THE CHEVROLET PRODUCTIVITY NETWORK

CHEVROLET

PRO TECH

REFERENCE BOOKLET

WINDSHIELD WIPER/WASHER SYSTEMS

TABLE OF CONTENTS

INTRODUCTION

MOTOR IDENTIFICATION 2

RECTANGULAR MOTOR 2
OPERATION 2
REPAIR 5
DIAGNOSIS 7
DELAY FEATURE 7

PERMANENT MAGNET MOTOR 8
OPERATION 8
REPAIR 12
DIAGNOSIS 13
DELAY FEATURE 14

ROUND MOTOR 15
OPERATION 15
REPAIR 18
DIAGNOSIS 19

MODIFIED PULSE MOTOR 20
OPERATION 21
REPAIR 23
DIAGNOSIS 24

MULTIPLEX PULSE MOTOR 24
OPERATION 25
REPAIR 26
DIAGNOSIS 26

SPECIAL TOOLS 26

INTRODUCTION

Chevrolet uses three basic families of wiper/washer systems. These are the rectangular motor, the permanent magnet motor and the round motor. Each type is available with or without a pulse (delay) feature. Two different types of washers are also used: bottle-mounted and motor-mounted.

This program includes wiper/washer systems for six model years, 1975 through 1980. Not all types were used each year. And certain types are used on certain cars or trucks. Instead of providing a lengthy application chart, we'll show you how to identify the various types. And we'll show you how to diagnose and repair them. You'll also find typical wiring schematics. We've eliminated wire colors, because they vary from carline to carline and from model year to model year.

MOTOR IDENTIFICATION

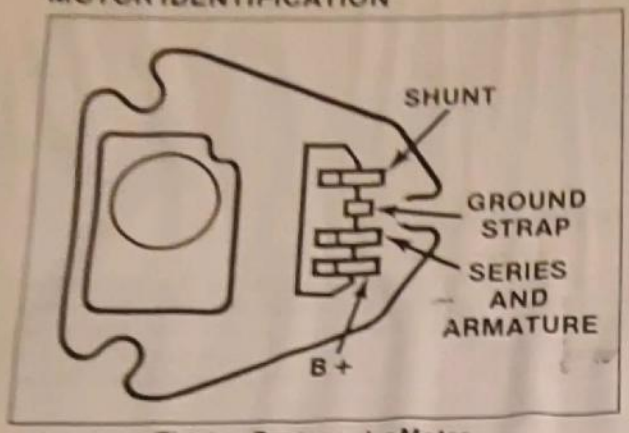

Fig. 1. Rectangular Motor

The rectangular motor is easily recognized by the shape of the motor housing. The rectangular housing is at a 90° angle to the mounting surface. Wiper blades park near the bottom of the windshield.

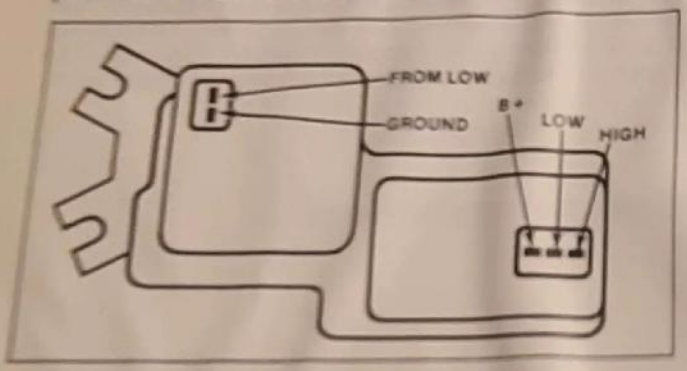

Fig. 2. Permanent Magnet Motor

The permanent magnet motor is recognized by the two-piece stamped steel housing. The halves are held together by staking. Wiper blades park near the bottom of the windshield.

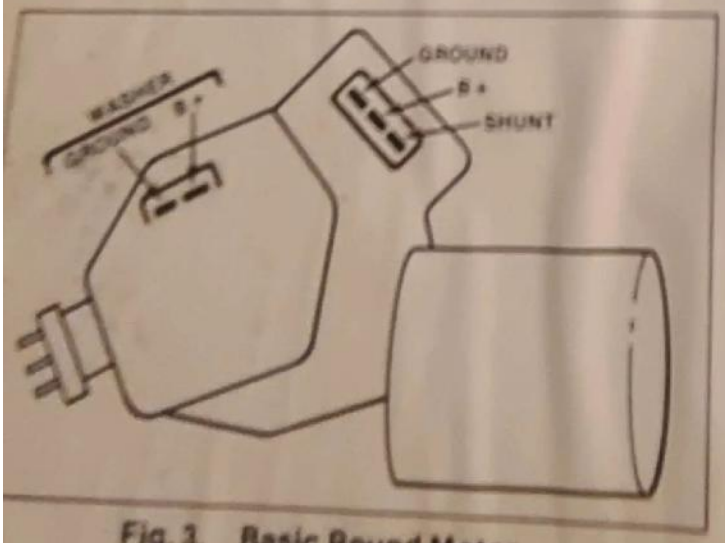

Fig. 3. Basic Round Motor

The basic round motor has a round, or cylindrical, motor housing. The basic motor has two sets of wire connectors. The motor connector has three terminals and the washer connector has two. Wiper blades park in a hidden position behind the rear edge of the hood.

