip under the voltage regulator armature *lightly* to prevent its points from opening, and slowly increase generator speed

until voltmeter registers about 4 volts. Hold the generator carefully at this speed, release the regulator armature and adjust spring hanger so the voltage reading is approximately 4 volts. After this adjustment is completed, install the other spring, and complete adjustment to 7.2 to 7.4 volts entirely on this spring, *without again touching the first spring.*

Checking for High Voltage

Lights flare up when engine is speeded up.
Ignition points burned or badly pitted.
Headlamp bulbs burn out prematurely.
Generator damaged from overheating.
Regulator points making poor contact.

One or more of the above symptoms indicate high voltage caused by the following:

1. Electrolyte in battery low or weak from adding water after loss by leakage or spilling.

   Readjust gravity of electrolyte only when battery is known to be fully charged.

2. Voltage regulator not operating. See that connections to regulator are correct. Check operation and calibrations as outlined under Testing "Current and Voltage Regulator."

3. Loose connections in circuit between generator and positive post of battery, dirty battery terminals, etc.

   Check voltage drop between generator terminal and positive post of battery. See Fig. 12-26. Connect test unit in circuit as shown. Be sure that all test resistance is out of circuit and that connection is made directly to battery post and not the cable terminal. Adjust engine speed to obtain a charging rate of 20 amperes—drop should not exceed one volt when generator is delivering this amount of current.

Should Voltage Drop Exceed Above

See that positive terminal is making good contact with battery post and is tight.

See that starter cable and charge indicator wire connecting to starter terminal is making good contact and that charge indicator terminals on instrument cluster are tight.

If voltage still measures more than above value, check drop across cut-out relay by placing positive lead on "GEN" terminal and negative lead on "BAT" terminal of regulator unit. If drop is more than .25 volt at 20 amperes, relay is at

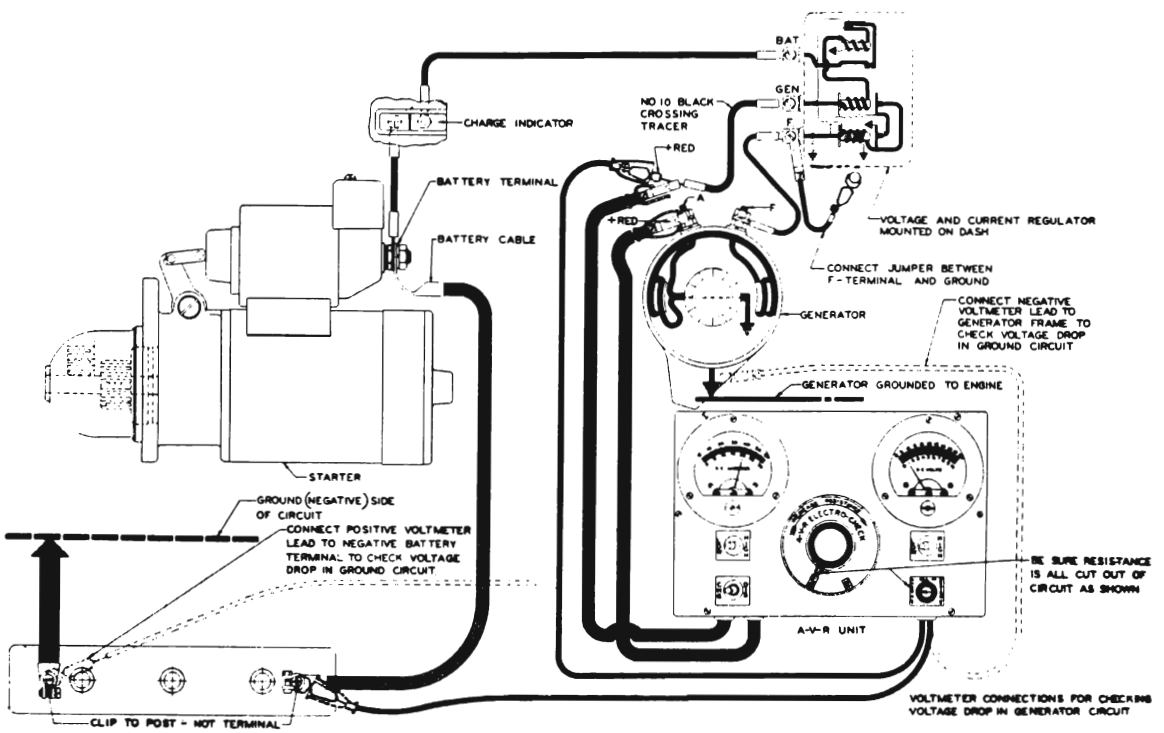


Fig. 12-26. Checking Voltage Drop in Generator Circuit

fault and should be examined for following: Dirty or pitted contacts; series coil (outside coil, large wire) poorly soldered or burned out; improper point setting or alignment. (Both sets of points.)

If Trouble Has Not Been Located

Check for defective connection in the ground circuit between generator frame and negative post of battery as follows:

Place positive voltmeter lead on negative post and connect negative lead to generator frame, as shown. Drop should register 0 on voltmeter at 20 amperes.

If any drop is indicated, see that battery terminal is making good contact to post and is tight. See that surface of engine where ground strap bolts to engine is clean and that connection is tight.

IGNITION DISTRIBUTOR

All Series

Ignition distributor is of the single breaker arm type. High speed operation is obtained by an especially light breaker arm and high speed cam, having an approximate dwell of 31 cam degrees when breaker points are set at .015".

Maximum operating efficiency of the engine has been obtained under all load conditions by the use of an advance mechanism controlled by the engine vacuum, in addition to the usual centrifugal mechanism, operated by the engine speed.

During acceleration or on heavy loads (wide open throttle) the spark advance required to develop the maximum power of the engine is considerably less than that required for light loads. The centrifugally controlled mechanism has therefore been calibrated to the requirements for full throttle operation. The increased spark advance for light loads is furnished by the vacuum-controlled mechanism. This consists of a unit, attached to the distributor housing, having a diaphragm linked to a hardened breaker plate mounted on ball bearings. Breaker plate is grounded to housing by ground wire. See Fig. 12-28. Under normal driving conditions (part throttle) the engine vacuum is enough to act on diaphragm and cause the breaker plate to

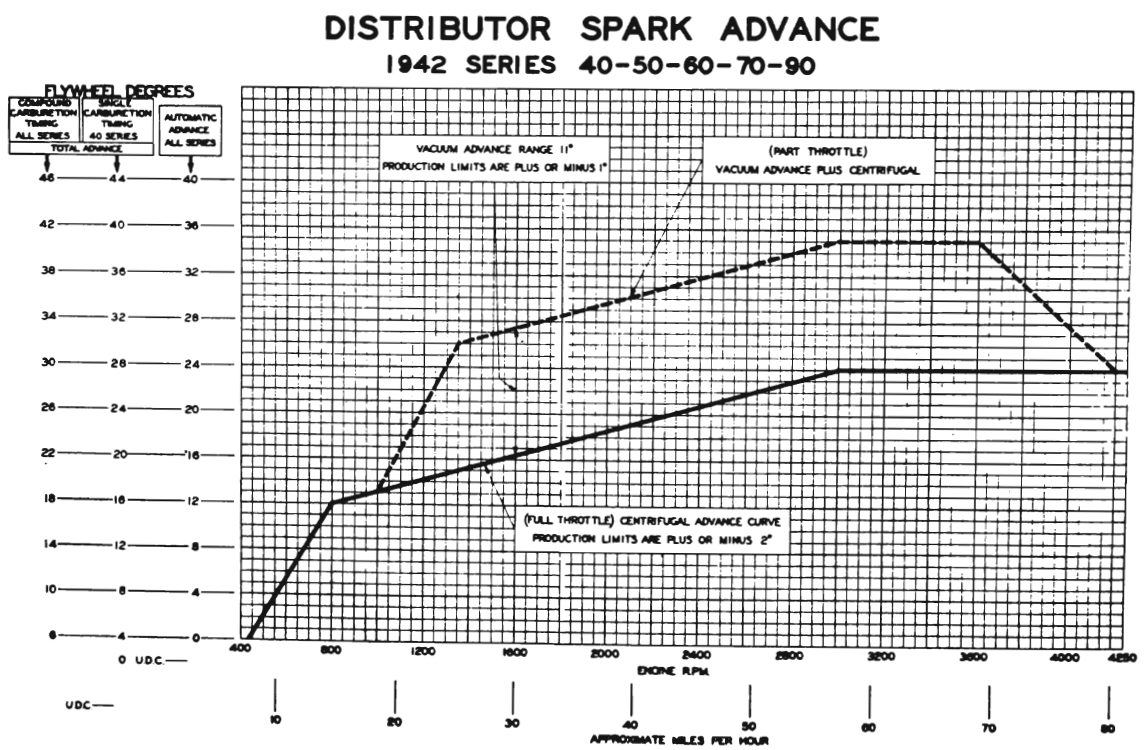


Fig. 12-27. Distributor Spark Advance—All Series

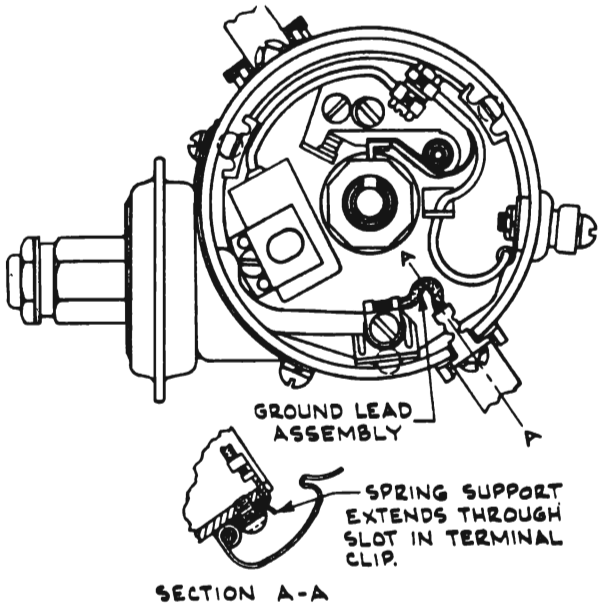


Fig. 12-28. Distributor Head Showing Method of Ground

move, thus adding to the advance supplied by the centrifugal mechanism.

During acceleration, or on wide open throttle, the engine vacuum is not sufficient to operate the diaphragm so that the breaker plate is held in the retard position by a calibrated spring which bears against the vacuum unit diaphragm.

The spark advance for obtaining satisfactory idling should be as low as possible. For this reason the centrifugal advance is made to cut-in above the idling speed. The vacuum control is taken from the carburetor side of the throttle fly with the fly in the closed position, therefore it is necessary to open the throttle equivalent to approximately 18 M. P. H. before sufficient vacuum is obtained at that point to advance the spark.

The distributor is driven directly from the camshaft through heat-treated steel gears, automatically lubricated by the engine oiling system. The upper bearing is burnished cast-iron and the lower bearing a special grade of bronze. The gear thrust is upward against a special bronze thrust washer.

End-play ..... .002" to .007"

Lubrication

Distributor Shaft

The distributor shaft is hardened and lubricated from a large sealed lubricant sump located in the bottom of the distributor bowl. This should be filled with a low pressure lubrication gun approximately every 1000 miles, using a good grade of chassis lubricant, such as is specified for front wheel bearings. The proper amount of lubricant is indicated by lubricant emerging from a relief hole in the front of the housing.

Cam Bearing

The rotor should be removed and a few drops of 10-W engine oil applied to the felt wick for lubricating the cam bearing.

Cam

The cam surface should be lubricated lightly with petroleum jelly applied with the end of the finger, to prevent chattering and squeaking of the breaker arm rubbing block.

Ignition Timing

	Degrees ahead of upper dead center (flywheel)
Series 40 Single Carburetor	4°
Series 40-50 Compound Carburetor (Ethyl gas)	6°
Series 60-70-90 (Ethyl gas)	6°
Firing order, all series	1-6-2-5-8-3-7-4

All engines are timed at the factory in accordance with the above.

Series 40-50 flywheels are marked for both 4° and 6° setting. See Fig. 12-29. Space between these marks is serrated and painted. Be sure to use edge of section as marked for desired timing.

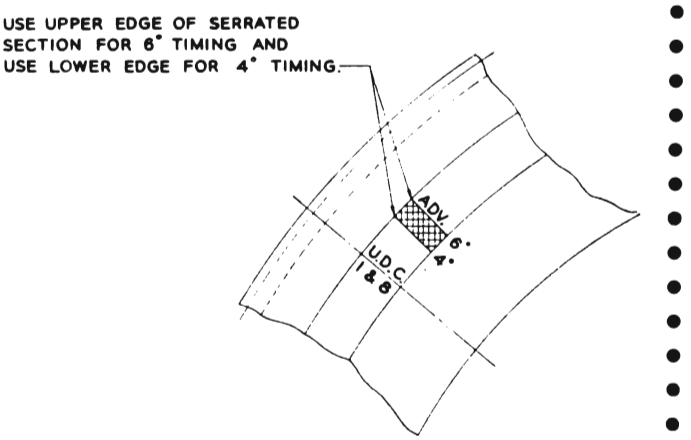


Fig. 12-29. Flywheel Timing Marks—Series 40-50

Series 40 timing is intended for normal gasoline having an octane rating of approximately 74 to 76.

Series 50-60-70-90 timing is intended for Ethyl or any other gasoline having an octane rating of approximately 78 to 80.

Tolerances of Cam Out-of-Synchronism

1½ cam degrees maximum.

Distributor Breaker Arm Spring Tension

Spring tension measured at back of breaker point is 19 to 23 oz. This can be changed by loosening spring tension adjustment screw and shifting spring in slot until tension is correct.

Breaker Point Opening

IMPORTANT

When resetting points use indicator and nominal gap of .015". See Fig. 12-30. Feeler

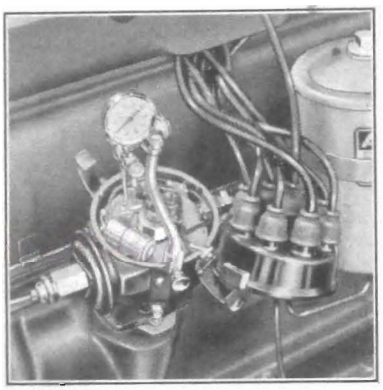


Fig. 12-30. Dial indicator check of breaker point opening, using distributor point checking fixture support, J-850

gauges are not recommended because of the error caused by building up of metal on breaker point. If points are pitted they should be dressed down before resetting.

Condenser Capacity Limits

.2 to .25 mfds.

Cam Dwell Angle

31° at .015" point opening (after rubbing block has been run in) angle may measure 2° less when block is new.

Installing Distributor

(a) See that cork oil seal is in place.

(b) Install distributor in position. Vacuum connection should point to rear and be approximately parallel with centerline of engine.

(c) Rotate distributor shaft until rotor segment is directly under No. 1 high tension terminal. See Fig. 12-31. Slot in oil pump shaft can be turned to correct position with screwdriver. See Fig. 12-32.

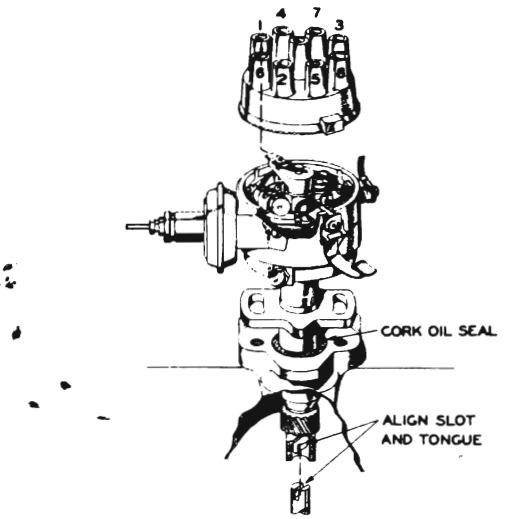


Fig. 12-31. Installing Distributor

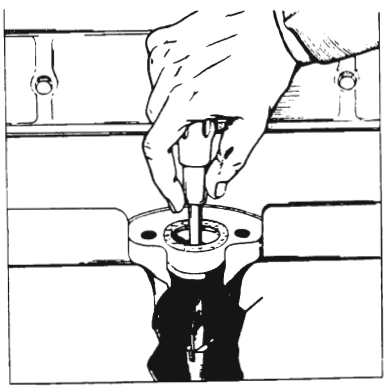


Fig. 12-32. Oil Pump Shaft Slot Alignment

Engine Timing Without Synchroscope

1. Check breaker point gap as follows:

(a) Remove distributor cap and rotor.

(b) Rock engine over slowly until breaker arm points are open to the widest position.

(c) Check gap with *indicator gauge.*

(d) If gap is incorrect, loosen lock screw and turn eccentric screw until gap is just .015".

(e) Tighten lock screw securely after adjusting the gap.

2. Uncover timing hole on side of flywheel housing.

3. With ignition "off," turn engine over until distributor rotor is approximately under No. 1 high tension terminal. If distributor has been removed, turn engine over until No. 3 cylinder exhaust valve starts to open.

   Continue to turn slowly until the "ADV" mark on flywheel comes directly opposite the index line on flywheel housing. This is the position to fire No. 1 cylinder.

4. Turn on ignition and remove the center high tension lead from the distributor cap and hold in position to form a gap with distributor housing. See Fig. 12-33.

   See that distributor points are closed with rotor in position to fire No. 1 cylinder. Next tap distributor lightly so that it rotates in a clockwise direction until the breaker points open, and a spark is produced at the gap.

5. After engine has been timed, the operation should be checked by revolving the crankshaft two revolutions and observing position of the timing mark on flywheel relative to index line on flywheel housing at the instant spark occurs.

6. Replace timing hole cover.

Ignition Timing with Synchroscope

Always check breaker point gap before retiming. See "Breaker Point Opening."

Engine timing can be checked and the timing operation performed quickly and accurately by use of the engine timing synchroscope.

(a) Insert lead from engine timing synchroscope into No. 1 terminal on distributor cap. Connect other lead to end of No. 1 spark plug wire as shown. See Fig. 12-34.

(b) Remove timing hole cover.

(c) Turn on ignition and allow engine to idle at speed *not to exceed 350 engine R.P.M.*

Direct the beam from timing synchroscope into timing observation hole in flywheel housing. If timing is correct, the "ADV" timing mark on flywheel will appear opposite the mark on flywheel housing at the instant flash occurs. If the lines do not coincide, loosen the distributor mounting screws and rotate distributor, either backward or forward, slowly until lines on the flywheel and flywheel housing are exactly opposite.

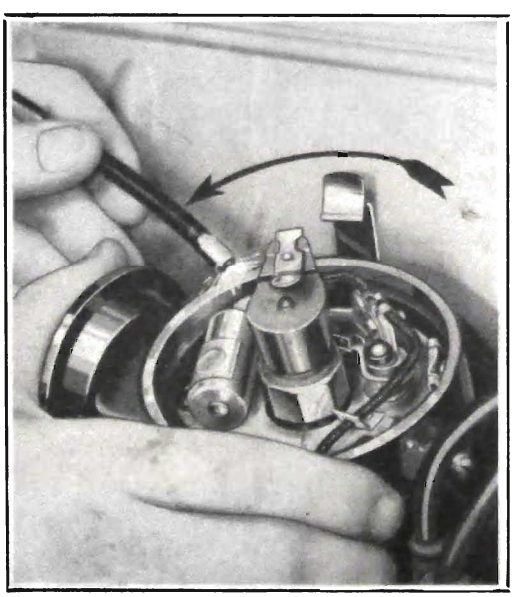


Fig. 12-33. Checking Timing

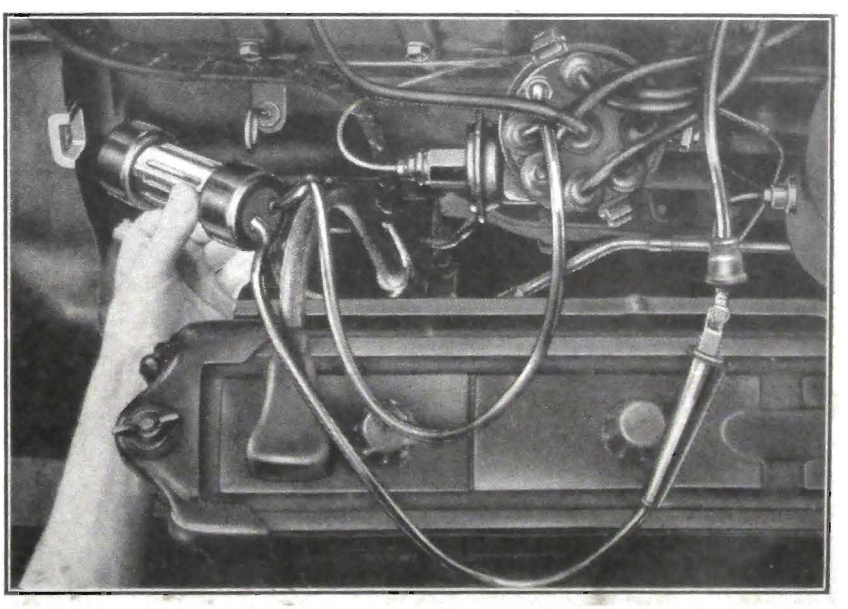


Fig. 12-34. Engine Timing, Using Timing Synchroscope J-696

Tighten distributor mounting screws with distributor in this position.

Replace timing hole cover.

See "Caution" under "Battery."

High and Low Octane Fuel Timing

The correct distributor setting for highest performance and maximum gas mileage for any fuel is best indicated when there is a very light "ping" between 10 and 20 M.P.H., upon accelerating in high gear with the throttle wide open.

Proper setting can be obtained without pointer and scale by following procedure

If spark ping is objectionable, rotate distributor *counter-clockwise* in small steps until desired setting is obtained. If it is desired to use fuel having higher than standard octane rating, the distributor can usually be moved in a *clockwise* direction until a very light ping is obtained as described above.

CAUTION

If it is necessary to move the distributor counter-clockwise more than a normal amount to remove objectionable ping, it is possible that an abnormal amount of carbon has accumulated which should be removed before making final distributor setting.