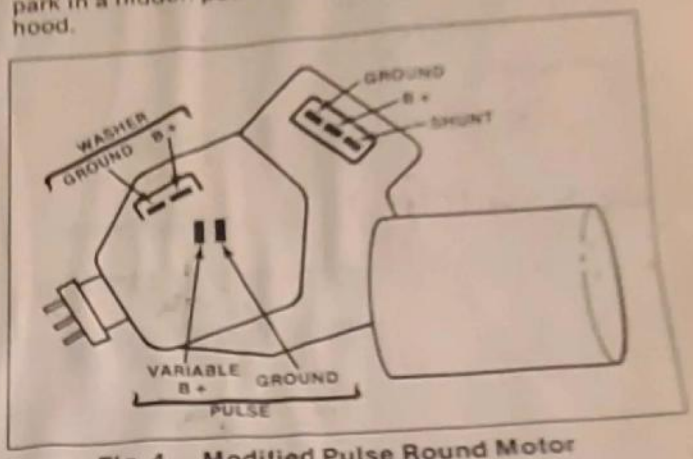

Fig. 4. Modified Pulse Round Motor

The modified pulse round motor has a motor connector, a washer connector and an additional two-terminal connector for the pulse feature. Wiper blades park in the hidden position.

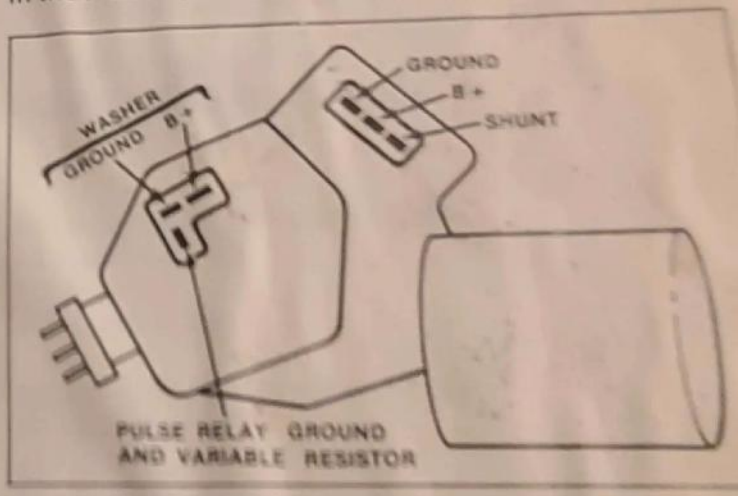

Fig. 5. Multiplex Pulse Round Motor

The multiplex pulse round motor has only connectors, but the washer connector has terminals, two for the washer and one at right a for the pulse feature. Wiper blades park in the h position.

RECTANGULAR MOTOR

OPERATION

Battery voltage is available at Terminal 2 w the ignition switch is on. Motor operation is c

by providing various grounds to complete the necessary circuits.

The rectangular motor has two speeds, controlled by a shunt circuit. This type of speed control is used on all Chevrolet wiper motors except the permanent magnet type. As we'll see, there are two field coils, a series and a shunt. When both are operating, the motor runs slowly. When the shunt is weakened, the motor runs fast.