If distributor has been removed be sure to place rotor under No. 1 terminal on cap and enter gear so that normal timing when checked with synchroscope will be obtained when distributor mounting screws are approximately in center of slots. This will permit adjustment for varied octane fuels.

NOTE: One degree on the flywheel is equal to approximately 1/8" at timing mark.

SERVICING IGNITION ON CARS EQUIPPED WITH RADIO

Occasionally radio installations are made by persons uninformed on operation of the ignition system. Such installations are often the cause of poor engine idle, missing, loss of power, excessive breaker point pitting, etc. The following suggestions may be useful in servicing radio-equipped cars. (For further information see Radio Section.)

In most instances, the new design factory-approved radios do not require suppressors on the spark plugs, but usually require one installed in the center high tension terminal of the distributor cap. Where spark plug suppressors are required, the value of resistance should not be higher than 15,000 ohms, preferably not higher than 10,000 ohms.

The use of radio spark plugs and splice type suppressors is not recommended.

CAUTION

Never place an additional condenser on the distributor terminal, as this will cause excessive pitting of the breaker points or missing. If a condenser is found to be necessary, it should be connected to the positive coil terminal. Factory-equipped radio cars have a condenser connected to the positive ignition coil terminal and is located inside the coil end cover. These coils are identified by the word "Radio" stamped on mounting bracket. See Fig. 12-35.

Some radio manufacturers also recommend closing up the high tension rotor gap in the distributor head by peening the rotor segment. This is extremely bad practice, and rotors found in this condition should be replaced. This usually results in breakage of rotor by causing the rotor sector to strike segments in the cap. It may also interfere with proper functioning of the automatic advance, causing loss of power, or sluggish acceleration.

See Radio Section.

IGNITION COIL

The ignition coil is the switch extension type which is mounted on the front of the dash and connected to the switch by a flexible steel conduit. See Fig. 12-36 and 12-37.

Service Instructions

Ignition coils do not require special service other than to keep all terminals and connections

Fig. 12-35. Condenser Installation for Radio Jobs

clean and tight. In case of failure in the windings, it is necessary to replace the complete coil.

The switch extension type coils are designed to permit the removal of the coil without disturbing the ignition switch or switch extension. These coils are locked to the switch extension assembly by means of the lock in the coil end cover which engages in the lock recess on the coil can.

To remove the coil from the switch extension assembly, it is necessary to remove the coil from its mounting and proceed as follows: (See Fig. 12-38.

1. Insert a thin blade of spring steel (Tool J-726) between the coil can and the coil

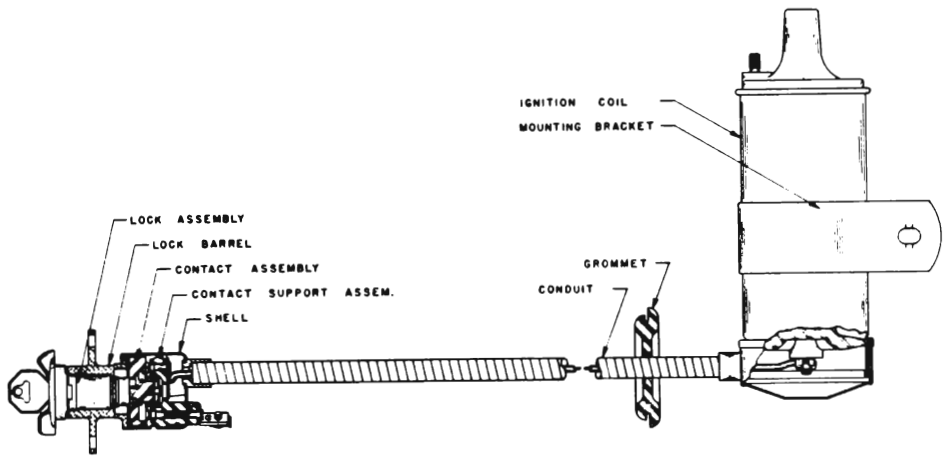


Fig. 12-36. Ignition Switch and Coil Assembly

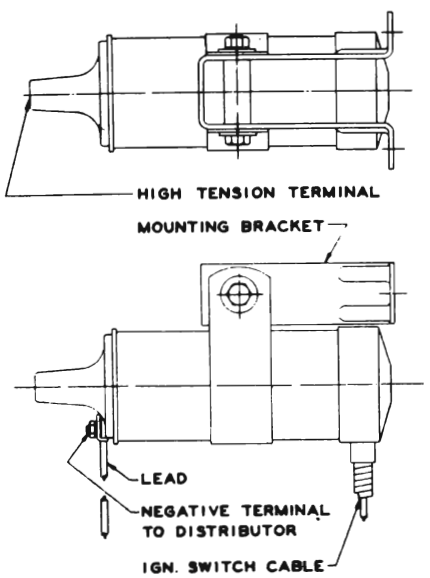


Fig. 12-37. Ignition Coil and Mounting

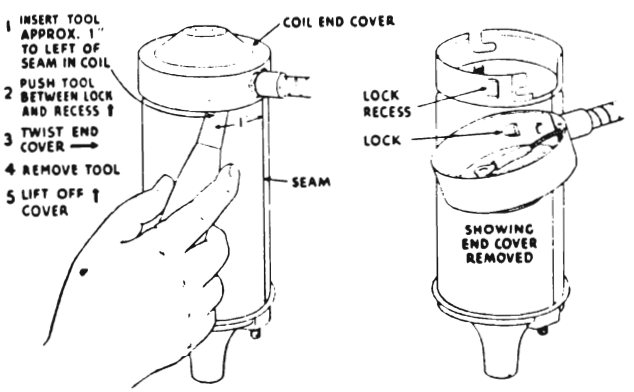


Fig. 12-38. Removing Ignition Coil Cover

end cover at a point approximately one inch to the left of the seam on the coil can.

2. Twist coil in counter-clockwise direction until lock is released from the lock recess.

3. Remove the tool to relieve the pressure between the coil end cover and the coil.

4. Lift off the coil end cover and disconnect the lead from the terminal on the coil.

To reassemble the coil and switch extension assembly, connect the extension lead to the terminal on the coil. Align the locating lugs on the coil end cover with the "L" slots in the coil so that the lock will be on the same side as the lock recess. Press on by hand (but do not force) and twist coil clockwise until the lock snaps into the lock recess.

Conditions Affecting Ignition Performance

If the ignition performance is unsatisfactory after the coil has been tested and found to be good, it is necessary to look for trouble elsewhere in the ignition circuit.

1. *Resistance in Ignition Circuit.* Energy is lost whenever resistance is present in a circuit. Oxidized, burned or pitted distributor contacts offer resistance to the flow of primary current. A loose connection or poor ground at the condenser or between breaker plate and housing, will cause faulty ignition. See Fig. 12-28. Connections at the battery, charge indicator, coil, and ignition switch should be clean and tight.

2. *Poor Insulation in Ignition Circuit.* Insulation in the ignition circuit is very important. The high tension cables should not be oil soaked, cracked, or punctured, as this will result in a loss of electrical energy. Insulation may have been damaged by battery electrolite when taking hydrometer readings. Examine the distributor cap for burned paths. If any of these conditions are present, the cables or distributor cap should be replaced.

3. *Defective Condenser.* A condenser failure will cause complete failure of ignition system. Condenser failures are due to punctured insulation, open circuits, high resistance connections, and low insulation resistance and will usually be evident by excessively pitted or burned contacts.

4. *Incorrect Spark Plug Gap Setting.* Spark plugs should be cleaned when dirt, oil and carbon are present. Replace the plugs if the points are badly burned or the porcelain cracked. The size of the gap largely determines the voltage required to fire the plug. A high speed engine miss can sometimes be traced to a wide spark plug gap. Set plug gaps according to specifications.

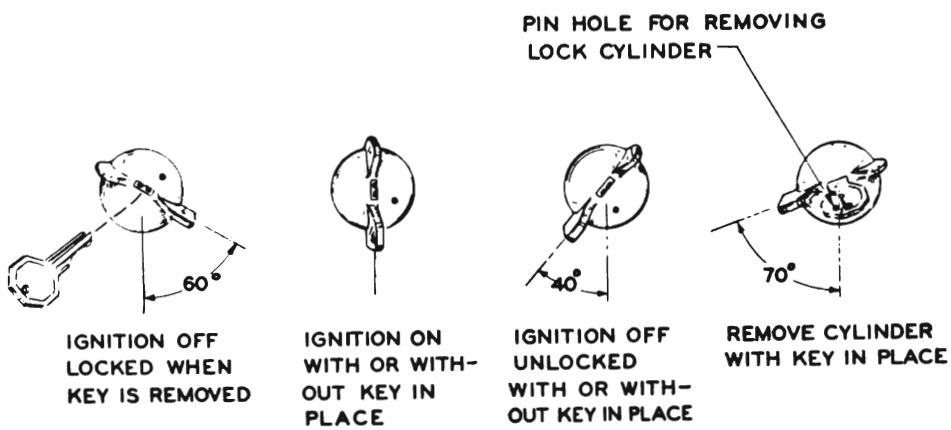


Fig. 12-39. Ignition Coil Lock

IGNITION SWITCH

Ignition switch is part of the coil extension assembly and is not serviced separately. The lock cylinder can be removed by turning switch lever to the left of center and insert paper clip in hole in front of cylinder to release pin which locks cylinder, continue to turn left and pull out assembly. Key must be inserted when removing cylinder. See Fig. 12-39.

Where key is lost and no record of key number has been kept, the key number will be found stamped on door lock bar. A new key can be cut on the key cutting machine by using this number.

Ignition Switch Failure to Unlock

Cage Bar Sticking

When ignition switch fails to unlock with the proper key, and lock has previously been operating satisfactorily, proceed as follows:

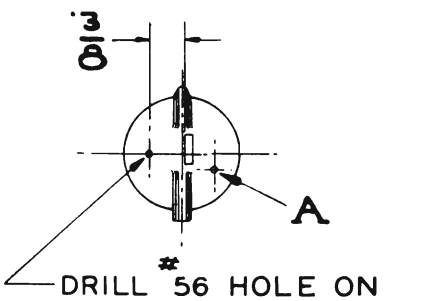


Fig. 12-40

Drill a .0465" (#56 drill) diameter hole 3/8" deep in lock cylinder as shown in Fig. 12-40. Holes must be located exactly as shown. Insert key in slot and scale 3/8" dimension from edge of key. A short piece of wire (or paper clip) having one end flattened by filing, is inserted in this hole, and used to pry the cage bar assembly down into correct position so that lock cylinder can be turned to the unlocked position. See Fig. 12-41. After turning lock cylinder slightly, remove the wire to prevent wedging and continue turning clockwise until "ignition off" unlock position has been reached. Remove cylinder in normal manner by inserting blunt end of wire in hole "A" to release pin. Continue turning clockwise and pull out assembly.

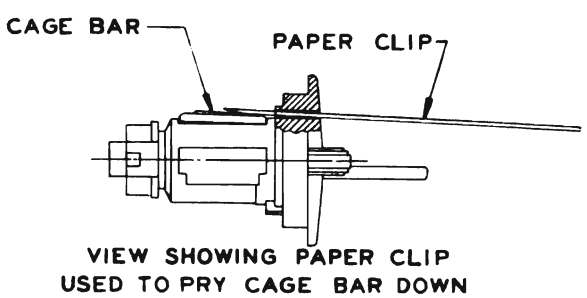


Fig. 12-41

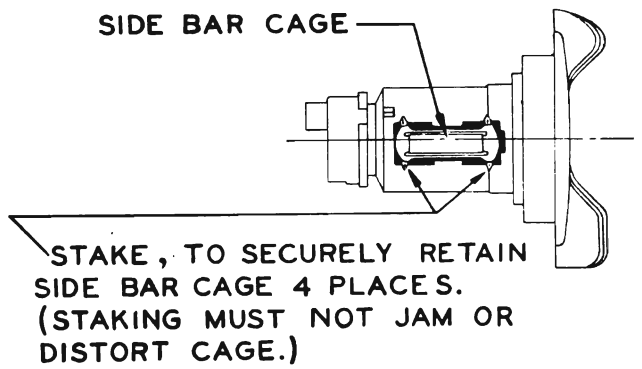


Fig. 12-42

Stake cage bar in place as shown in Fig. 12-42 and replace cylinder. Check operation of lock with key. If operation is satisfactory, the hole which was drilled should be plugged with a small pin #00x1/8—Parker Kalon Type "U."

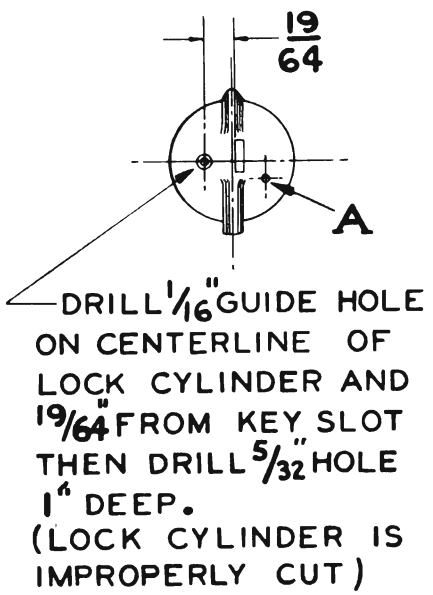


Fig. 12-43

Lock Cylinder Improperly Cut

When ignition switch lock fails to unlock due to faulty cylinder, that is, key never has operated, proceed as follows:

Drill a $\frac{1}{16}$" diameter guide hole 1" deep in lock cylinder as shown in Fig. 12-43. Hole must be in exact location as shown. Insert key in lock to scale the $\frac{18}{64}$" dimension from edge of key. Using this $\frac{1}{16}$" hole as a pilot, drill a $\frac{5}{32}$" diameter hole 1" deep in lock cylinder.

CAUTION

Do not allow drill to angle. Remove drill occasionally to help remove chips—this step is very important. Blow all remaining chips out of hole with an air hose. It may be necessary to pick some chips loose using a short wire (or paper clip). This operation drills out the cage bar so the cylinder may be turned without use of a key. Turn lock cylinder clockwise to ignition "off unlock position" and insert wire in hole "A" to release cylinder. Finish turning cylinder clockwise and remove. Clean out lock barrel and install a new cylinder which has been cut to fit key.

SPARK PLUGS

AC type 46 spark plugs are used on all series. These plugs have 14 m/m threads and a $\frac{13}{16}$" hexagon nut. See Fig. 12-45.

Because of high electrical stress on the insulation when high compression is used, the electrode gap on the type 46 plug should be set at .025". Occasionally it is necessary to set the gap to .030" to secure good idle. This should be done only in extreme cases, as it may result in bringing about high speed missing after the plugs have been in use a short time.

To obtain maximum performance, it is advisable to clean or, if necessary, replace the spark plugs at intervals of 10,000 miles. Plug life will lengthen materially if given a good cleaning occasionally. Satisfactory results can be assured only when genuine AC plugs of the type recommended are used.

SPARK PLUGS

Adjustment of Spark Plug Gap

In adjusting spark plug gap, always make adjustment on the grounded electrode and never on the center electrode, as the porcelain may be broken or cracked.

Fig. 12-45. Spark Plug

Fig. 12-46. Spark Plug Cleaner

Cleaning Spark Plugs

To thoroughly clean fouled or dirty spark plugs without injuring insulation, use the AC Spark Plug Cleaner. See Fig. 12-46.

Spark plug covers have louvers provided for ventilation of plugs.

LIGHTING CONTROL

When any work is necessary under the cowl, battery should always be disconnected to protect instruments and wiring circuits.

Control Switch

All Series—Delco-Remy

Foot Selector Switch

All Series—Delco-Remy

Two switches are used for operating "Sealed Beam" Headlamps—a control switch on the instrument board, and a foot selector switch on the toe-board.

The control switch is operated by a knob, located in the left side of the grille and panel assembly having three position, which are OFF, PARKING and DRIVING. See Figs. 12-47 and 12-48.

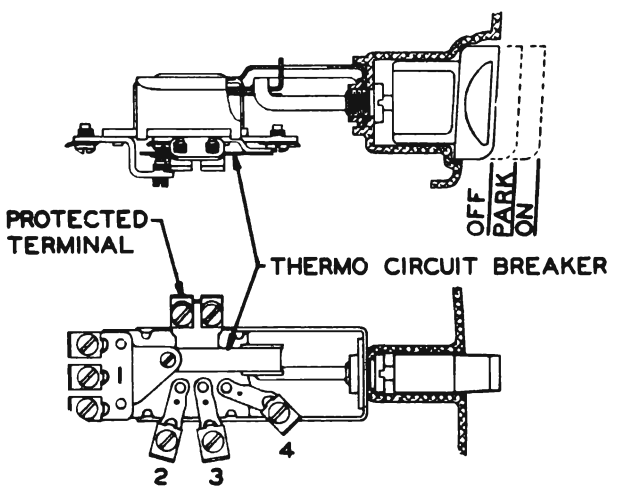


Fig. 12-47. Light Switch

Off Position (knob pushed all the way in)—Turns off headlamps, parking lamps, tail lamps, license lamp and instrument lamps. (See instrument lamp switch operation.)

Parking Position (knob pulled one notch out)—Turns on the parking lamps, tail lamps and license lamp.

Driving Position (knob pulled all the way out)—Turns on either the "upper" or "lower" headlamp beams, depending on position of the foot switch, as well as tail lamps and license lamp.

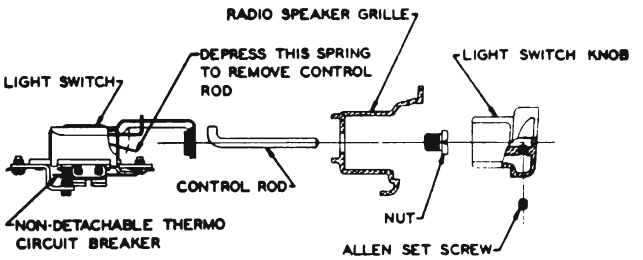


Fig. 12-48. Light Switch, Disassembled

To remove assembly from panel: Loosen set screw under knob. Remove knob with special wrench J-1589, remove mounting nut.

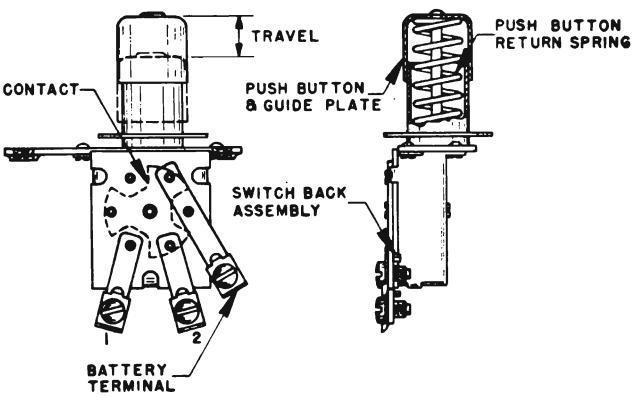


Fig. 12-49. Foot Dimmer Switch

THERMO CIRCUIT BREAKER

A thermo circuit breaker, mounted on the light control switch, is used on all models for protecting the light wiring from damage due to short circuits.

The dome light circuit on Series 50-60-70-90 is protected by a 30 amp. fuse and is therefore independent of the thermo circuit breaker.

This device consists of a bi-metal blade and set of contacts connected in series with the lighting circuit. Current in excess of the normal lighting current causes the bi-metal to heat up

sufficiently to separate the points and cause them to vibrate, thus cutting down the current and protecting the wiring.

Circuit Breaker Adjustment

The current adjustment of the circuit breaker is sealed and should not be changed; neither should the bi-metal be sprung or the contacts filed or sanded, as this will alter the calibration. Inasmuch as the current required to open the contacts depends somewhat on outside temperature, the circuit breaker should be checked at normal temperature (70 to 80 deg. F.)

When adjusted correctly, the circuit breaker points will stay closed indefinitely at 30 amperes, but will open in three minutes at 42 amperes. It is not practical to readjust in service, and switch should be replaced if circuit breaker is defective.

Service Suggestions

Thermo circuit breaker vibrates—This indicates a short circuit in one of the lighting circuits and may be traced as follows:

1. Pull switch successively to each lighting position. If circuit breaker vibrates in all positions except *"off"* the trouble should be found in the tail lamp and license lamp circuit.

2. If the circuit breaker vibrates in *parking* position only, look for a short in parking lamp circuit.

3. If the circuit breaker vibrates in *driving* position and is normal in all others, inspect headlight wiring circuit and lamp assemblies. If both filaments in headlamps burn at same time, headlamp unit should be replaced.

4. If the circuit breaker vibrates with light switch in all positions, including *"off"* position, the ground will be found in one of the following circuits: Lighting switch to stop light switch, lighting switch to instrument light switch, glove compartment light, map light, clock and the dome light on the Series 40. The trouble can be traced to the particular defective circuit by removing above connections one at a time.

   If the trouble is in the dome light circuit, the circuit breaker will not vibrate when the six-way connector is disconnected.

5. If the circuit breaker vibrates only when the service brakes are applied, the ground will be found in circuit from stop light switch to rear signal lamps.

For information in tracing circuit see Wiring Diagram.

Fuse Protection for Dome Light and Rear Compartment Cigar Lighters

Series 50-60-70-90 and Model 41SE

Inasmuch as the cigar lighters for the rear compartment are connected to the dome lamp feed wire, this circuit is protected by a 30 ampere cartridge fuse in a connector located in back of the instrument panel and connecting to the charge indicator. This circuit is therefore protected independently of the thermo circuit breaker.

INSTRUMENT LAMP SWITCH

The instrument lamp switch is located in the upper left corner of the grille and panel assembly. This switch has four positions:

Off position .....Knob pushed all the way in
Bright position .....Knob pulled out one notch
Medium position....Knob pulled out two notches
Dim position .....Knob pulled all the way out

The instrument lights cannot be turned on until the light control switch is pulled out to either the (parking) or (driving) position.

There is a 14 ampere fuse located on the back of the switch assembly which protects the switch, instrument lamp and clock lights. Fuse

can be replaced without removing switch. The upper terminal on switch is the hot or live terminal. The lower terminal feeds the instrument lamps and clock light.