Low Speed

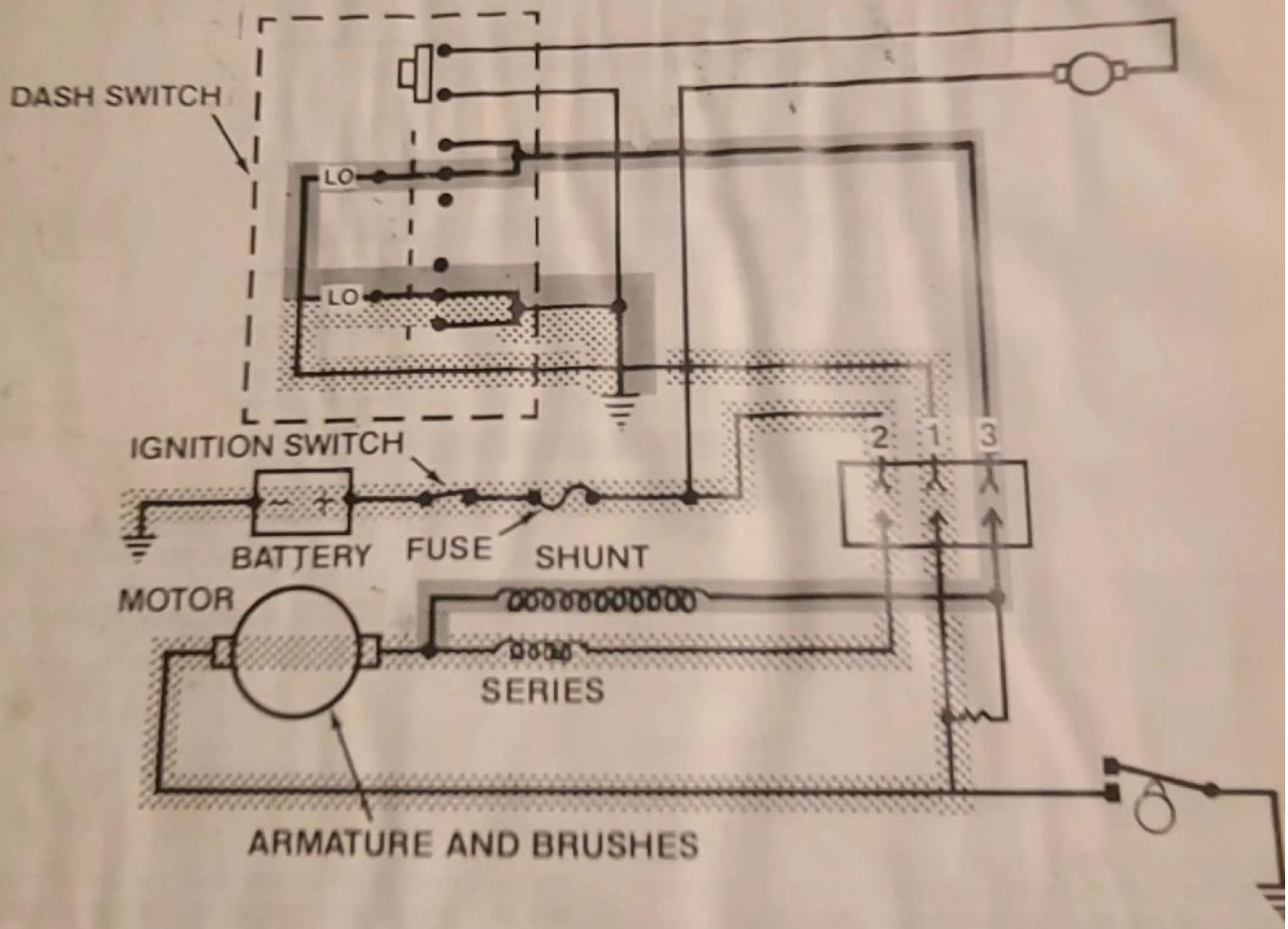

Fig. 6. Low Speed

Refer to figure 6. Notice that Terminal 1 provides a ground path for current to flow through the series winding and the armature and brushes. Also notice that Terminal 3 provides a ground path for the shunt winding. When the shunt is operating at full syst voltage, it creates a counter field. This causes motor to run slowly, but with high torque.

High Speed

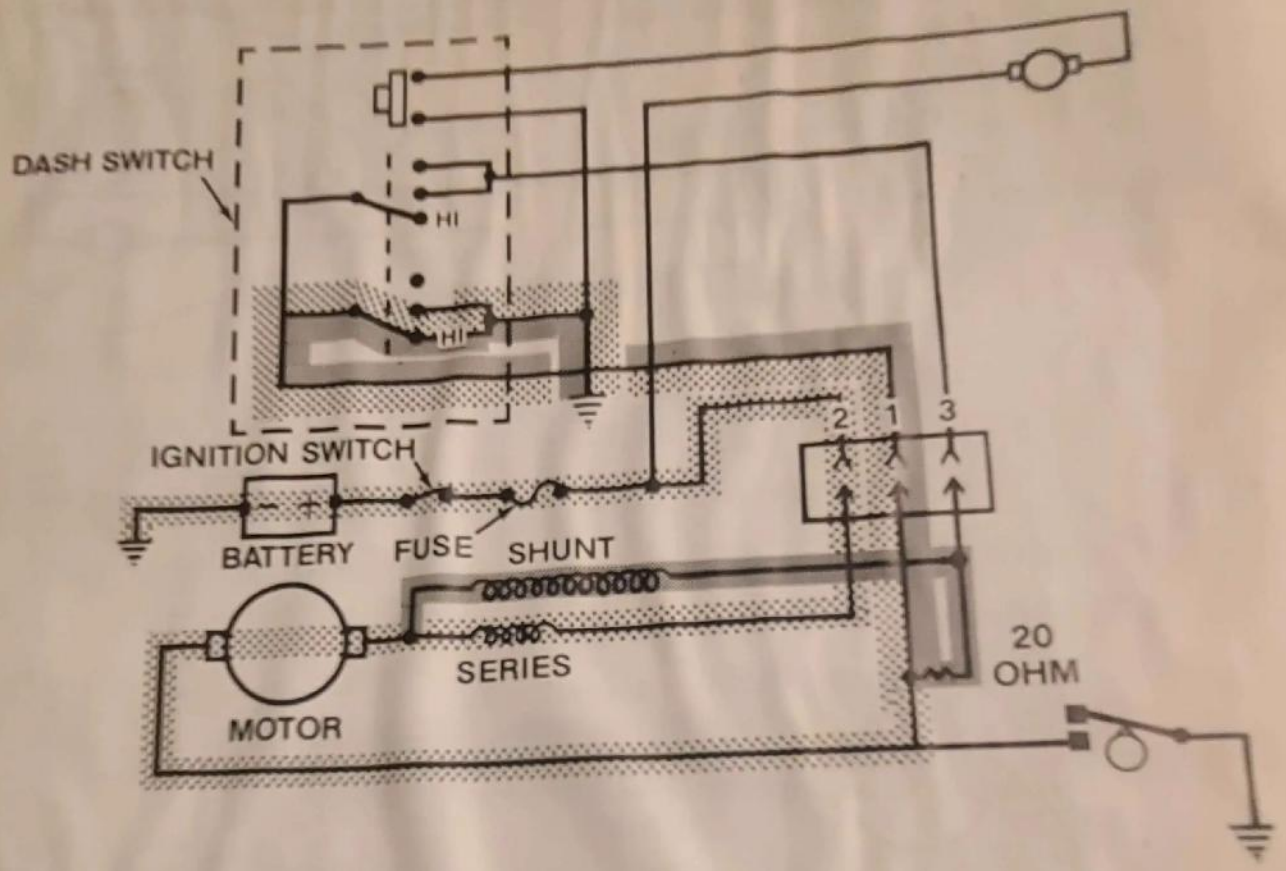

Fig. 7. High Speed

With the control switch moved to HIGH, the ground for the shunt is disconnected at the switch (fig. 7). Now, shunt current has to flow through the 20-ohm resistor. Reduced current flow weakens the shunt field, so the motor can run fast, but with reduced torque.

It's important to remember that low speed requires two field coils, series and shunt. High speed requires the series field and a weakened shunt field.

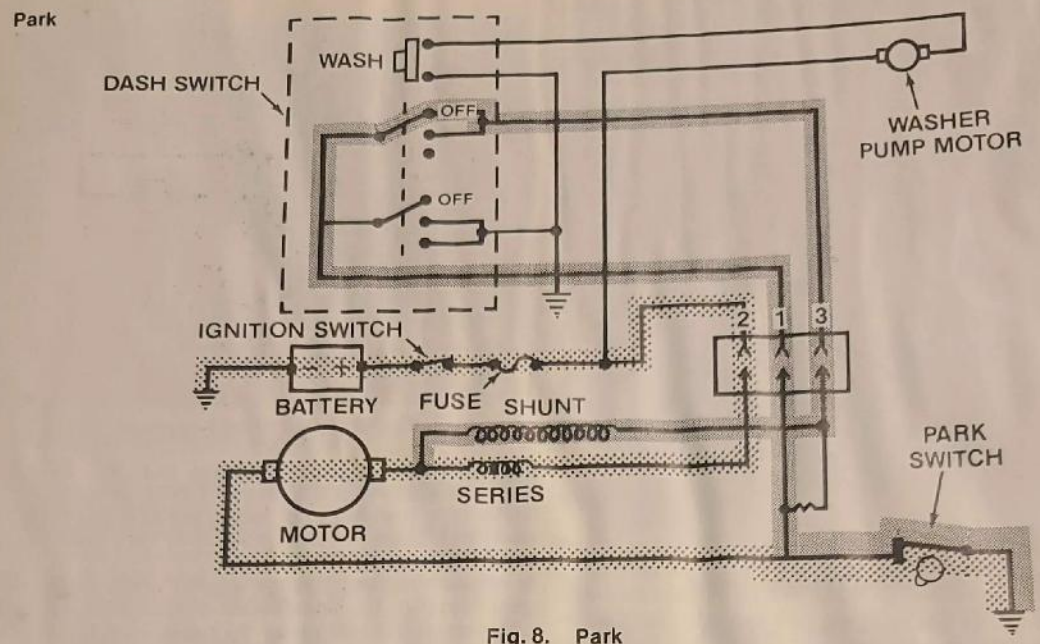

Fig. 8. Park

All Chevrolet wiper motors shut off in much the same way. The normal operating ground is removed when the control switch is turned off. A temporary circuit is provided by the park switch. The park switch is opened by a cam in the motor when the wiper blades are in the parked position (fig. 8). Notice that both series and shunt fields are grounded through the park switch, so the motor operates at low speed during the park cycle. The motor can be restarted by moving the control switch to LOW or HIGH.

Wash

The rectangular motor uses a bottle-mounted pump with an electric motor. Battery voltage is always available at the washer motor. When the wash button is pressed, it provides a ground path and the motor runs as long as the button is held. On Monzas, depressing the wash button also mechanically turns the switch to the LOW position. You can trace the wash circuit for yourself in figure 8.

NOTE: If you should find an older car with a washer pump mounted on the rectangular motor, it is serviced like the pumps discussed in the Permanent Magnet and Round Motor sections of this booklet. You should also see the appropriate service manual.

REPAIR

The rectangular motor is factory-assembled by staking the components together. If internal components need repair or replacement, you'll have to open the case by drilling the stakes. Use screws and nuts to assemble.

Disassembly

1. Clamp crank arm in vise. Remove nut (fig. 9).

CAUTION: Failure to use a vise may result in gearbox damage.

Fig. 9. Removing Crank Arm

2. Use 3/16-inch drill to remove stakes.
3. Mark ground strap location. Lift gearbox cover off.
4. If park switch, terminal board or 20-ohm resistor is damaged, use 7/64-inch drill to free terminal board assembly (fig. 10). Attaching parts are included in repair kit.

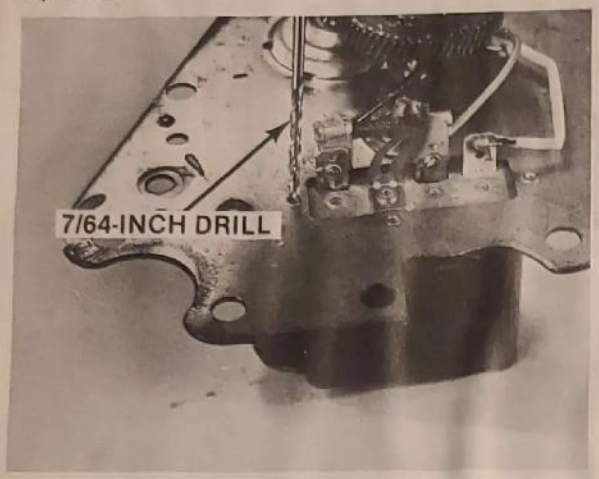

Fig. 10. Removing Terminal Board

5. If armature or brushes need service, unsolder motor leads from terminal board.
6. Remove motor tie bolts. Hold end cap against field housing. Pull field housing from gear box.
7. Move brush springs into notches provided to release tension. Slide brushes away from commutator (fig. 11).