Switch can be removed from grille and panel assembly by first loosening set screw on underside of knob. Pull knob off. With special spanner wrench, J-1589, remove mounting nut.

MAP LIGHT AND SWITCH ASSEMBLY

A front compartment and map lamp is located in the lower left corner of the grille and panel assembly and is protected by the thermo circuit breaker. To turn on light pull out knob. The light switch is part of the lamp assembly and operates when the knob is pulled out. Pushing the assembly in turns off the light. See Fig. 12-50.

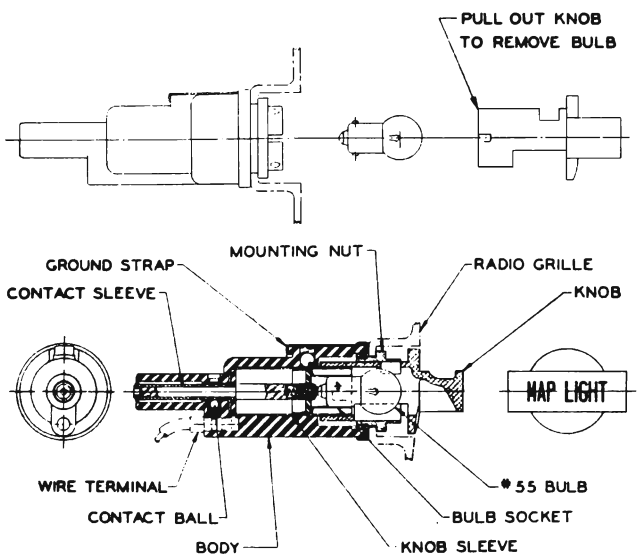


Fig. 12-50. Map Light Switch

To replace a bulb or to remove the assembly, pull knob out in *"light on"* position and then continue to pull on knob until same is removed.

To remove assembly from panel, use special prong type socket wrench, J-1588, and unscrew nut. Disconnect wire from terminal. Remove assembly.

To replace knob it is necessary to line up key in knob with slot in knob sleeve.

GLOVE COMPARTMENT LIGHT AND SWITCH ASSEMBLY

The compartment light and switch assembly is mounted to the striker plate by two screws and is protected by the thermo circuit breaker. The switch turns on and off as the door is opened and closed.

STOP LIGHT SWITCH

A stop light hydraulic switch, installed in the brake line, is used on all series. This switch requires no adjustment.

Care must be taken to see that the switch is assembled tight in the fitting to avoid leaks that may interfere with the operation of the brakes.

DIRECTION SIGNAL SWITCH

A Direction Signal Switch operated by a lever located just above Transmission Control Lever operates front and rear signal lamps. Switch is turned on manually and can be turned off manually. It also turns off automatically when wheel straightens up after completion of turn.

If signal is given for one direction and turn is made opposite, the switch will be turned off automatically as the turn is being made.

Pilot lights located behind arrow heads at the left and right extremities of the instrument cluster, flash a green warning signal which indicates the direction for which the signal has been set. If the pilot light does not flash after signal switch lever has been set for turn, it indicates that either the front or rear signal bulbs or pilot light is burned out. See Fig. 12-51.

Signal lamps will not operate unless ignition switch is turned on.

To operate the signal lamps, the switch lever must be flipped in the direction that steering wheel is to be turned, i.e., up for left turn, down for right turn.

The switch is located in the lower part of the housing below the steering wheel. The movable member of the switch, molded with handle integral, from Bakelite, is supported on ball bearings. The handle, protected by a hardened steel ring extends through the movable plate, which carries the trigger release and supports the manual operating lever. This plate is also supported by ball bearings. It is held in any one of the three positions — LEFT, OFF, RIGHT — by a

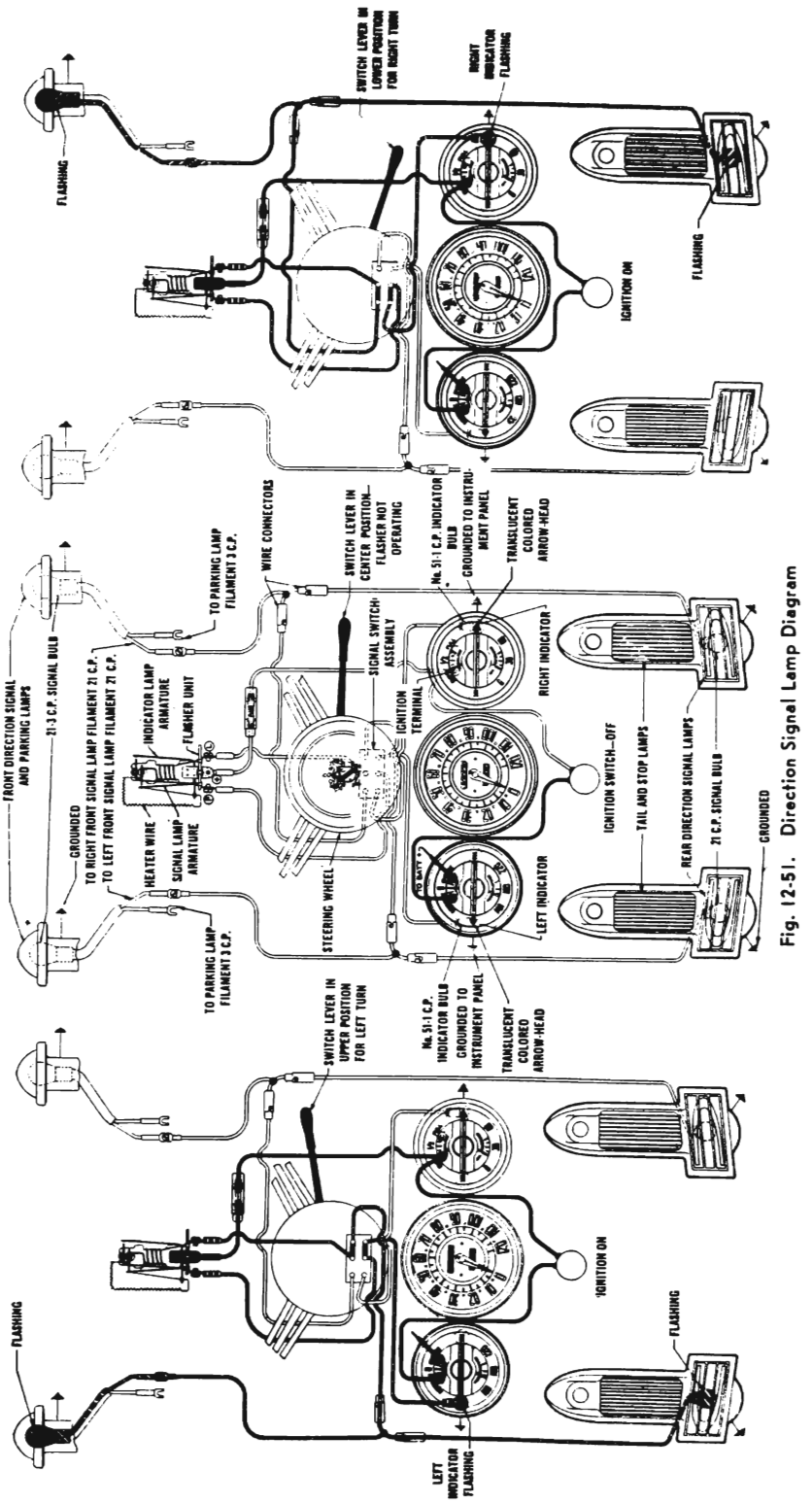


Fig. 12-51. Direction Signal Lamp Diagram

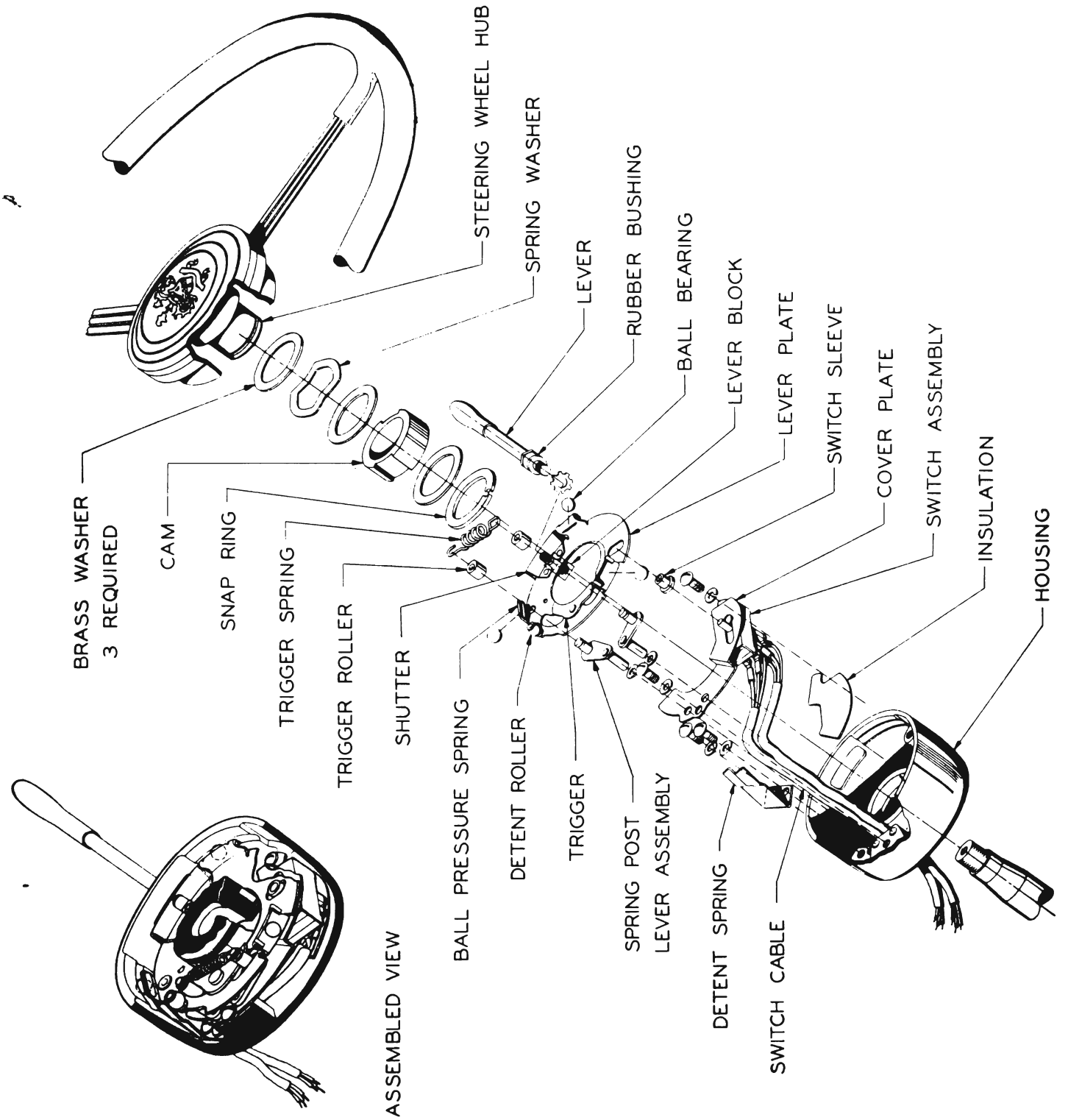


Fig. 12-52. Direction Signal Switch (Exploded View)

roller which engages with a detent spring in the switch housing. See Fig. 12-52.

Rotation of the plate in either direction by the operating lever causes the double-ended spring loaded pawl (trigger) to be pressed against the notched ring (cam) on the steering wheel hub. When the handle has been set in the direction in which the wheel is turned, the pawl ratchets over the notch in the cam, and does not engage. Movement of the wheel in the opposite direction, such as after completion of turn, causes the notch in the cam to engage the pawl and thus rotate the plate and shift the switch to the "off" position. This action withdraws the pawl from the cam in which position it remains until the operating lever is again set for a turn.

The cam consists of a hardened steel ring with two diametrically opposite elongated notches. This cam ring is assembled between brass washers, a shoulder on the hub of the steering wheel, a spring washer and ring which is snapped into a groove in the wheel hub. The assembly forming a friction clutch which facilitates adjustment and coincidentally prevents accidental locking or jamming of the steering wheel. Thus can in no way interfere with steering.

Signal Switch Adjustment

Steering wheel must be assembled to steering shaft so that the lower spoke in wheel is straight down when front wheels are straight ahead. See "Steering Wheel Location," "Removal and Replacing Steering Wheel."

If necessary to remove or install the steering wheel for any reason, always place signal switch lever in "off" position to prevent hub striking pawl and damaging the switch assembly.

If signal switch is properly adjusted, the automatic release will not operate unless the steering wheel is rotated at least one-third revolution. The actual returning of the switch to the "off" position takes place as the steering wheel returns to the straight-ahead position.

If switch does not operate as above it may be readjusted as follows: (See Fig. 12-53)

1. Move signal lever to indicate right turn.
2. Rotate steering wheel to the right until first click is heard, or slight movement of lever is felt, after right "Y" spoke has passed lower center position.
3. Hold switch lever down firmly and turn the steering wheel back slowly until right "Y" spoke is approximately 2" to the right of straight-down position.
4. Release hold on switch lever. Switch will automatically return to "off" with any further movement of wheel towards the straight-ahead position.

Adjustment for a left turn is automatically controlled by the above procedure.

The clutch friction for maintaining this adjustment is controlled by a crimped steel washer —shown in the correct position of assembly, Fig. 12-52. This washer should require a pressure of 125 to 150 pounds to compress to a height of 1/8". If trouble is experienced with the switch lever adjustment the tension of this spring should be checked or the spring washer replaced.

DIRECTION SIGNAL LAMPS

The rear direction signal lamp for indicating the driver's intention of turning to vehicles in the rear is mounted as part of each stop and tail lamp assembly.

Front direction signal lamps for indicating the driver's intention of turning to those approaching from the front, are incorporated in the parking lamps. See Fig. 12-54.

A flasher mounted on the steering column to instrument panel bracket causes both front and rear signal lamps and pilot light to flash "on" and "off" 85 to 100 times per minute, when direction signal switch is turned on.

If pilot light operates for one direction but not for the other, look for . . .

1. Either front or rear signal bulb burned out.
2. Pilot bulb burned out.
3. Open circuit between switch and lamp.
4. Defective switch.

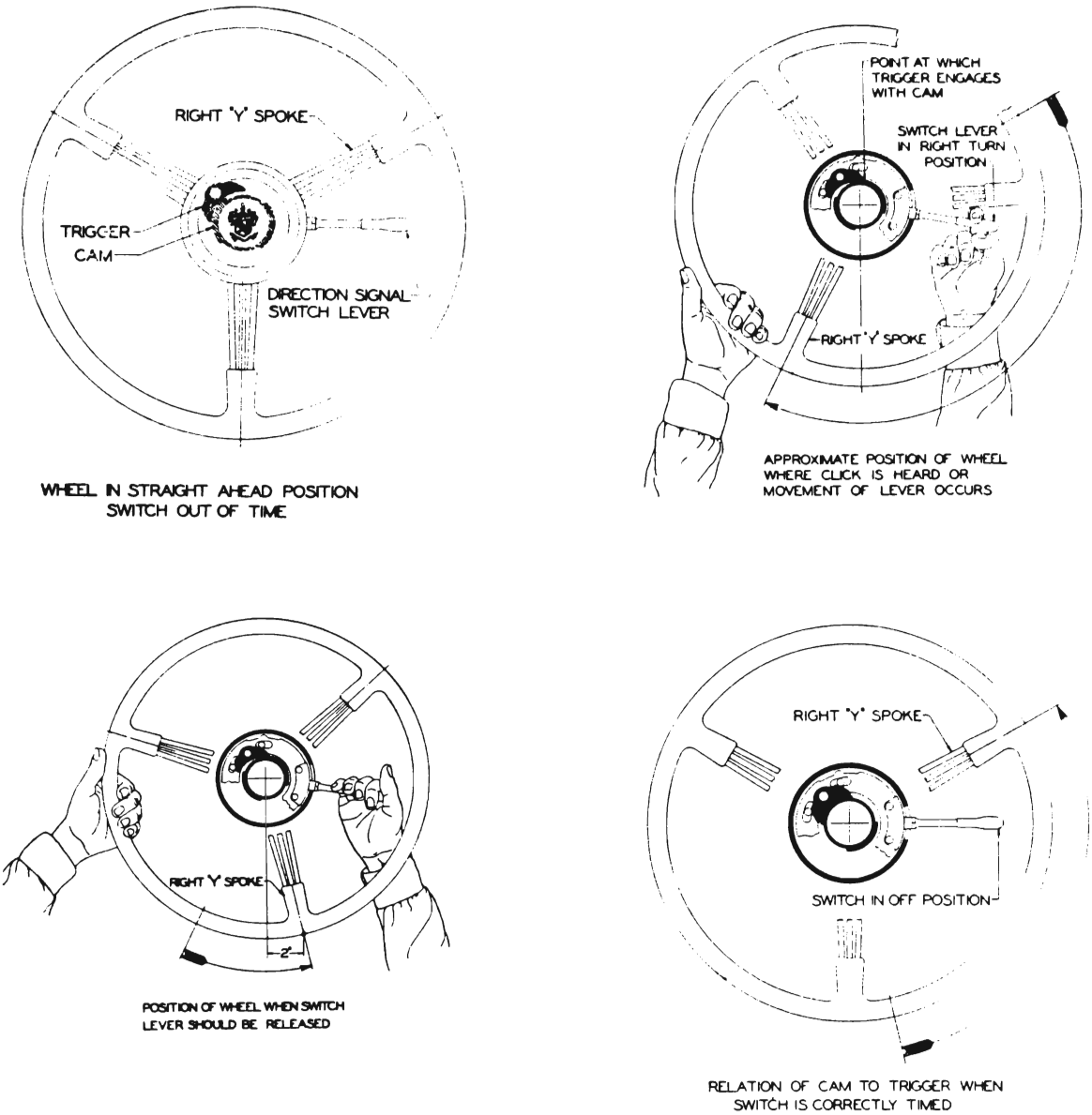


Fig. 12-53. Direction Signal Switch Timing

If pilot light does not operate for either direction look for . . .

1. Any of the above.
2. Burned-out fuse.
3. Defective flasher.

The pilot bulb will burn continuously if the Flasher is wired wrong.

The circuit is protected by a 14 ampere fuse located in a splice type fuse holder, clipped to instrument panel and parking brake lever bracket brace.

Signal lamps will not operate properly if bulbs of other than the specified candlepower are used.

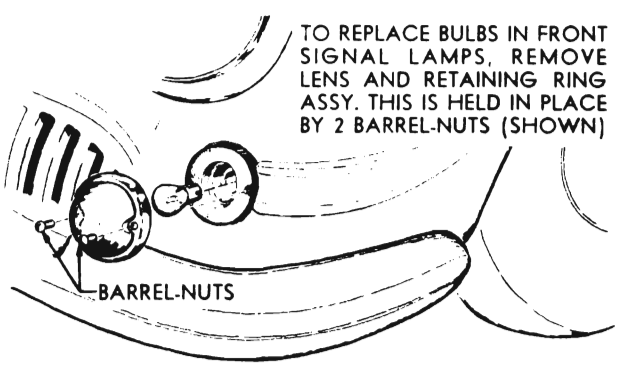


Fig. 12-54. Front Fender Lamp

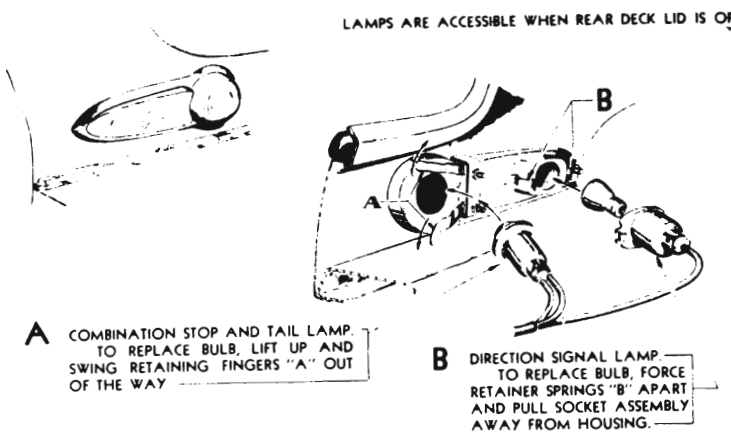


Fig. 12-55. Tail, Stop and Direction Signal Lights—Series 50-70

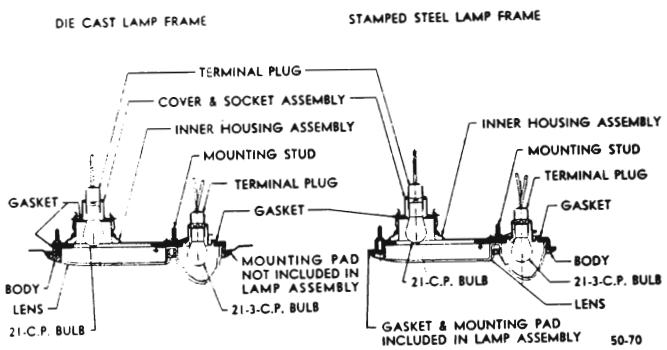


Fig. 12-56. Tail, Stop and Direction Signal Lights—Series 50-70

COMBINATION TAIL AND STOP LAMP

All models are provided with two combination rear signal lamps combined with tail and stop lamp.

Combination tail and stop light bulbs have two filaments rated at 21 C.P. and 3 C.P. The 21 C. P. filament lights when the brakes are applied. The 3 C.P. filament is for the tail light. This bulb has one pin offset to prevent reversing the position of the 21 C.P. and 3 C.P. filaments.

A window in the side of the lamp housing provides light for the trunk compartment when the tail lights are turned on, on Series 40-60-90. The Series 50-70 is lighted with a separate lamp located in the deck lid and operates automatically when tail lights are turned on.