Fig. 11. Brush Springs

8. Remove armature and end cap. Pull end cap from armature. Do not lose plastic thrust plug. Remove end play washers from commutator end of shaft.

Assembly

Follow disassembly procedure in reverse. Observe these tips.
1. Remember to install plastic thrust plug in armature (fig. 12).

Fig. 12. Installing Armature

2. Assemble two wave washers between two flat washers at commutator end of armature (fig. 12).
3. Replace brushes and brush holder if brushes are worn out. Brush holder is held to field housing by retainer clips.
4. In gearbox, install wave washer and intermediate gear first (fig. 13). Then install output gear and shaft with cam at least 90° away from park switch. Lubricate gears with Multifak EP-1, or equivalent.

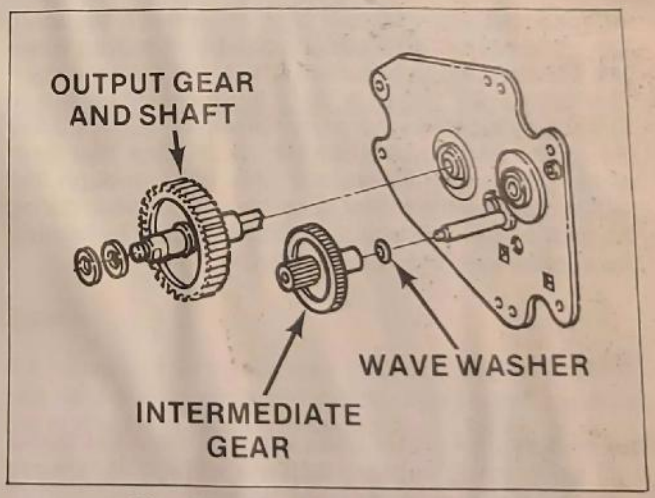

Fig. 13. Gearbox Assembly

5. To install gearbox cover, align locating dowels and intermediate shaft. Install 8-32 x 5/16-inch screws, washers and nuts.
6. Use end-play washers as required to limit output shaft end play to 0.005-inch. Install snap ring. Pack seal cap with waterproof grease and install.
7. Run motor to park position and install crank arm. Use vise to tighten shaft nut.
8. If available, use Tester J-25079-B to test motor operation.

DIAGNOSIS

NOTE: Your service manual includes complete diagnosis procedures. Several of them are outlined here.

Condition 1: Motor Shuts Off, but Blades Stop Randomly on Windshield

The park switch could be the cause, if it is hung open. But, try this first.

1. Connect jumper wire between motor ground strap and good ground on dash. Put control switch in OFF position.
2. If motor now parks, look for poor continuity between ground strap and dash sheet metal. Check for corrosion.
3. If motor still stops randomly, disassemble motor and check park switch. Replace if required. See Disassembly for procedure.

Condition 2: High Speed Only

1. Check switch for proper continuity in each position. Replace switch if required.
2. Remember, low speed depends on shunt field for operation. Remove gearbox cover and look for loose connection or cold solder joint where shunt is soldered to terminal board (fig. 14).

Fig. 14. Shunt Wire Connection

Condition 3: Motor Won't Operate at Any Speed

1. Check for voltage at Terminal 2. Repair as needed.
2. Check continuity of wiring and switch.
3. Disassemble motor and remove armature.
4. Test armature for ground. Use self-powered test lamp or ohmmeter. Hold one lead against shaft. Move other lead from bar to bar on commutator (fig. 15). If continuity is indicated, armature is grounded. Obtain replacement.
5. Check armature for opens. Coils are interconnected so continuity check won't work. Look for burned areas between commutator bars. Replace armature with burned areas.

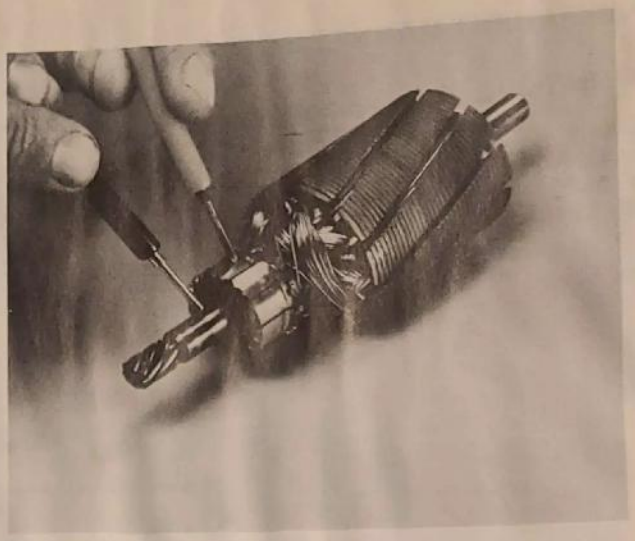

Fig. 15. Test for Ground

DELAY FEATURE

Rectangular motors are available with a pulse controller for a delayed wipe operation (fig. 16). The Chevette type is on the left. The controller is plugged in between the column switch and the instrument panel harness. The Monza system, on the right, uses a remotely-mounted controller and a unique dashboard switch with the variable resistor built in.