Bulb Replacement

Rear bulb replacement is made from inside of trunk. See Fig. 12-57. To replace tail and stop light bulb on Series 40-60-90 and the directional

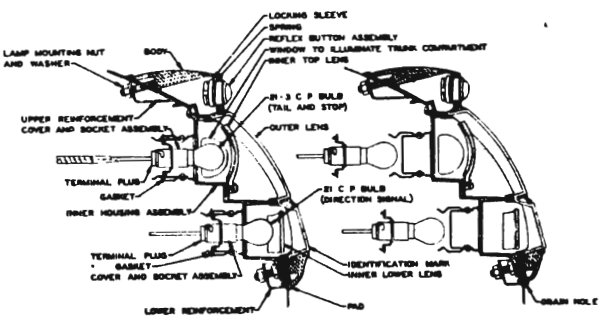


Fig. 12-57. Tail and Stop Light, Disassembled—Series 40-60-90

signal light bulb on Series 50-70, spring retaining clip out and pull out socket plate. Retaining clips are different in width to prevent reversal of socket plate when installing.

To replace tail and stop light bulb on Series 50-70, lift retaining fingers and rotate away from lamp. See Figs. 12-55 and 12-56. Pull out socket and replace bulb. In replacing socket make sure that depression in socket plate enters alignment notch in housing.

To replace front signal lamp or parking lamp bulb, remove the two door screws and lift the cover off. See Fig. 12-54.

"SEALED BEAM" HEADLAMPS

"Sealed Beam" headlighting is used on all models. These lamps are designed so that the light source, the reflector, the lens and gasket are all assembled in one securely sealed unit. See Fig. 12-58. When the filament burns out or lens breaks, a new unit is to be installed, thereby assuring maximum light efficiency. The replacement unit is provided with a longer filament life than in previous headlamp bulbs.

"Sealed Beam" headlamps provide two separate and distinct beams.

1. A country (upper) beam (bright lights) is designed to illuminate the road evenly and is for use on the open highway when no other vehicles are approaching. Fig 12-59.

2. A traffic (lower) beam is also provided and is low enough on the left side to avoid glare in the eyes of the oncoming drivers. It is intended for use on heavily traveled highways and should always be used when meeting other vehicles. This beam is designed so that it does not throw a dazzling light

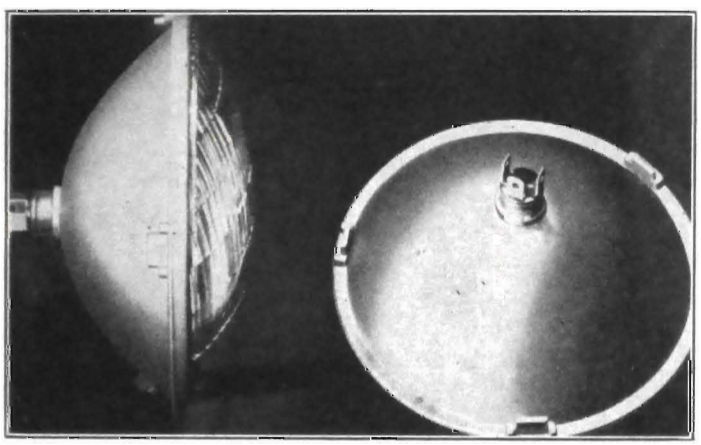
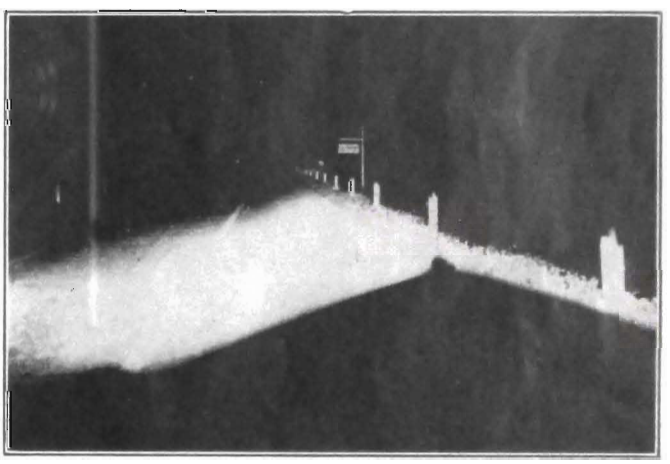


Fig. 12-58. Sealed Beam Headlamp Unit



Lower Beam

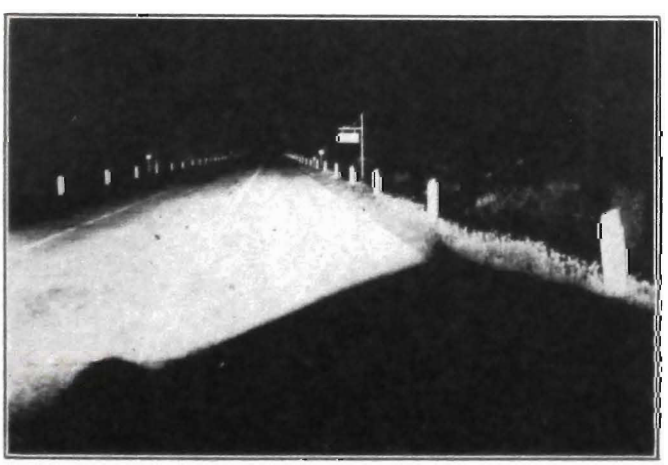


Fig. 12-59. Upper Beam

Fig. 12-60. Lower Beam

into the eyes of the approaching driver under any condition of car loading. At the same time the distribution of light is such that the right side of the road is illuminated as far ahead as is practicable without causing glare on curves. See Fig. 12-60.

The operation of the headlights is a simple one, allowing the motorist to use either the country (upper) or the traffic (lower) beam as traffic and road conditions demand by the use of a conveniently located foot switch. By pulling the light button on the instrument board to the last position, either the country (upper) or traffic (lower) headlamp beams are obtained alternately by operating the foot switch.

When the country (upper) beams are lighted, a dot between the words *"Bright Lights"* at the top of the speedometer will be illuminated in red, making it convenient for the driver to determine when this beam is in use. *Never pass an approaching car with this red light burning.* **Always use the traffic (lower) beam when meeting.**

Lamp Construction

See Figs. 12-61, 12-62.

The "Sealed Beam" reflector unit (A) is held to a sub-body (B) by a retainer ring (C) and three screws which may be removed for removal of the unit. The sub-body forms a ball and socket joint with lamp housing (D) and is held to the housing by four coil springs (E), plus the vertical adjustment screw (F), and the horizontal adjustment screw (G). With this type of mounting the horizontal light beam adjustment can be made without disturbing the vertical light beam setting and vice versa. The reflector unit is provided with three locating lugs (H) which fit into corresponding slots in the sub-body. These lugs are so located that the reflector unit can only be mounted in one position.

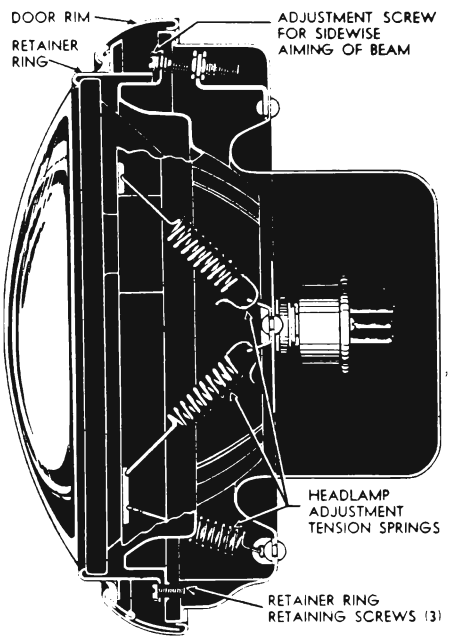


Fig. 12-62. Headlamp Adjustment

With this new system the problem of maintenance has been greatly simplified, requiring only aiming of the beams and the replacement of burned-out or broken units.

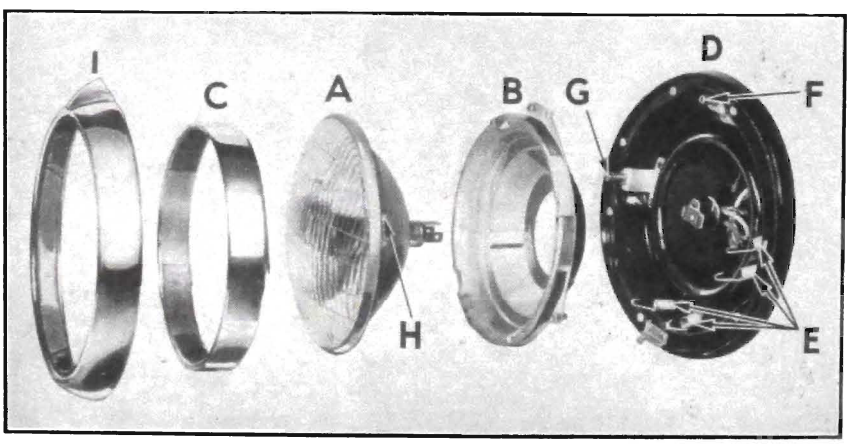


Fig. 12-61. Sealed Beam Headlamp Unit (Exploded View)

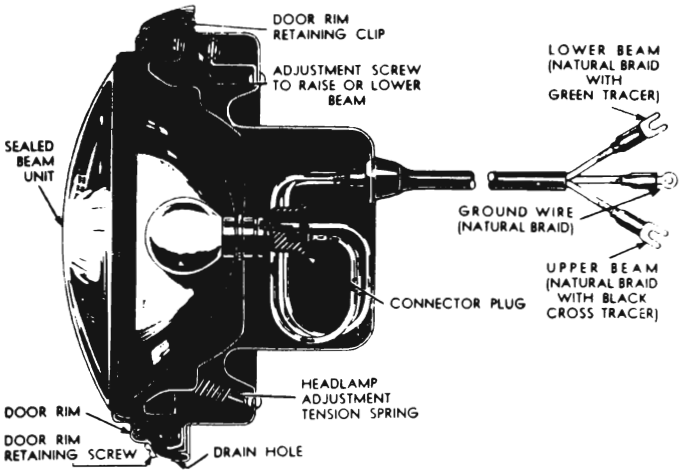


Fig. 12-63. Headlamp Adjustment

To Replace Reflector Unit

Two types of "Sealed Beam" headlamp units are available. One of these types is made entirely of hard glass and the other is a composite unit consisting of a metal reflector and a glass lens. Both are completely interchangeable from the standpoint of electrical connections, beam patterns and physical dimensions.

1. Remove headlamp door rim. See Figs. 12-64 to 12-68 inclusive.
2. Remove three screws holding the retaining ring. *Do not disturb aiming screws.*
3. Remove retaining ring, allowing reflector unit to be removed.
4. Remove connector plug from reflector unit.
5. Install new unit by reversing the above operations.

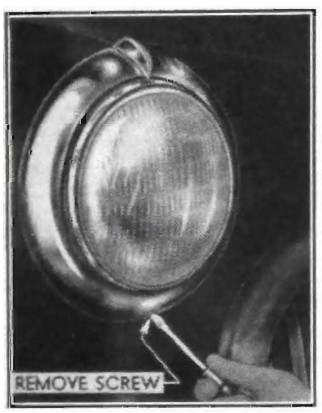


Fig. 12-64
Remove screw

Fig. 12-65
Swing rim out at bottom and lift upward to disengage lug at top of rim

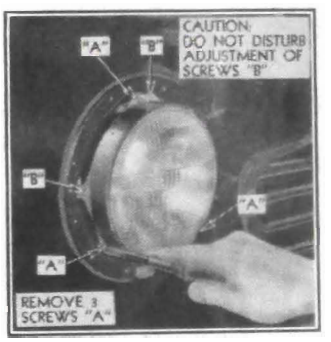


Fig. 12-66
Remove three screws "A"

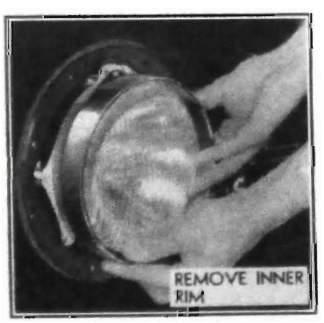


Fig. 12-67
After 3 screws "A" have been removed, rotate rim counter-clockwise and remove

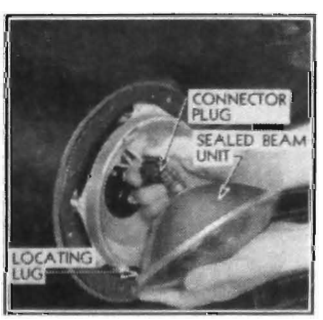


Fig. 12-68
Remove Sealed Beam Unit

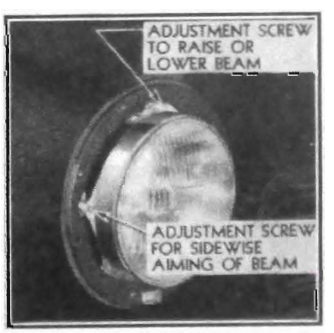


Fig. 12-69
Aiming Adjustment

"Sealed Beam" Headlamp Aiming Adjustment

To obtain the maximum results in road illumination and the safety that has been built into the headlighting equipment, *the headlamps must be properly aimed.*

Place the car on a level stretch with a light colored vertical screen 25 feet ahead. For best road lighting results, draw a horizontal line on this surface at the level of a point 3" below the headlamp center. If, however, your State requires a loading allowance, draw this horizontal line below above mentioned line, by the amount required by your particular State. Sight through the center of the rear window over the center of the radiator ornament and so determine a point on the horizontal line midway between the headlamps. Draw vertical lines through points at the right and left of this center point directly ahead of the center of each headlamp. On cars equipped with a divided windshield, it is necessary to locate a point on the horizontal line by sighting past the left edge of the center divider and then past the right edge. A point midway between these two points represents the center line of the car on the screen from which lines directly ahead of the headlamp centers can be located.

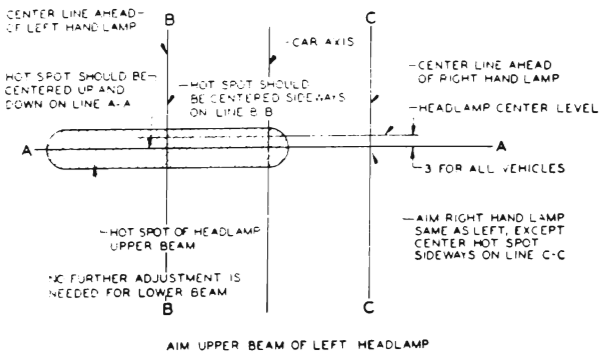


Fig. 12-70. Headlamp Adjusting Chart

Place lighting switch in the position which produces the country (upper) beam (bright lights). When the country (upper) beam is lighted the lower filaments on both lamps are illuminated.

Independent adjustment of both horizontal and vertical aim is provided in "Sealed Beam" headlamps with adjustment screws accessible from the front of the lamp after first removing door rim. Fig. 12-69 shows the vertical and the horizontal adjusting screw. The light beam is moved to the right or left by tightening or loosening the horizontal adjusting screw. The beam may be raised or lowered by turning the vertical adjusting screw.

Cover one lamp to obscure the beam of light and then adjust the beam from the other lamp so that the center of the zone of highest intensity falls on the intersection of the horizontal line 3" below the headlamp center and the vertical line directly ahead of the lamp. Repeat the operation for the other lamp. No further adjustment is needed for the traffic (lower) beam. See Figs. 12-70 and 12-71.

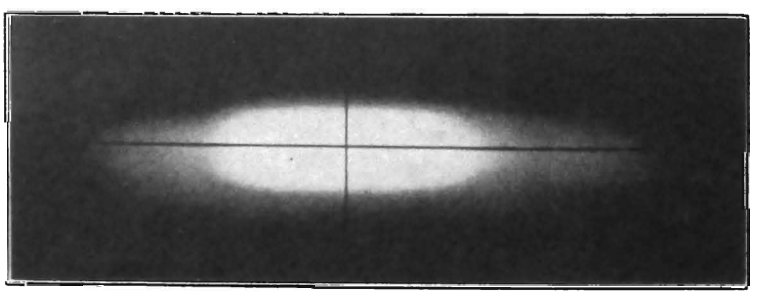


Fig. 12-71. Headlamp Beam Hot Spot

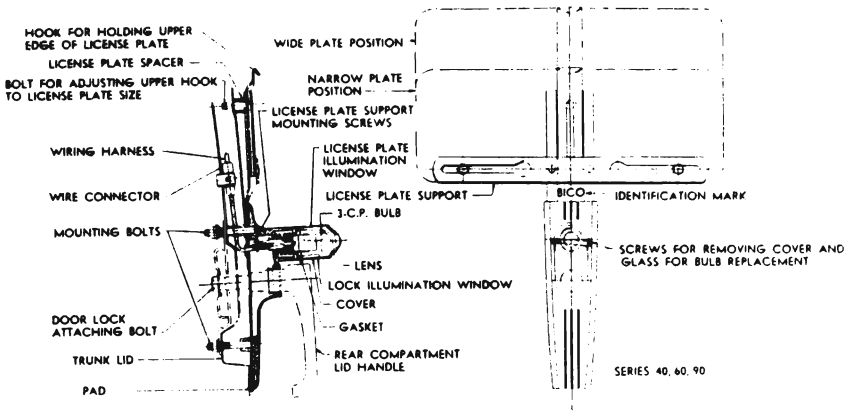


Fig. 12-72. Rear License Plate Bracket—Series 40-60-90

REAR LICENSE PLATE LAMP

Series 40-60-90

The license plate lamp is a part of the rear deck lid handle and license bracket assembly and operates in conjunction with the tail lamp. Wiring connections are made by a connector on the lid for accessibility and protection from water. To replace bulb remove the two screws holding hood in position on lamp assembly. See Fig. 12-72.

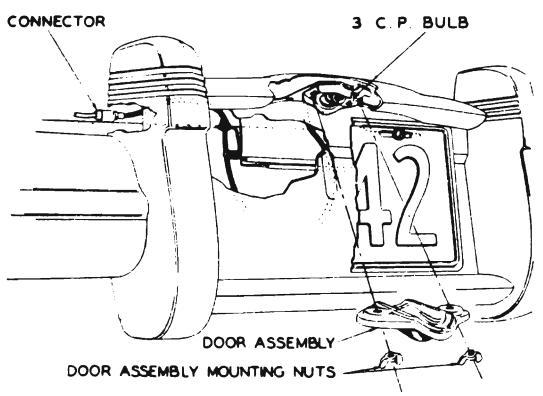


Fig. 12-73. Rear License Plate Bracket—Series 50-70

Series 50-70

The license plate lamp is a part of the license plate frame and operates in conjunction with the tail lamp. A connector located inside the trunk compartment makes the necessary wiring connections.

To replace the bulb remove the two wing nuts holding the door in place. See Fig. 12-73.

CHARGE INDICATOR

A charge indicator is located in the instrument cluster, and has the appearance of an ammeter and will indicate "charge" when battery is being charged and "discharge" when battery is being discharged.

The current required to move the pointer against the stop has been increased to 15 amperes for both charge and discharge. The pointer dampener has been improved to reduce pointer fluctuation when voltage regulator is functioning.

ELECTRIC CLOCK

Buick electric clocks may be installed in the glove compartment door by removing the medallion.

A 2-ampere fuse is located in a splice type fuse holder clipped to the right radio support bracket. In addition to the 2-ampere fuse the clock operating wire is protected by the thermo circuit breaker. Clock light wire is protected by the 14 ampere fuse located on the back of the instrument light switch.

Clock Installation—Both Borg and Jeager

Series 40-60-90

1. Remove battery terminal.
2. Install clock in glove box door in place of medallion, using the same nuts and lockwashers.
3. Clip wire cable to hinge with clip provided on clock wire to prevent chafing on sharp

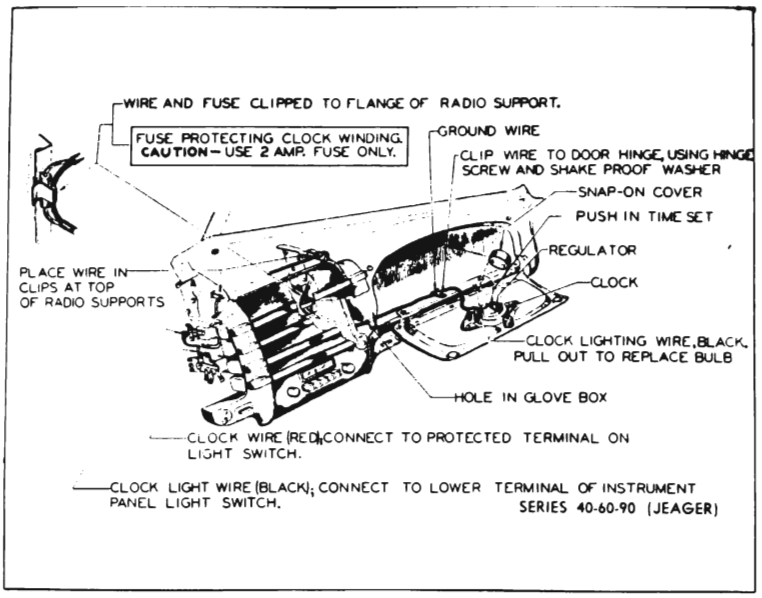


Fig. 12-74. Clock Installation—Jeager—Series 40-60-90

edge of door opening. This clip also is the ground for the clock.

4. Attach clock lighting wire (black) to lower terminal on instrument light switch.
5. Connect clock operating wire (red) to protected terminal on light switch. This is the double top terminal.
6. Clip fuse holder to lower right radio support.

The Jeager clock will start automatically when it is reset after the battery is connected. Reset knob is accessible after snap on cover is removed. See Fig. 12-74.

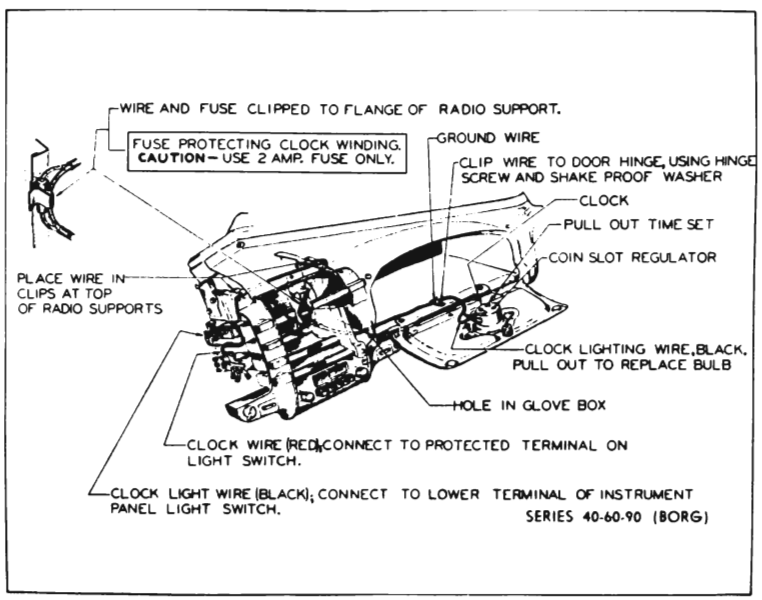


Fig. 12-75. Clock Installation—Borg—Series 40-60-90

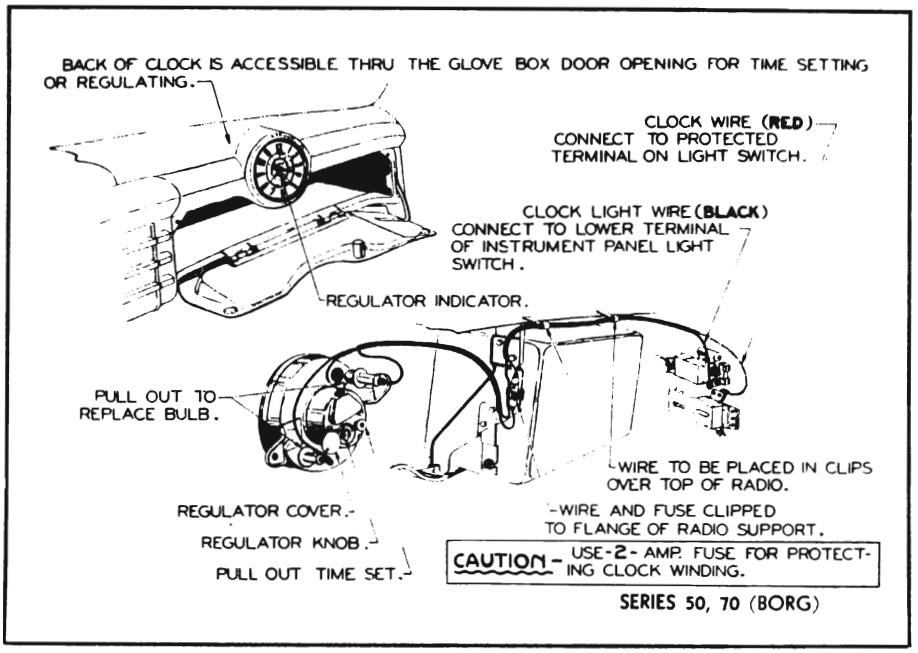


Fig. 12-76. Clock Installation—Borg—Series 50-70

Series 50-70

Series 50-70 clock is mounted on the instrument panel above glove compartment door.

If properly connected the clock will be illuminated when the instrument panel lamps are on.

Borg Clock

Touch battery cable firmly to battery terminal to make the initial wind of the clock.

CAUTION

It is very important that this initial wind be fully made. After the battery cable has first been touched to the battery terminal as above, strike it immediately again to see if there is a spark. If there is, allow the clock to run down until it stops ticking and repeat as above until there is no spark, **making sure all other instruments are off.** Then immediately make the permanent connection before clock runs down, which will require from three to four minutes.

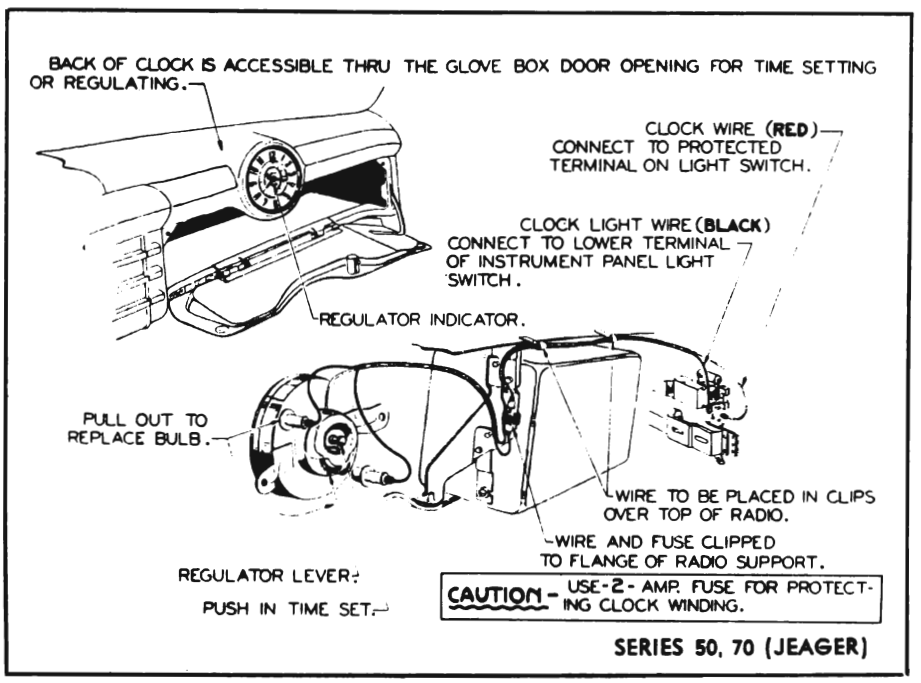


Fig. 12-77. Clock Installation—Jeager—Series 50-70

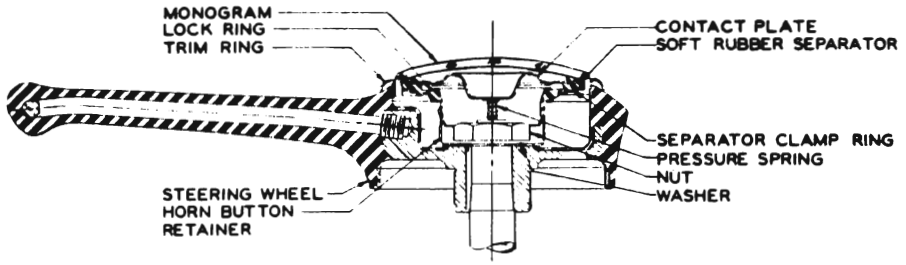


Fig. 12-78. Horn Button—Solid Spoke Wheel

WARNING

If the above procedure is not followed correctly, the fuse may be blown and will have to be replaced. The clock is self-starting, winding approximately every 3½ minutes and consumes a negligible amount of current. See Fig. 12-75.

TIME RESET AND REGULATION

Series 40-60-90

Time reset and regulation on both Borg and Jeager clocks is the same as in 1941 models.

Series 50-70

To reset clock open glove compartment door and reach through opening in glove box to reset knob. On the Borg clock it is necessary to pull knob out to reset. See Fig. 12-76. On the Jeager clock the knob is to be pushed in when resetting. See Fig. 12-77.

To obtain more accurate regulation a regulator indicator is provided on the face of the clock. This indicates the amount and direction the regulator is moved.

To regulate the Jeager clock move the regulator lever which is located on the back of the clock toward "F" to make clock run faster and toward "S" to make clock run slower. See Fig. 12-77.

The Borg clock is regulated in the same manner, however, the regulator is a knob located underneath a sliding cover. See Fig. 12-76.

More accurate regulation can be obtained when the regulator is moved one division at a time.

HORN BUTTON

The horn button assembly of the solid spoke wheel consists of a button, contact plate, rubber separator and lock ring.

A spring holds the wire connection against the center of the contact plate at all times. Contact to ground is made between the outer edge of the contact plate and lock ring, thus completing the circuit when ring is pressed. See Fig. 12-78.

The horn button may be removed by prying on the outer edge of the button with a small screwdriver.

The horn ring of the flexible spoke wheel can be removed by removing the three screws on the underside of the hub. See Fig. 12-79.

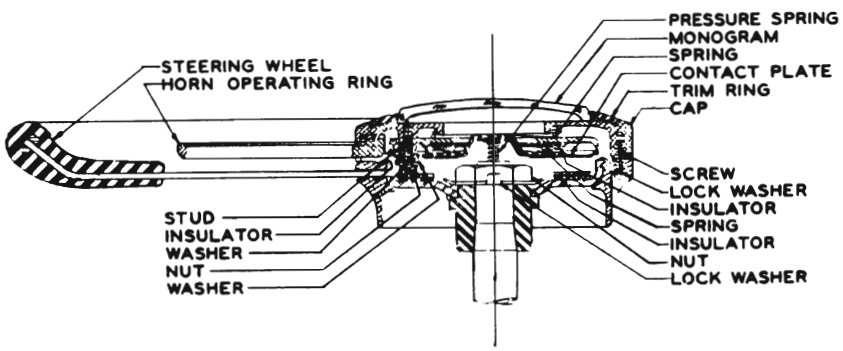


Fig. 12-79. Horn Button—Flexible Spoke Wheel

The horn ring cap on the flexible spoke wheel is serviced as an assembly. The plastic trim ring in horn ring cap if found loose can be tightened by heating and forming the plastic rivet with a rivet forming punch. Punch should be heated just sufficient to hiss when touched with a wet finger. Use pressure of 15 to 20 lbs. on punch when forming rivet.

HORNS

Two Delco-Remy horns are used on all series. These are electrically operated air trumpet type mounted on the dash and operated by a relay controlled from the horn button. This relay is mounted on the front of the dash.

The horns are pitched to produce a pleasing blend, the high pitch horn being mounted on the left-hand side of the dash, and the low pitch horn mounted on the right-hand side.

The horns have been made exceptionally compact by a spiral air column cast into the base.

Horn Adjustment

1. *Air Gap.*

   (a) Remove the horn back shell. See Fig. 12-80.

   (b) The air gap adjustment is very important and should be checked before making the current adjustment. **The gap must be uniform across the entire surface of the armature, and should be as follows:**

   High note horn . . . .035" to .039"
   Low note horn . . . .045" to .049"

   The gap can be regulated by means of the air gap adjusting nuts.

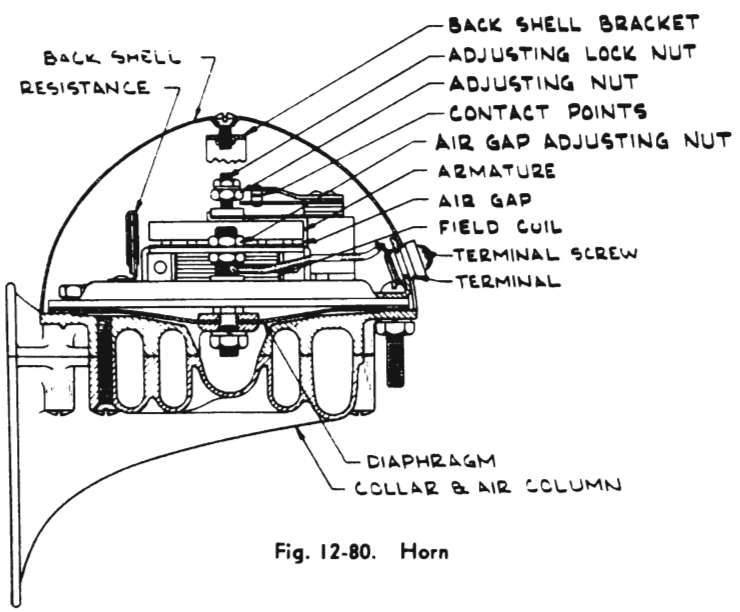


Fig. 12-80. Horn

2. *Tone.*

   (a) Disconnect one horn and connect ammeter in series with the other horn. See Fig. 12-81. This can be done easily by clipping one of the A.V.R. ammeter wires to battery terminal on starter and the other to the horn terminal.

   Set A.V.R. switch so that rheostat is cut out. If a regular ammeter is used, wire connecting the ammeter should not be over a few inches long and should be of at least #10 gauge to avoid excessive voltage drop.

   (b) Regulate charging current by varying engine speed until voltmeter connected to horn terminal and grounded part of horn registers 6 volts, while horn is blowing.

   (c) Loosen locknut and turn the adjusting nut until current consumed by right horn is 19 to 21 amperes and 17 to 19 amperes for the left horn. Current can be decreased by turning the adjusting nut to the right, and increased by turning to the left. Increasing the current increases the volume; however, too much current will cause the horn to have a sputtering sound, and may cause the horn to lock in cold weather. This adjustment is very sensitive, and the adjusting nut should not be moved more than one-tenth of a turn at a time and locked in position each time before trying the horn. Both horns are adjusted in same manner. If an ammeter is not available, adjust according to sound.

   (d) After each unit has been adjusted and operated individually, horns should be

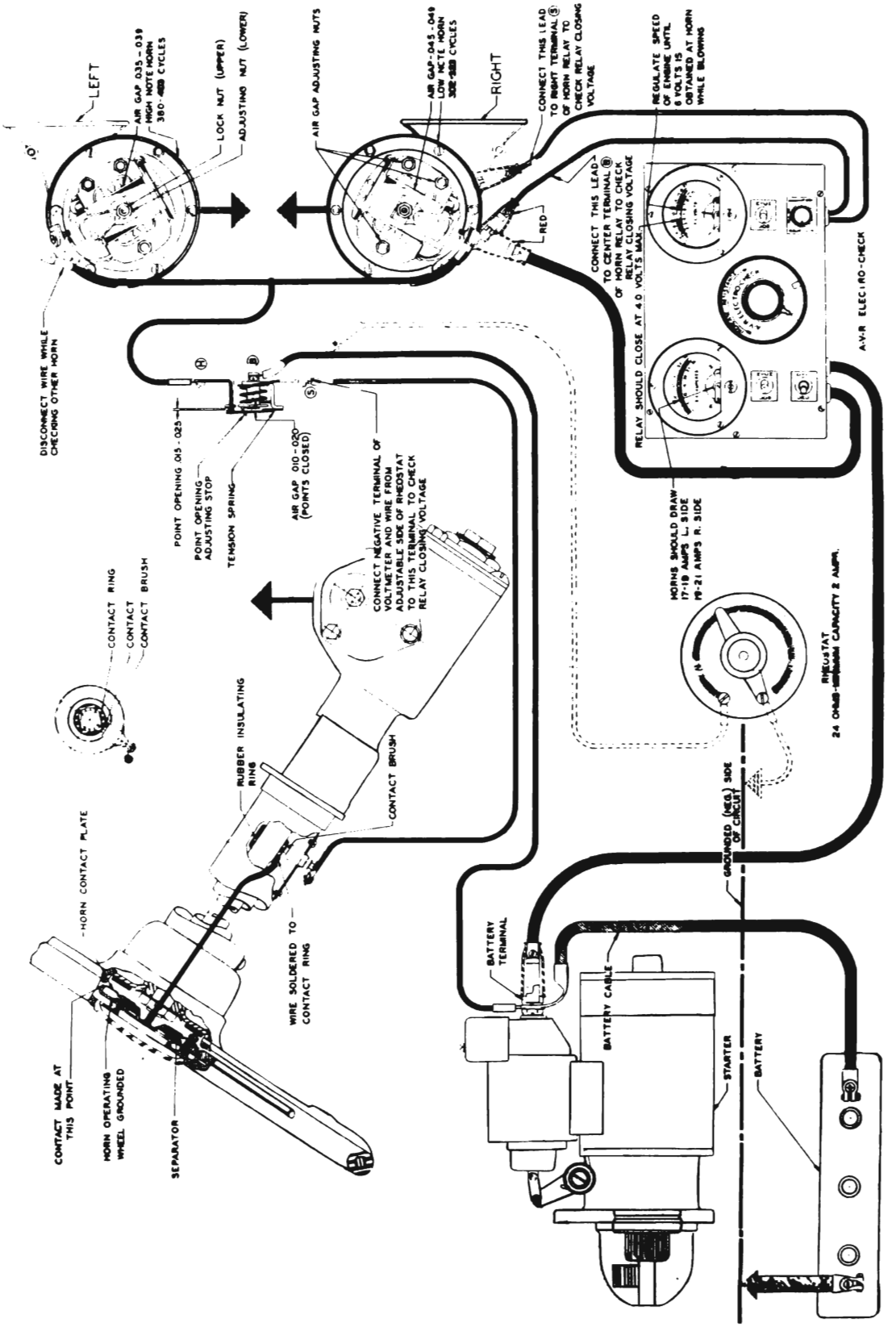


Fig. 12-81. Connection Diagram for Checking Horns

sounded together for proper blend of tone.

High note horn . . . 380 to 400 cycles
Low note horn . . . 302 to 323 cycles

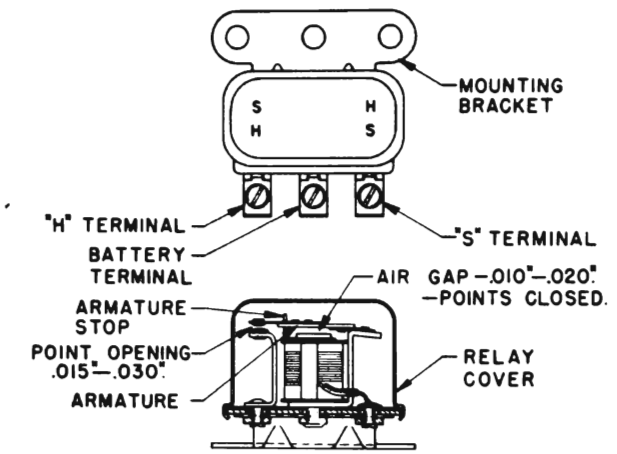


Fig. 12-82. Horn Relay

Horn Relay Adjustment

The point opening of the relay should be .015" to .025". The air gap with the points closed should be .010" to .020". Relay, when adjusted properly, should close at 4 volts maximum.

The point opening can be changed by bending brass stop which bears against the relay armature when the points are in the open position. The air gap can be adjusted by bending the lower contact support. See Fig. 12-82.

GASOLINE GAUGE

An electric gasoline gauge, manufactured by the AC Spark Plug Company, is used. See Fig. 12-83.

Removing the Tank Unit

To remove the tank unit, it is necessary to first remove the gasoline tank; disconnect gasoline supply line at tank; remove gas gauge wire from clip on rear cross member, and disconnect connector to tank unit wire, located in left rear corner of trunk compartment. Remove two tank support bolts and lower tank on left side. The unit can then be removed from the tank by taking out five screws which hold it in place. In replacing tank unit make sure that insulation is folded over terminal and snapped over wire.

It is not necessary to disconnect the tail pipe or tail pipe hangers to replace gauge.

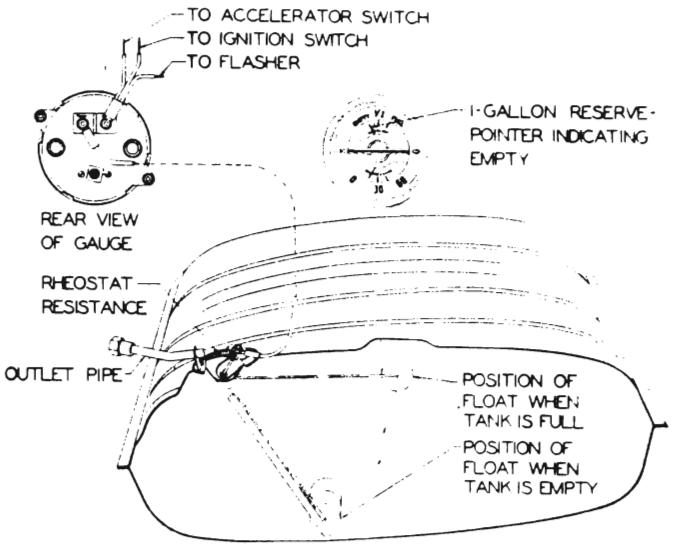


Fig. 12-83. Gasoline Gauge

Gasoline Reserve

Gasoline gauges are designed to provide approximately 1 gallon reserve when pointer is at "*empty*" position.

CAUTION

Do not lubricate either the dash or tank units. No lubrication is necessary in the dash unit and bearings in the tank unit are automatically lubricated by the splash of gasoline.

When connecting wire to dash unit, make certain that the white wire having black parallel tracers, which leads to the tank unit, does not come in contact with ammeter connection or the left terminal on dash unit marked "IGNITION," as this may result in damage to the tank unit rheostat.

SERVICE SUGGESTIONS

Check with gasoline gauge tester, Tool HMO-204, and follow instructions included with same, before removing or replacing either dash or tank units.

Gauge Does Not Register When Ignition Switch is Turned "On"

This may be caused by break in line between the dash unit and ignition switch, or faulty ignition switch.

Gauge Shows "Full" Under All Conditions

1. This may be caused by break in the wire between dash unit and tank unit. To remedy this, check the wire and all connections. Examine connector, which is fastened to white wire having black parallel tracers which connects wiring harness to tank unit. This is located on the harness in the rear compartment near lower left rear corner.
2. Tank unit burned out. Replace tank unit.
3. Tank unit improperly "grounded" due to loose mounting screws or paint under screw heads. Tighten screws holding the tank unit. "Ground" the tank to the chassis and test.

Gauge Shows "Empty" Under All Conditions

1. This may be caused by the wires being reversed on the dash unit. To correct this trouble re-attach wires to proper terminals.
2. Dash unit not "grounded." Replace dash unit.

Work in locating the trouble will be considerably simplified if testing tool HMO-204 is available, as this can be connected with the gauge by a short piece of wire, and grounding the body of the unit to the chassis. The tester can then be moved to the *"full"* and *"empty"* positions. If the dash unit indicates corresponding positions, the trouble is confined to tank unit and wiring.