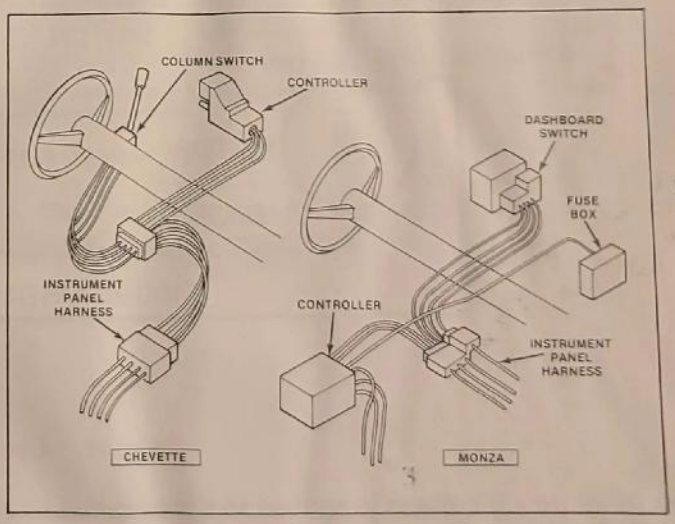

Fig. 16. Rectangular Motor Delay Controllers

A suspected controller on Chevette is diagnosed by bypassing it. Unplug both controller connections. Then plug the column switch into the instrument panel harness. The system should now perform like a standard non-pulse rectangular motor. If it does, replace the controller. On Monza, substitute a known-good controller and/or switch to find the defective component.

PERMANENT MAGNET MOTOR

OPERATION

Battery voltage is available at Terminal 1 whenever the ignition switch is on. Motor operation is controlled by providing various grounds to complete necessary circuits.

Unlike other Chevrolet wiper motors, the permanent magnet motor does not have field windings. Instead, two permanent magnets are built into the motor housing. Motor speed is controlled by three brushes, one for low speed, one for high and one common.

Low Speed

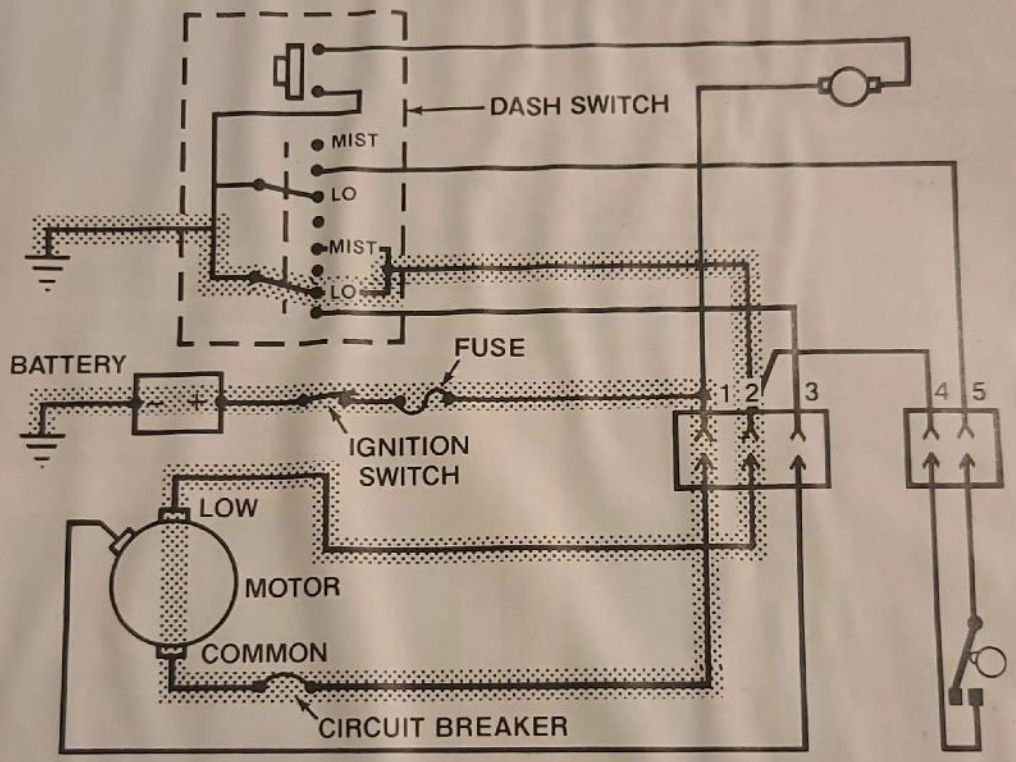

Fig. 17. Low Speed

Refer to figure 17. Voltage is applied to the common brush. In low speed, the control switch provides ground for the low speed brush. The motor then operates at low speed. The MIST position of the control switch also operates low speed as long as the switch is held.

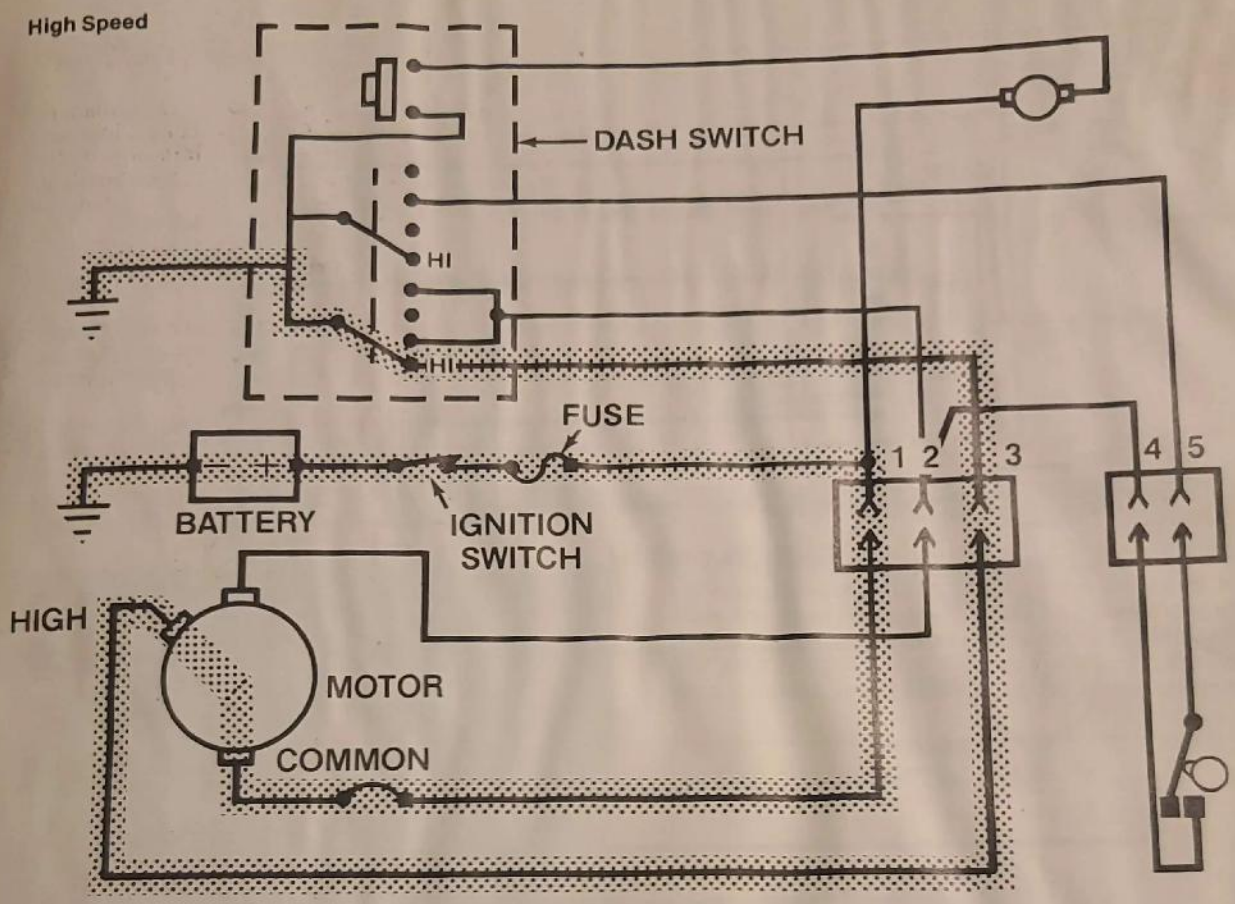

Fig. 18. High Speed

When the control is moved to HIGH (fig. 18), current flows from the armature through the high speed brush. The circuit to ground is completed at the control switch.