CIGAR LIGHTER

Cigar lighter is operated by pressing "in" until it latches. It will automatically return to "off" position when heated to proper temperature. A thermal fuse protects the unit against overheating if held in manually for too long a period. This fuse is located at the back of lighter and is replaceable. See Fig. 12-84.

CIRCUIT DIAGRAM

With the aid of these diagrams each circuit, to various units, may be traced. See Figs. 12-87 to 12-91 inclusive.

BATTERY

Series 40-50.....100 ampere hours

Series 60-70-90 .....120 ampere hours

All series are equipped with Delco-Remy storage batteries located under the hood on the right side, to better protect the battery and to make it more accessible. Authorized service can be obtained at branches or service stations of United Motors Service.

Batteries in new car stock should receive regular attention in order to prevent sulphation of plates due to inactivity of the battery. Batteries should be rotated and the older ones used first.

Registration

The battery manufacturer is represented by Authorized Service Stations which are prepared to carry out terms of the maker's warranty. In order that Buick owners shall have the benefit of this warranty, it is necessary for the dealer to register battery with the local station in all new car deliveries.

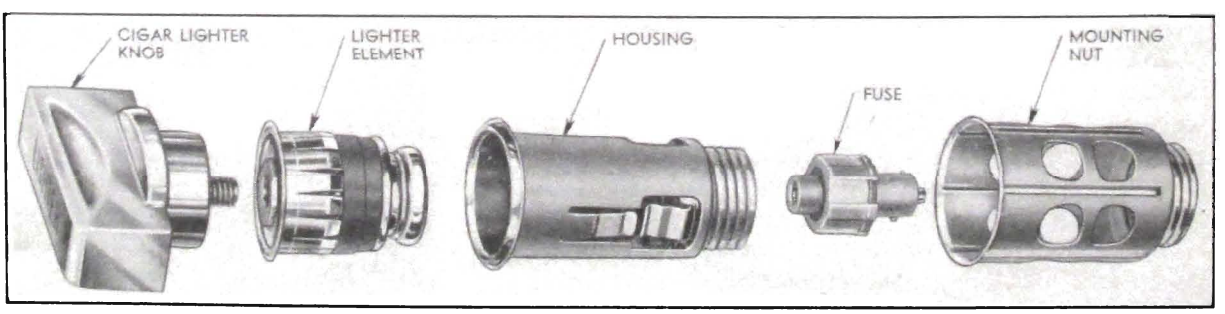


Fig. 12-84. Cigar Lighter Disassembled

Care

The battery support is bolted to the top of the frame. A rectangular clamp holds the battery to the support through two long bolts fitted with wing nuts.

When installing battery, care must be used to make certain that negative terminal is grounded. This is important for proper operation of the various electrical units. **Before connecting the positive cable see instructions under "Electric Clock—Caution."**

It is also very important that the battery clamping bolts be tightened occasionally to make certain the battery is held securely in the box. Wing type nuts are used and should only be drawn up finger tight. Tightening with wrench may distort battery case. Positive terminals are equipped with rubber boots to protect against any short-circuiting. Filler caps are doubly vented to prevent loss of solution.

The battery requires very little attention, but periodical inspection is essential to secure the maximum efficiency and life.

The electrolyte should always be maintained at the proper level, and pure distilled water added to each cell until the solution is ¼" above the top of the separators. **Do not overfill.** Usually this should be done once a week in the summer and twice monthly in the winter; and in freezing weather, it should be added just before using the car.

To prevent corrosion of battery terminals and connections, apply a coating of petroleum jelly over the battery post and strap terminals, making sure that connections are properly tightened. If corrosion occurs, clean posts and terminals with a strong soda solution before applying the petroleum jelly. Do not allow this to get inside the battery.

- See that gasket is in place when the filler plugs
- are tightened and the top of battery is kept dry.

An occasional inspection should be made of battery cable connections as looseness is one of the causes of burned-out headlamp bulbs and burned ignition points.

Periodical hydrometer readings are advisable. **Care should be used to keep acid away from wiring, also sheet metal.**

When a hydrometer is used for checking the condition of a battery, correction must be made for temperature. A battery in good condition should register not less than 1.250 specific gravity at 75° F. For each 5° decrease in temperature, the specific gravity rises approximately .002. Therefore, at 0° F. this battery would show a specific gravity of 1.280.

Corresponding to the above, for each 5° increase in temperature, the specific gravity decreases .002. Therefore, in extremely warm climates where freezing never occurs, a battery in good condition should measure not less than 1.235.

From the accompanying data it will be seen that a battery checking 1.200 specific gravity at 75° F. will freeze at approximately 40° below zero. See Fig. 12-85.

Never use so-called quick electrolytes for the purpose of keeping the battery fully charged, as these invariably reduce the life of the battery.

CAUTION

Batteries give off highly inflammable hydrogen gas when charging and continue to do so

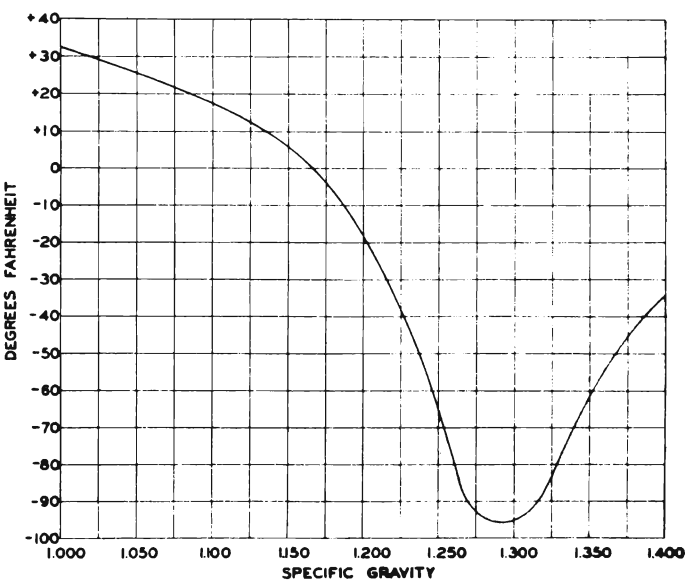


Fig. 12-85. Freezing Points of Solutions of Sulphuric Acid at Various Densities

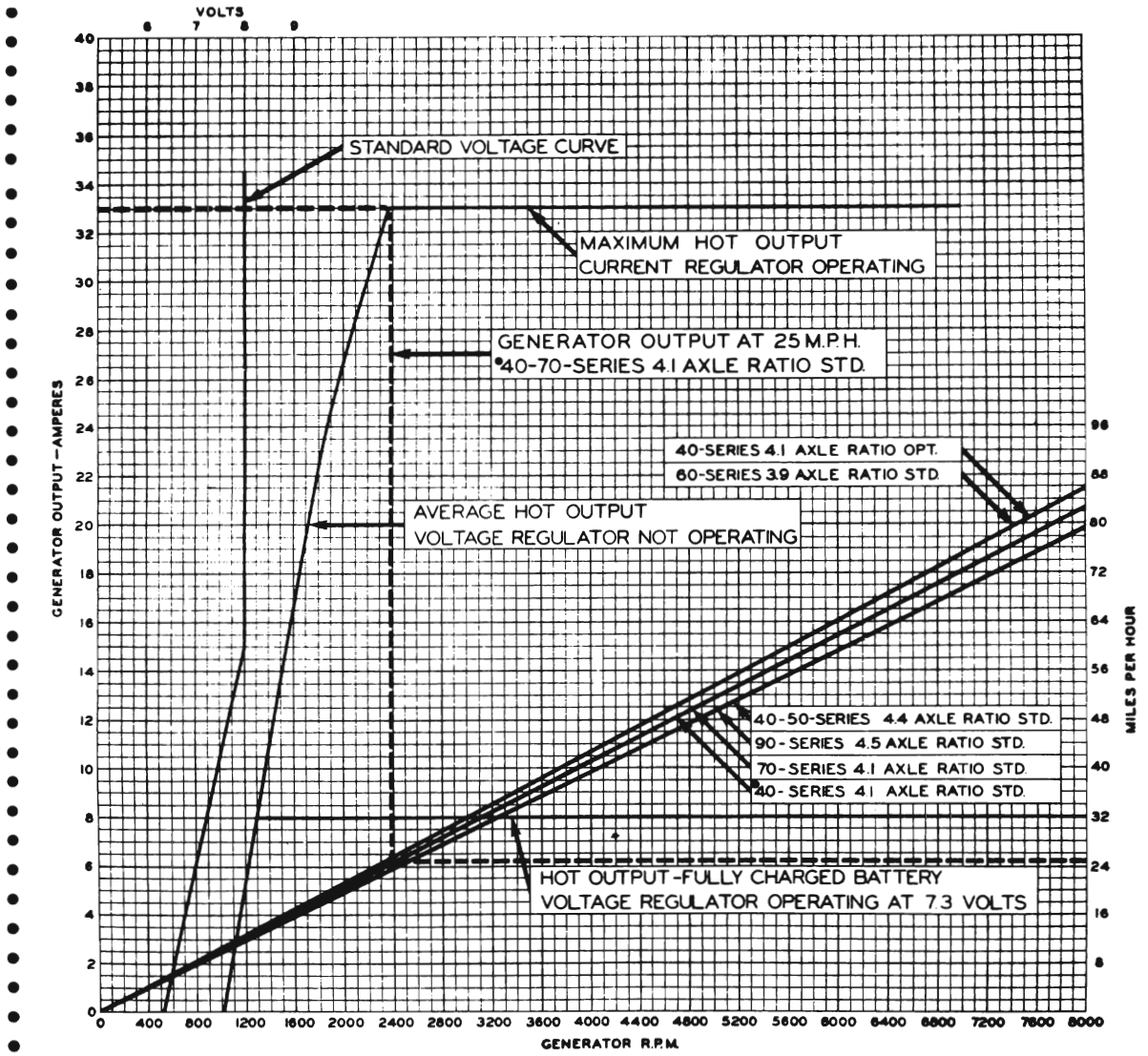


Fig. 12-86. Generator Output—All Series

for some time after receiving a steady charge. Under no condition should an electric spark or open flame be allowed to occur around a battery, particularly in vicinity of vent cap.

The high tension lead wire connected to synchroscope should never be allowed to rest on top of battery when checking engine timing. Should this high tension wire contact battery (especially vent cap) so as to produce a spark, an explosition of escaping hydrogen gas might occur. This is a highly dangerous practice. No conductor of electricity should contact top of battery and matches or any open flame should not be used when checking electrolyte level.

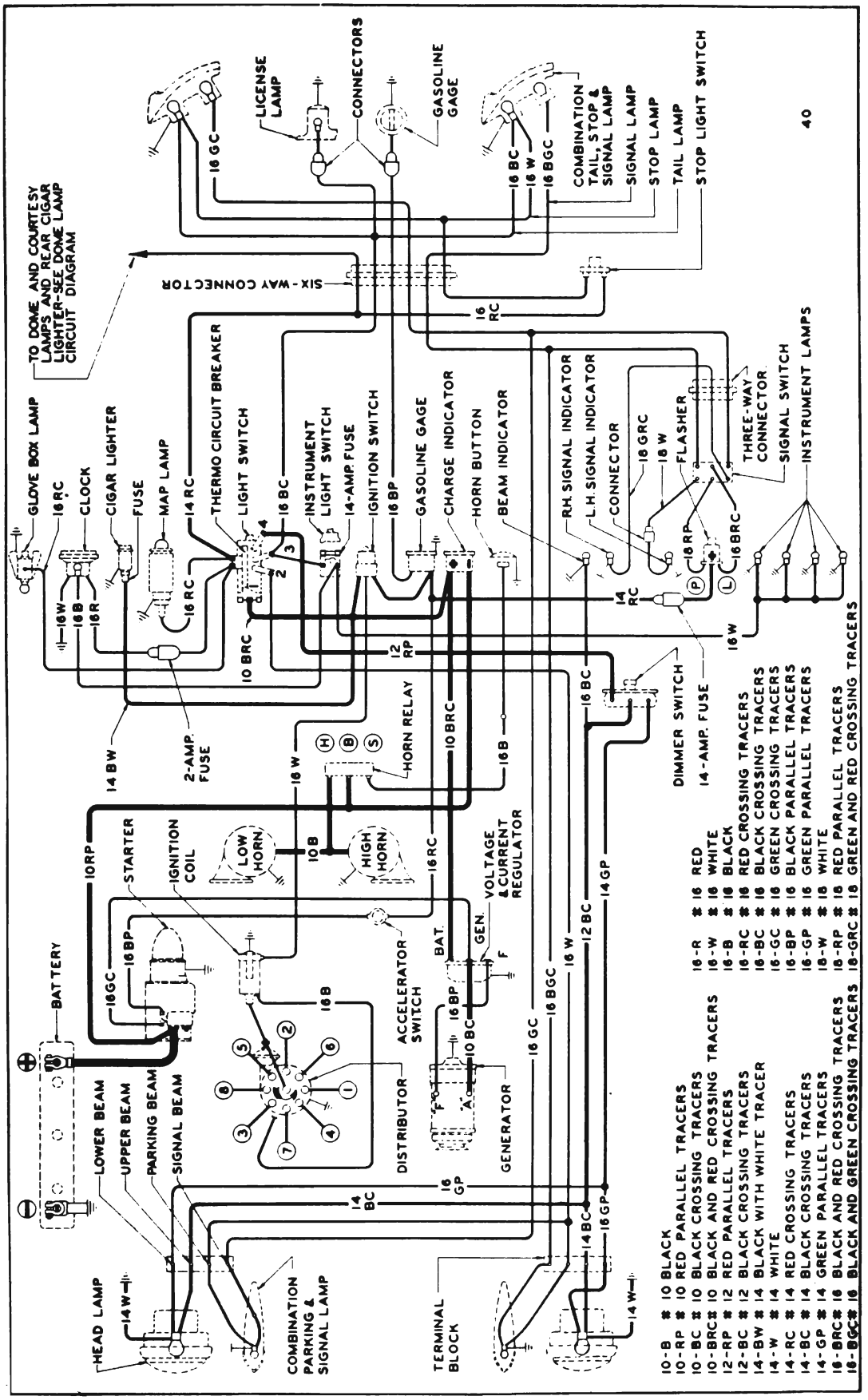


Fig. 12-87. Wiring Circuit Diagram—Series 40

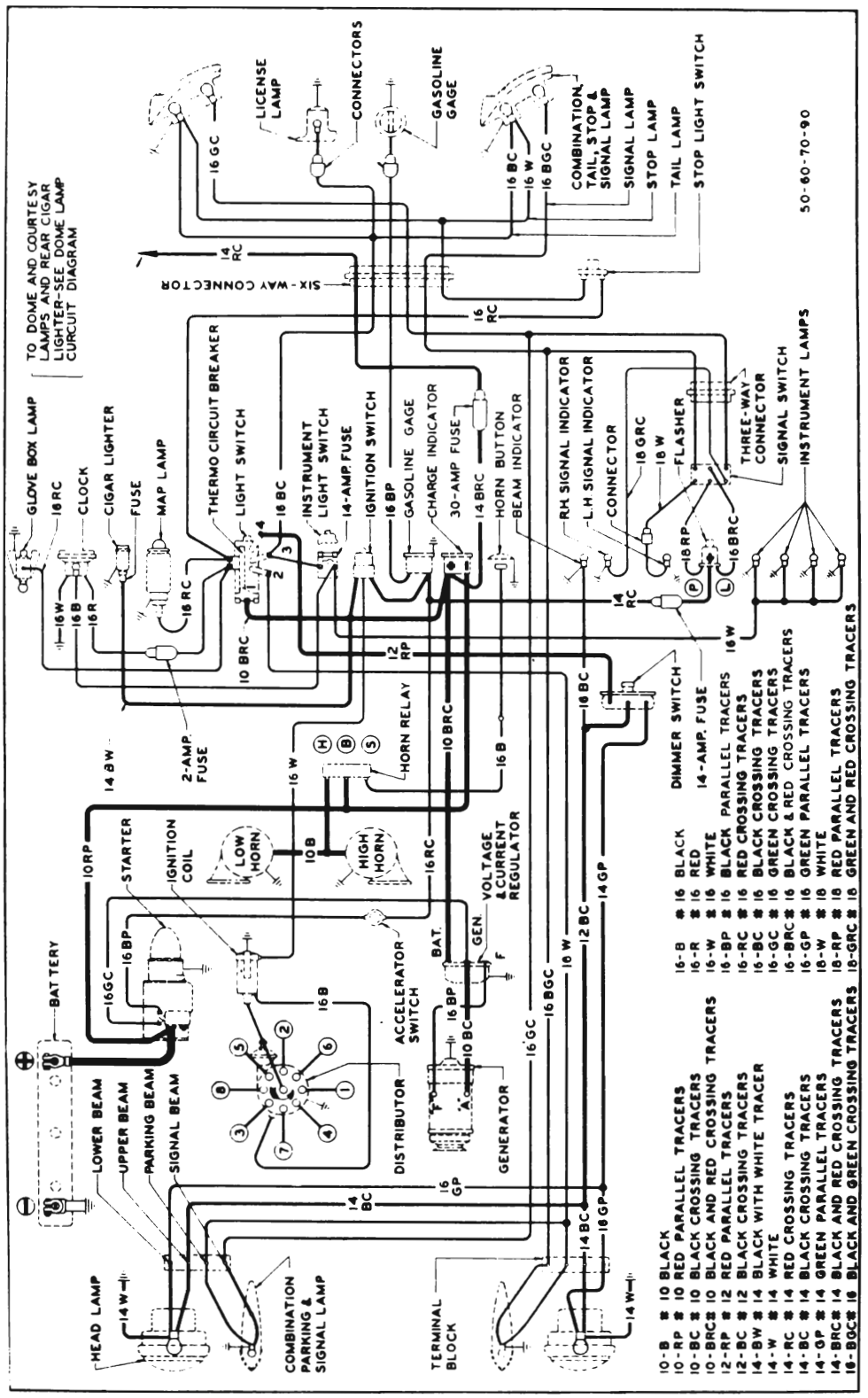
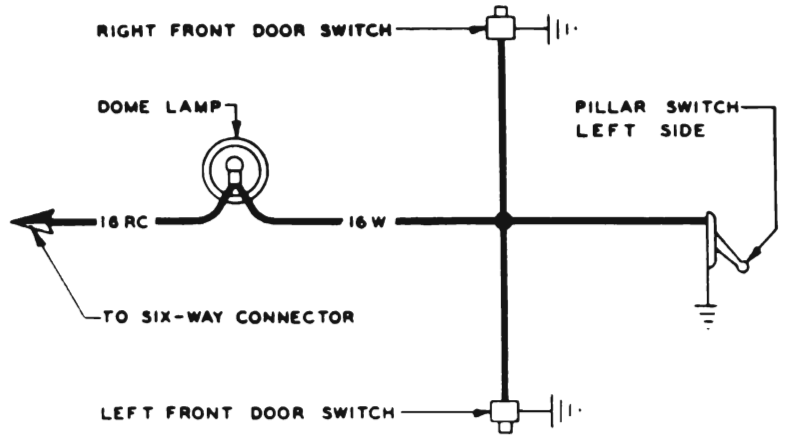
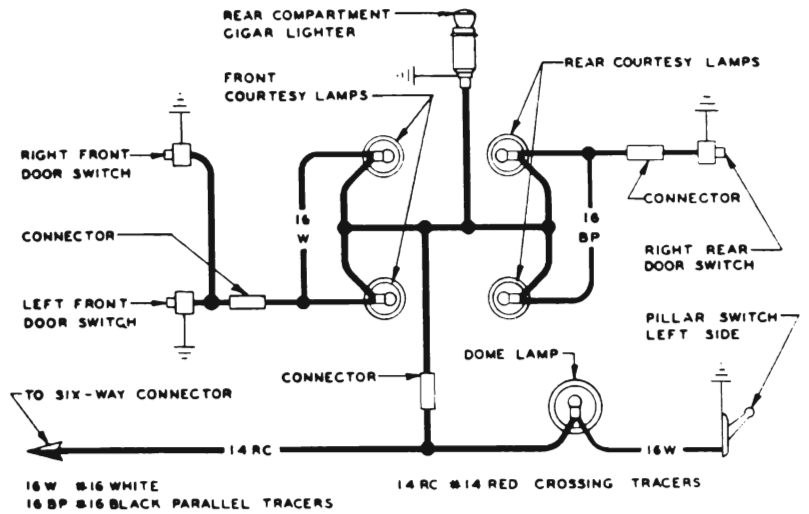


Fig. 12-88. Wiring Circuit Diagram—Series 50-60-70-90



MODELS 41-46-46S-46SSE-47 48-48S-56S-66S-76S



MODELS 41SE-61

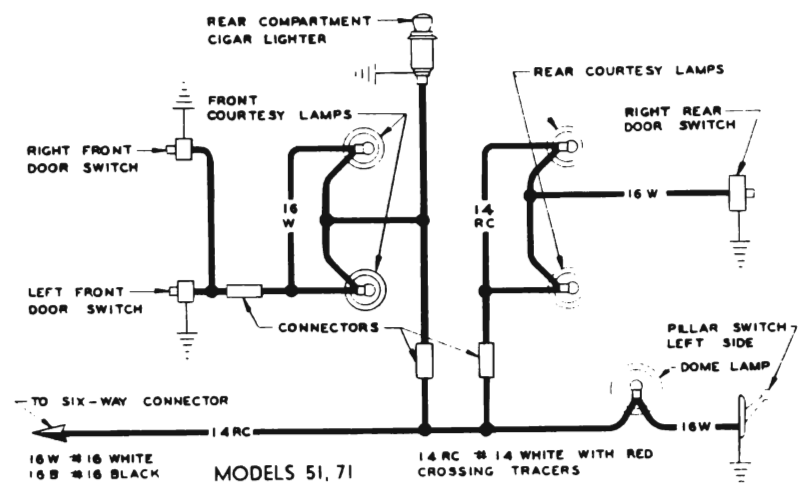


Fig. 12-89. Wiring Circuit Diagrams

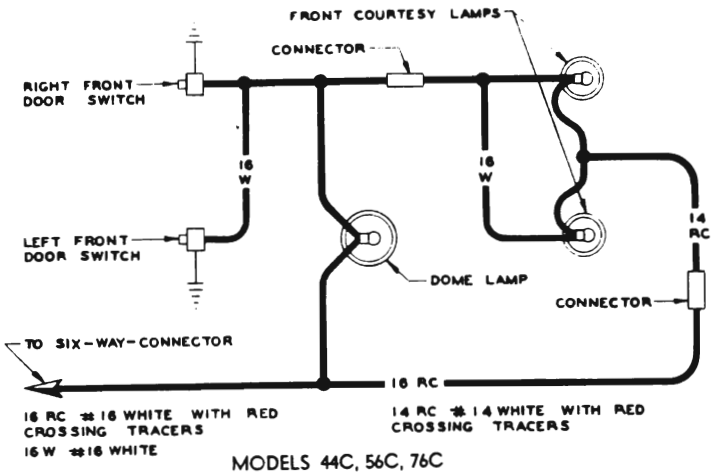


Fig. 12-90. Wiring Circuit Diagram

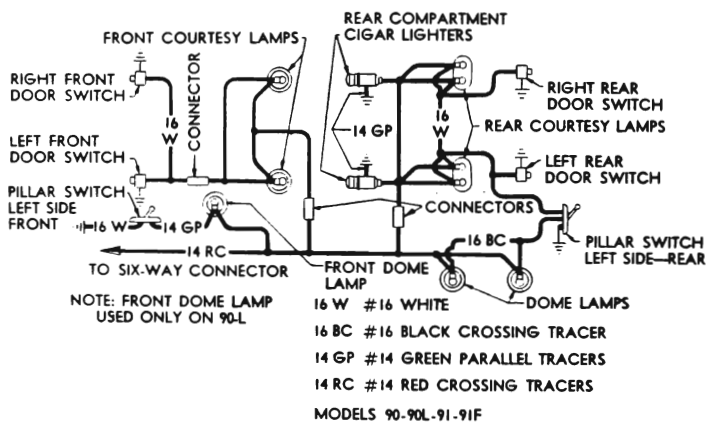


Fig. 12-91. Wiring Circuit Diagram

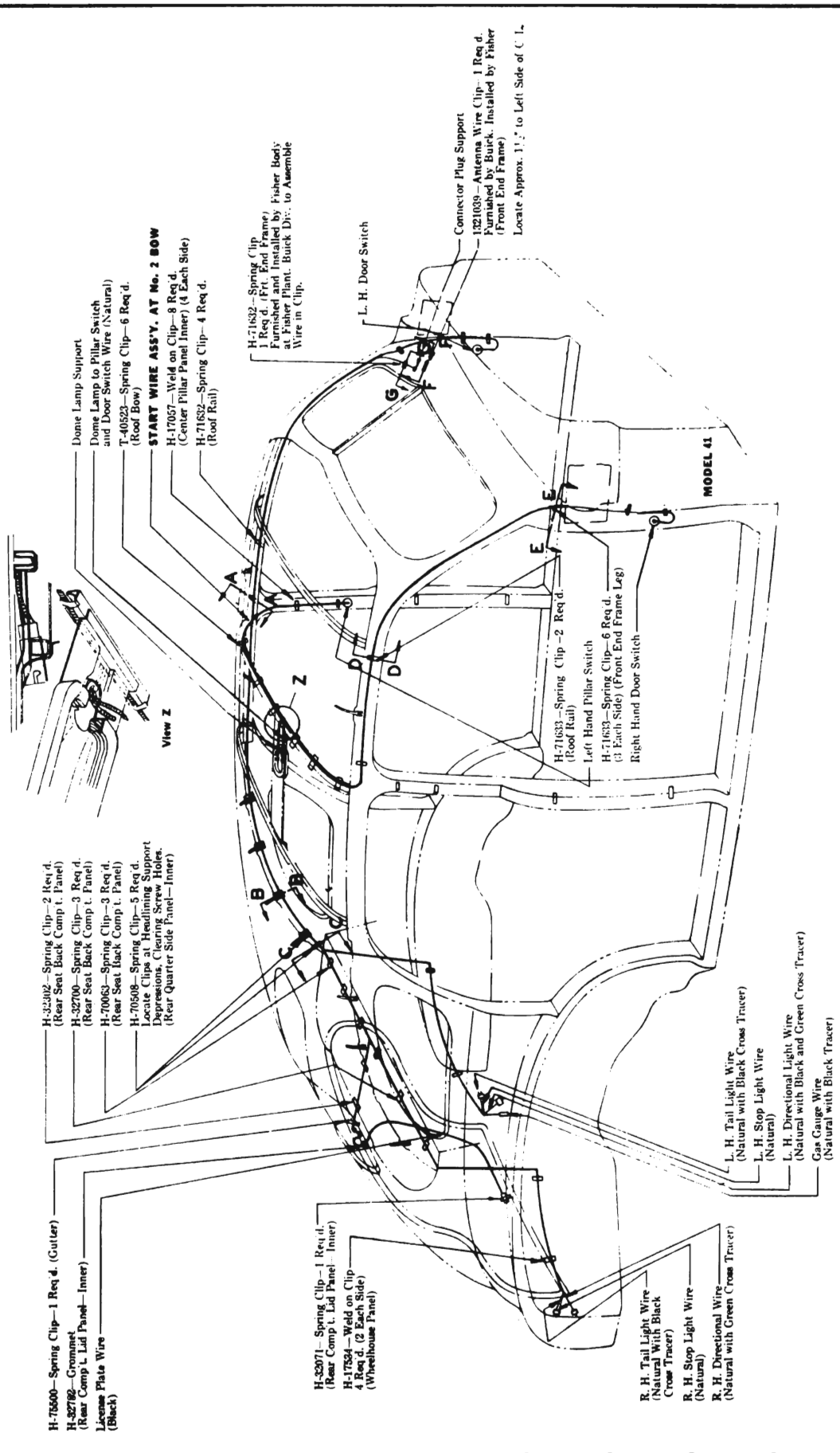


Fig. 12-92. Body Wiring Diagram—Model 41

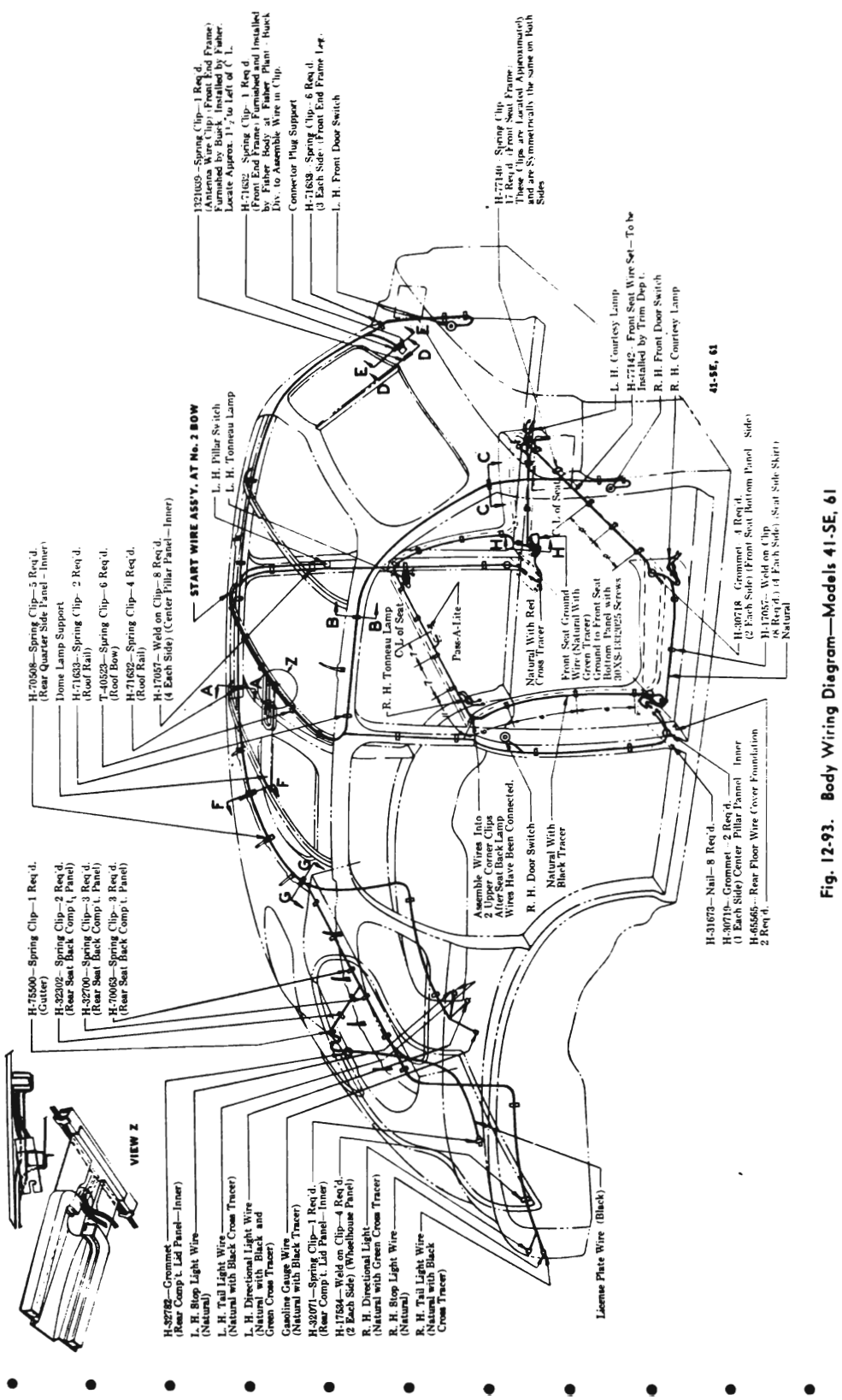


Fig. 12-93. Body Wiring Diagram—Models 41-SE, 61

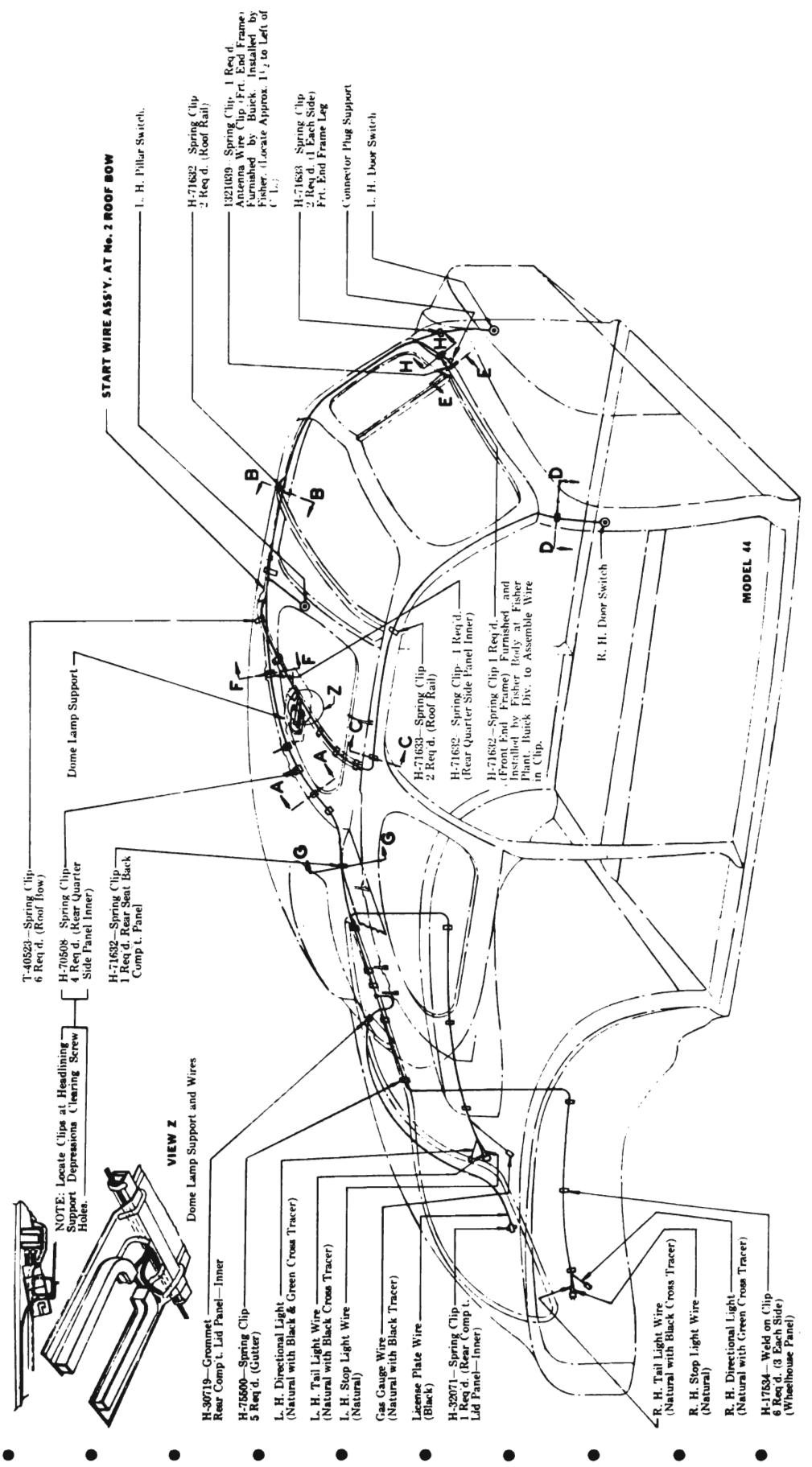


Fig. 12-94. Body Wiring Diagram—Model 44

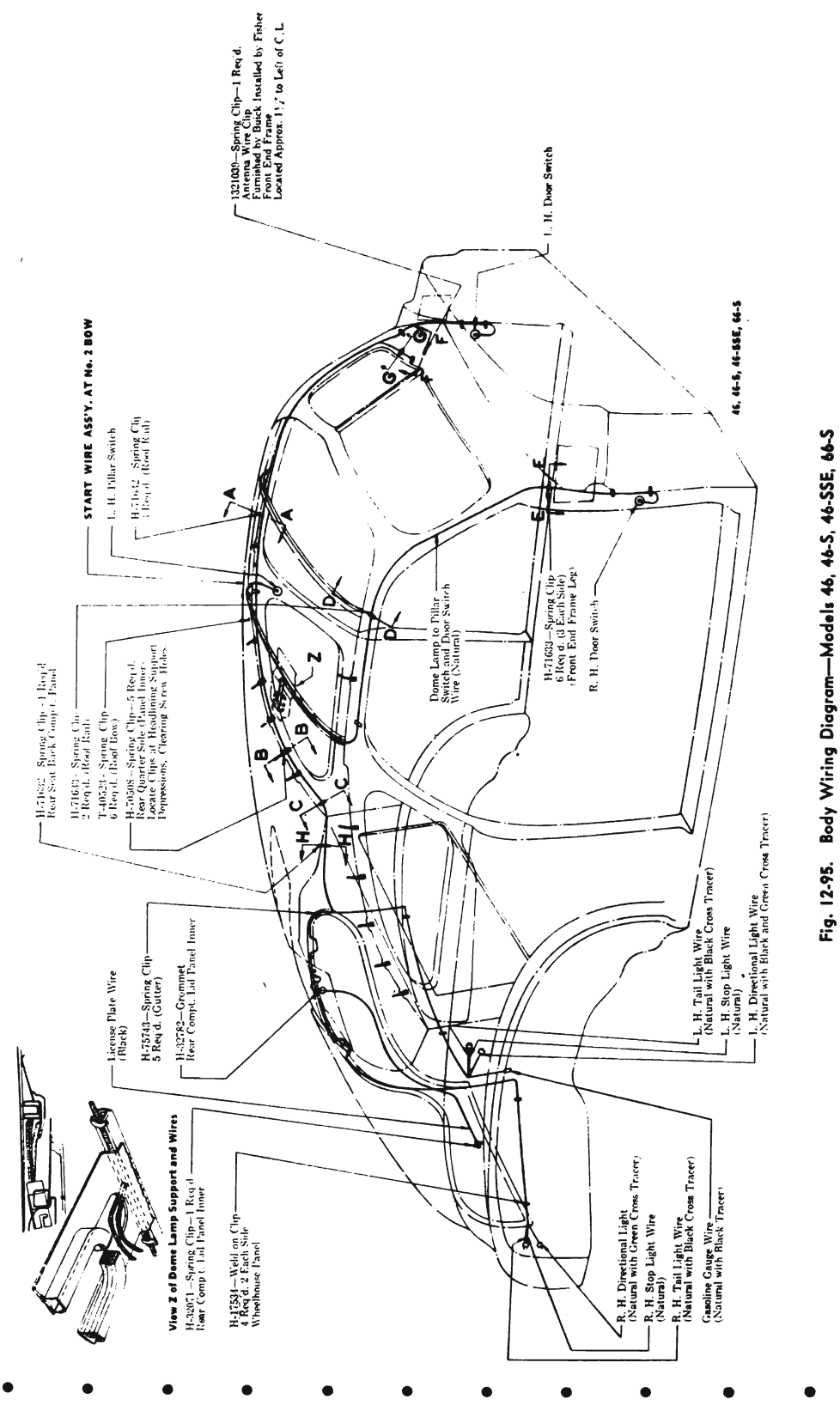


Fig. 12-95. Body Wiring Diagram—Models 46, 46-S, 46-SSE, 66-S

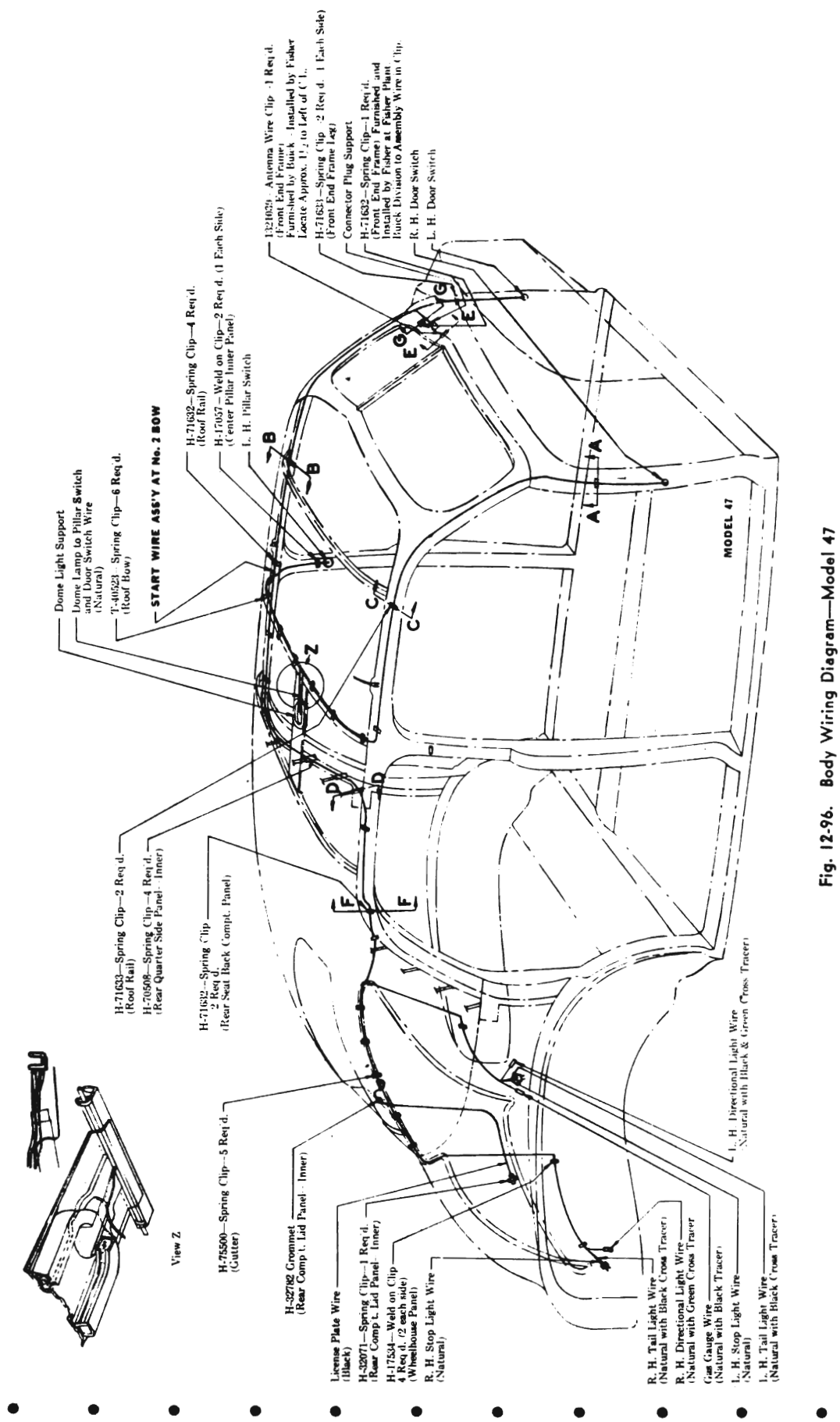


Fig. 12-96. Body Wiring Diagram—Model 47

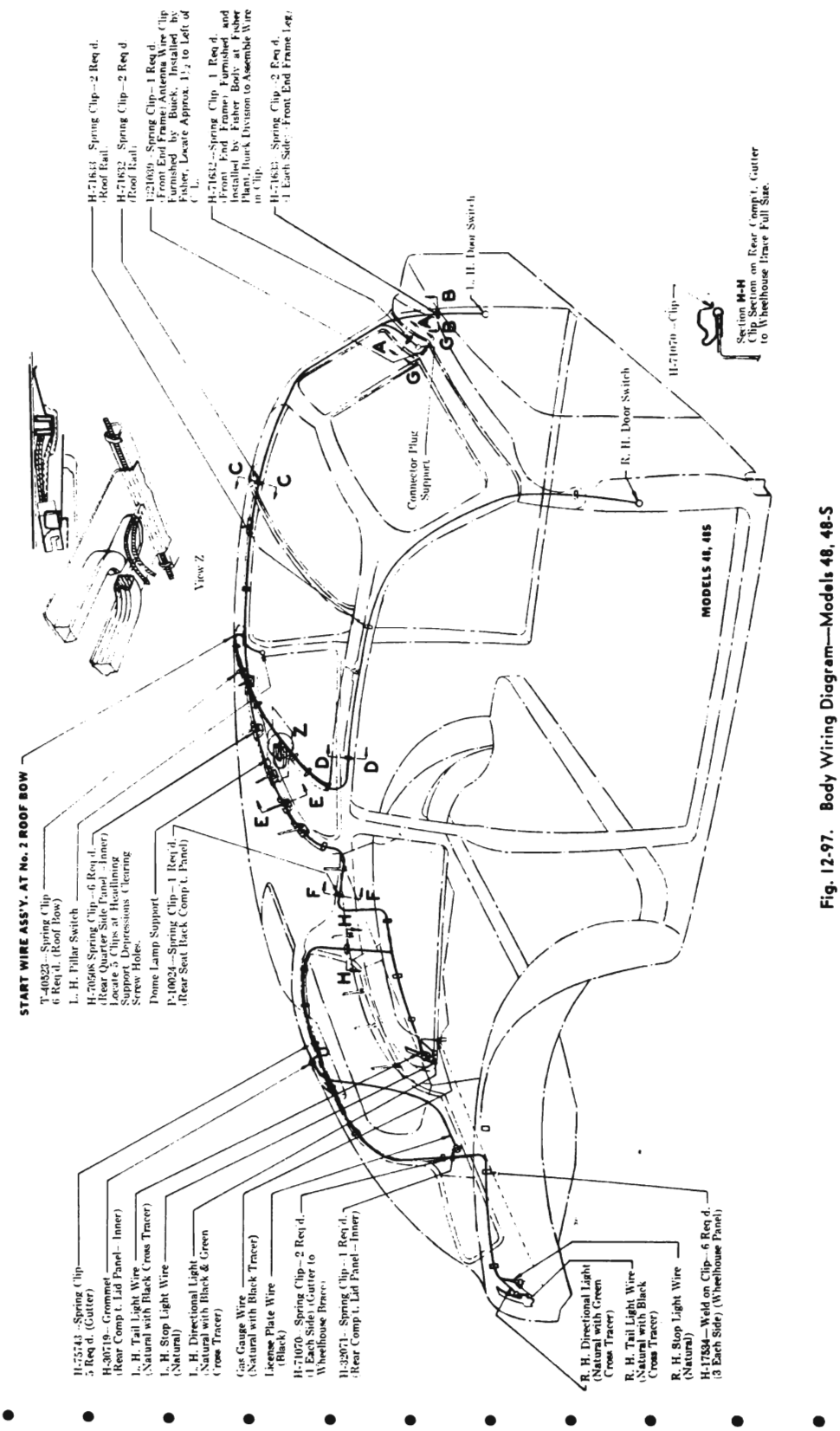


Fig. 12.97. Body Wiring Diagram—Models 48, 48-S

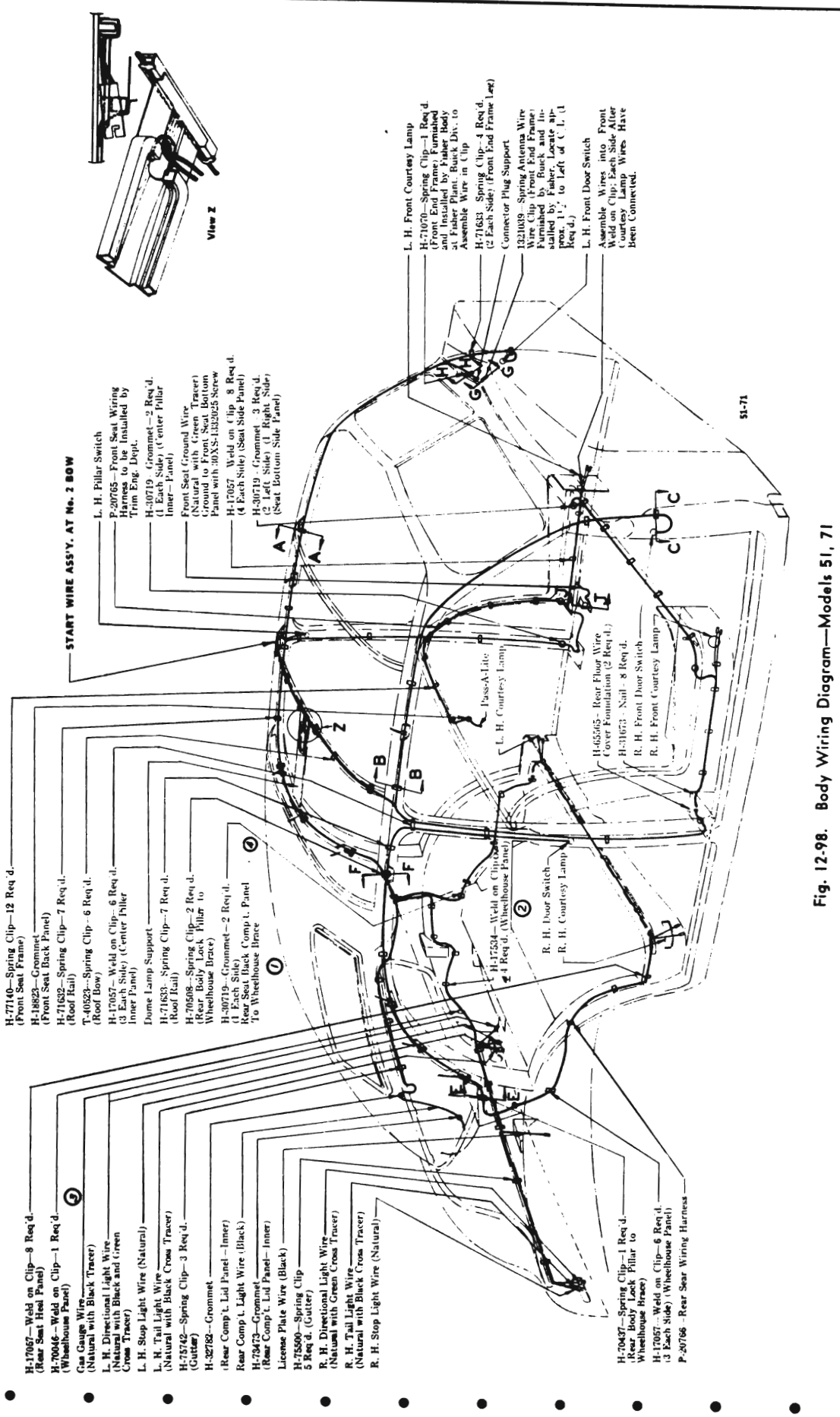


Fig. 12-98. Body Wiring Diagram—Models 51, 71

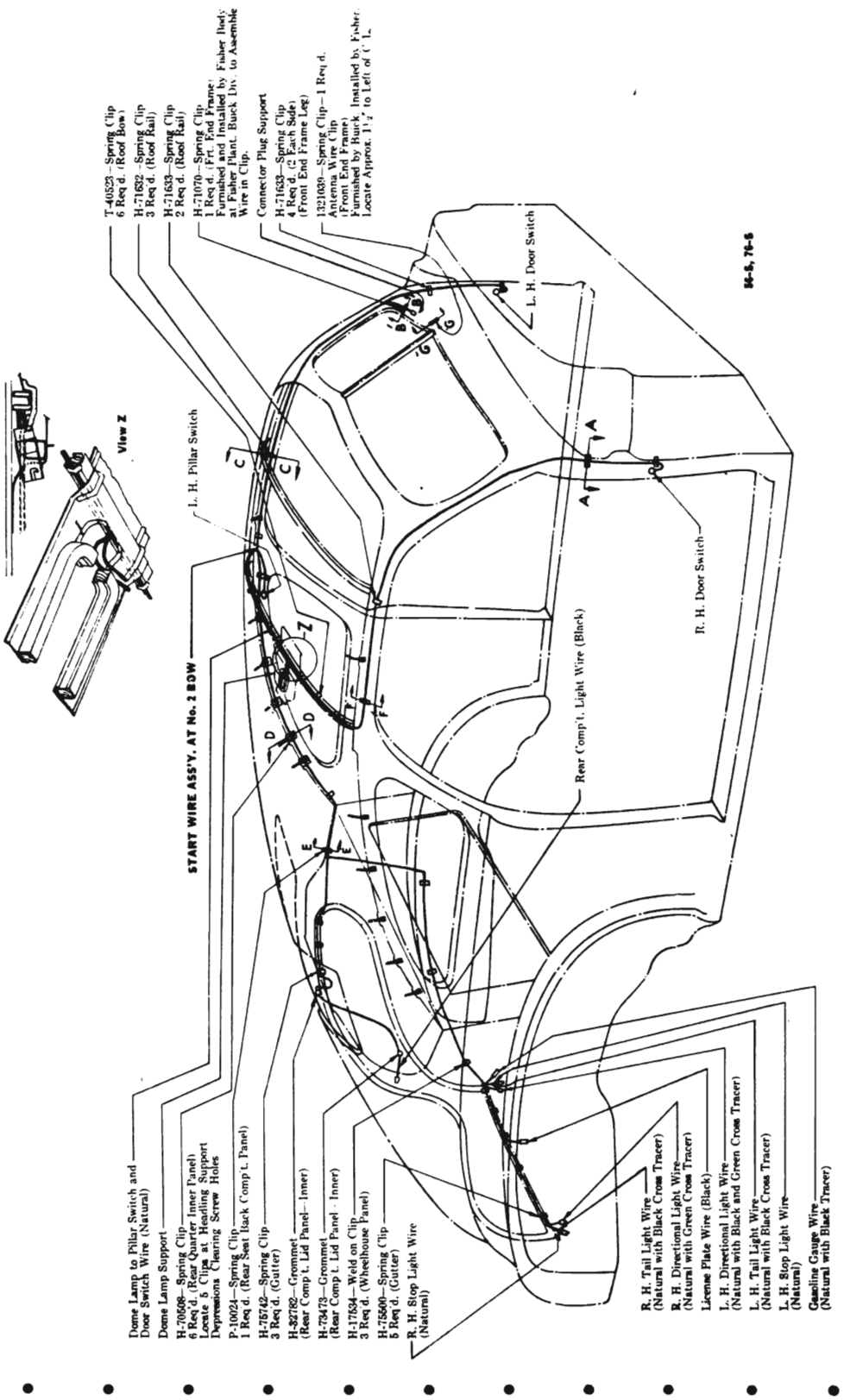


Fig. 12-99. Body Wiring Diagram—Models 56-S, 76-S

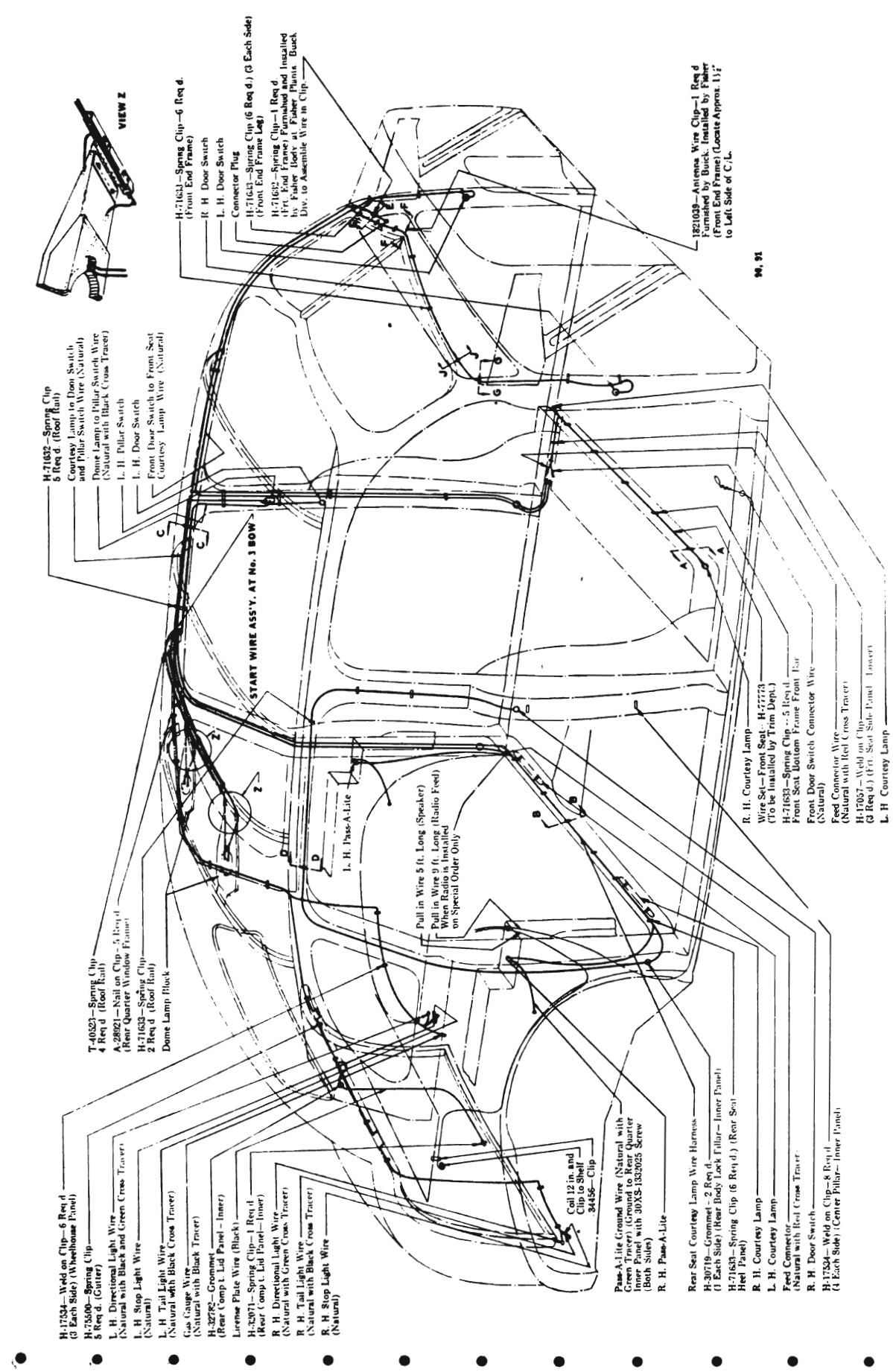


Fig. 12-100. Body Wiring Diagram—Models 90, 91

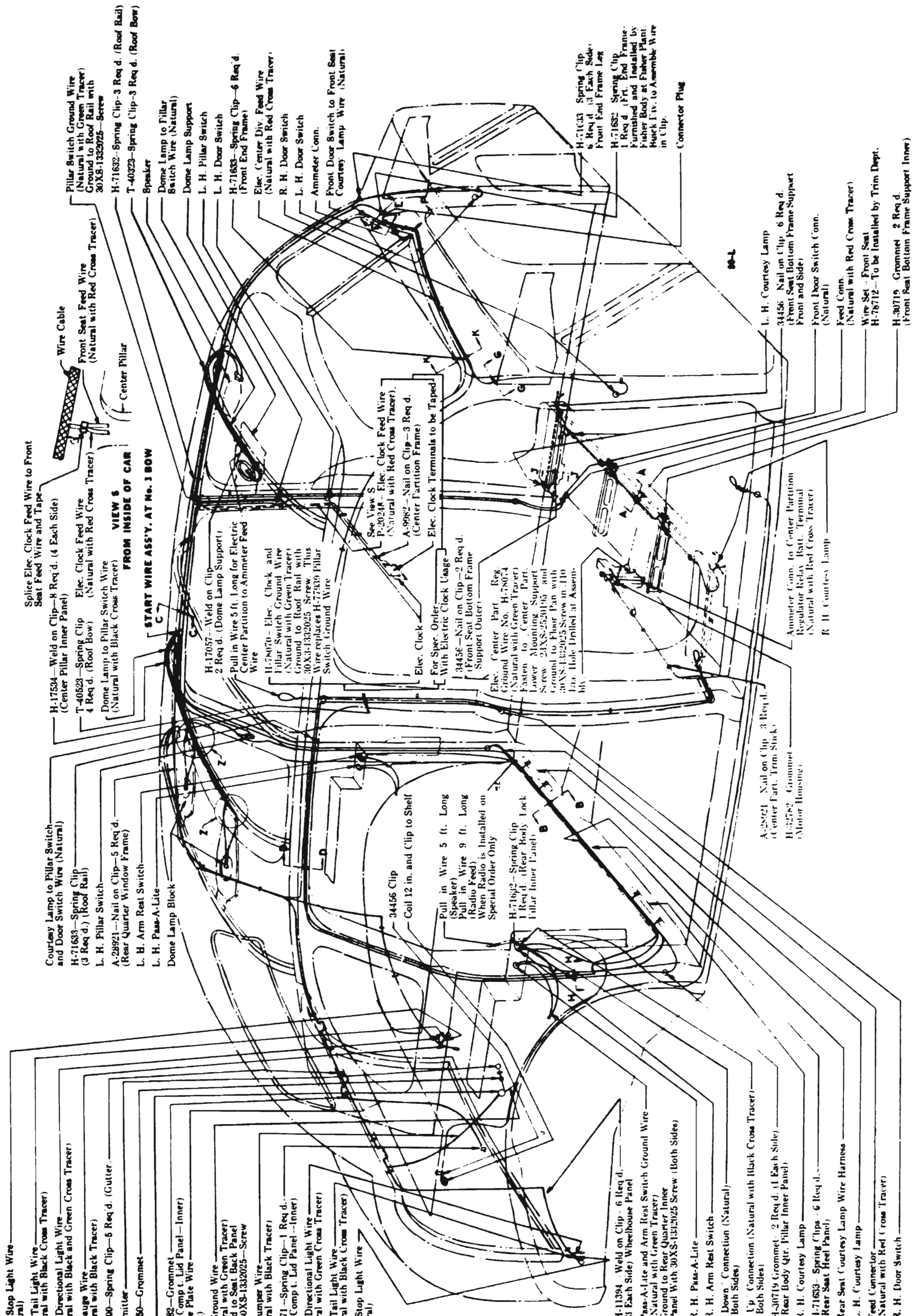


Fig. 12-101. Body Wiring Diagram—Model 90-L

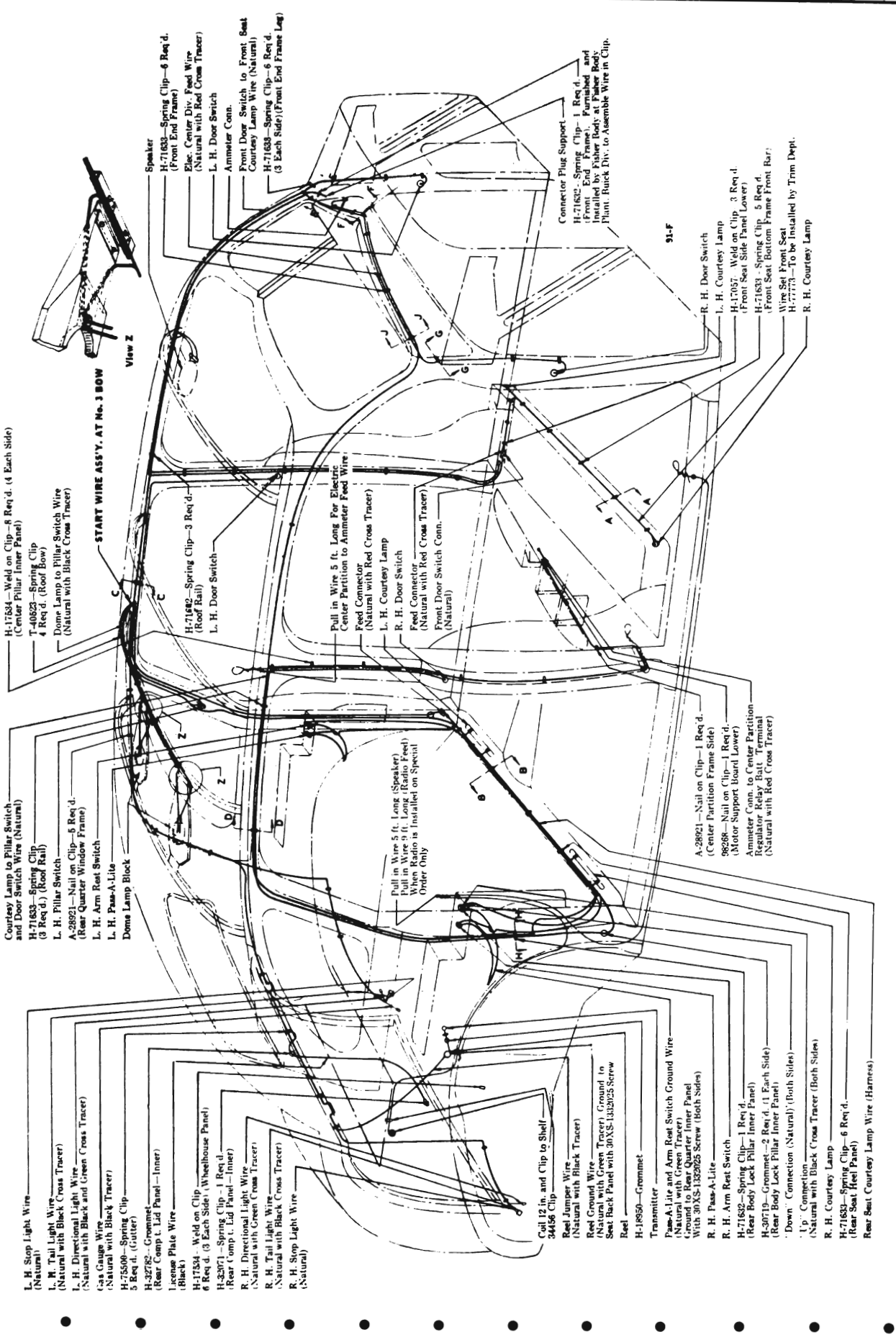


Fig. 12-102. Body Wiring Diagram—Model 91-F