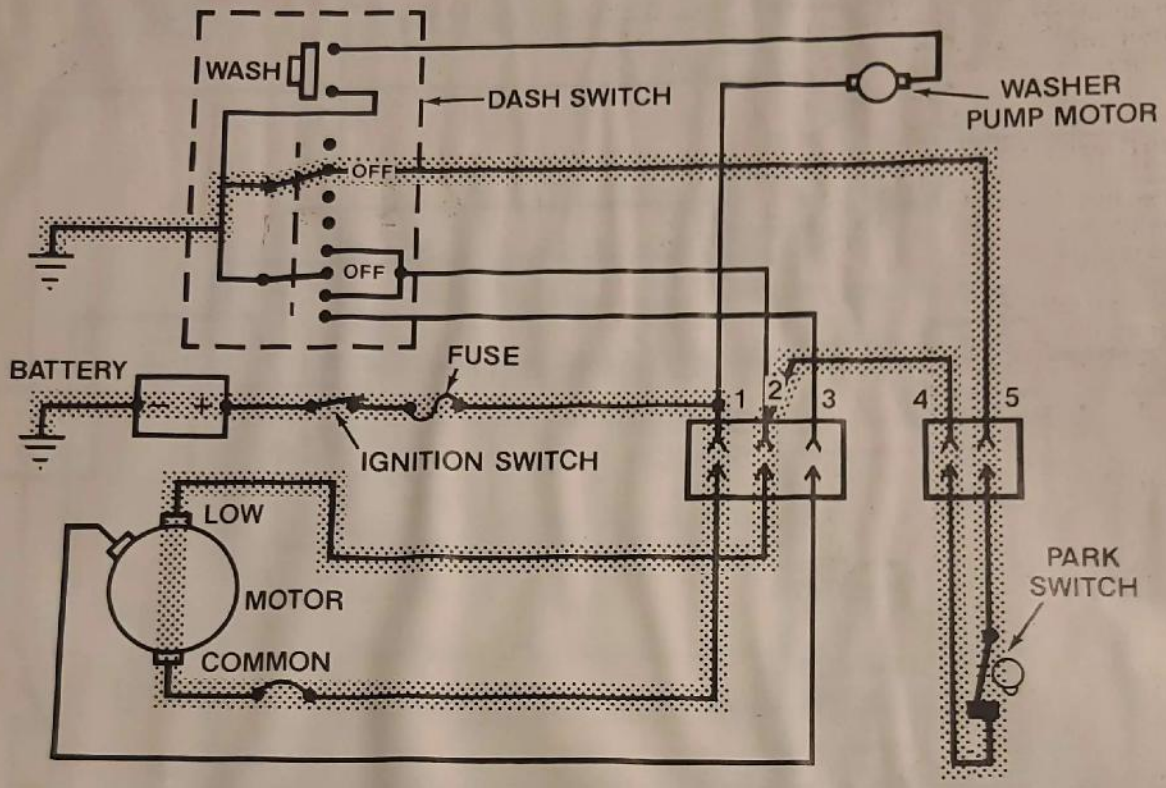

Fig. 19. Park

When the control switch is turned off (fig. 19), several things happen in sequence. The current path to ground is broken at both the LOW and HIGH positions. This would normally make the blades stop wherever they happened to be. But the park switch provides a temporary circuit for low speed. The motor continues to run until a motor-driven cam opens the park switch when the wiper blades are near the bottom of the windshield.

Wash (Car System)

The permanent magnet motor uses two types of washer pumps. On cars, the pump is bottle-mounted with an electric motor. Ground is provided by the control switch. Trace the washer circuit for yourself in figure 19.

Wash (Truck System)

Trucks use a wiper/motor-driven washer pump. This same type pump is used on all round motors and on some rectangular motors in older cars.

The pump components are located under a plastic cover on the gearbox portion of the motor assembly (fig. 20). The valve assembly (A) is next to the piston assembly (B). Also notice the armature (C), coil (D), pawl (E), ratchet wheel (F), and ratchet dog (G).

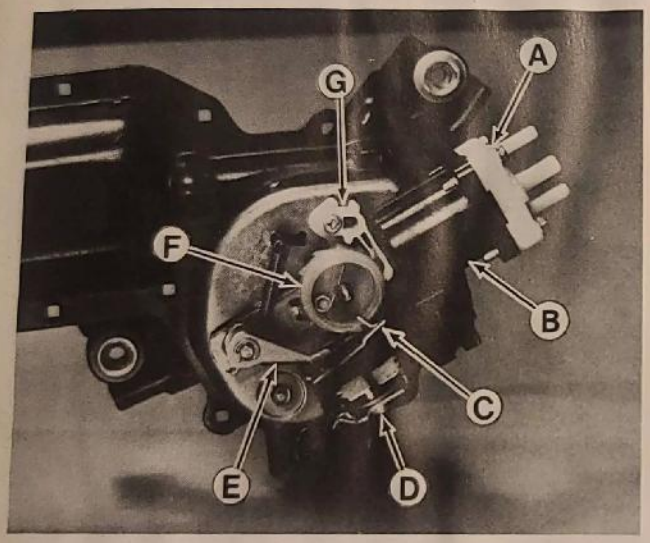

Fig. 20. Pump Components

Any time the motor is running, a cam on the gear moves the cam follower and the attached ratchet pawl back and forth (fig. 21). The specially-shaped relay armature keeps the pawl from contacting the ratchet teeth, so the pump remains inactive.

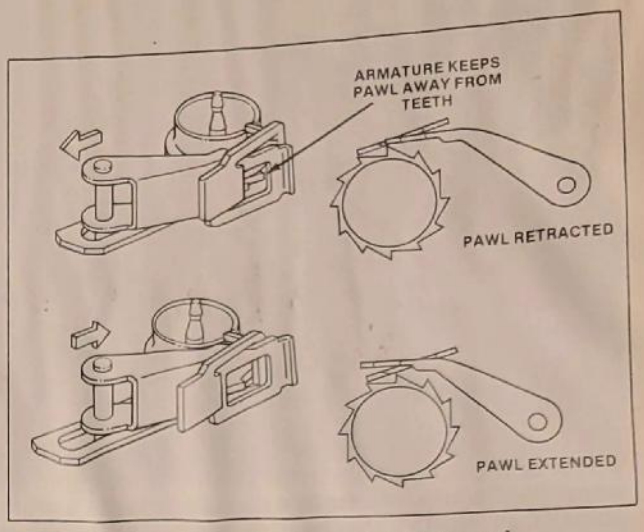

Fig. 21. Pump — Not Engaged

When the washer button is pressed, the relay coil is energized and magnetically pulls the armature away from the pawl. This allows the pawl to engage the first tooth on the ratchet wheel (fig. 22). Remember, the pawl is constantly moving back and forth. Each time it moves, it can now rotate the wheel one tooth.

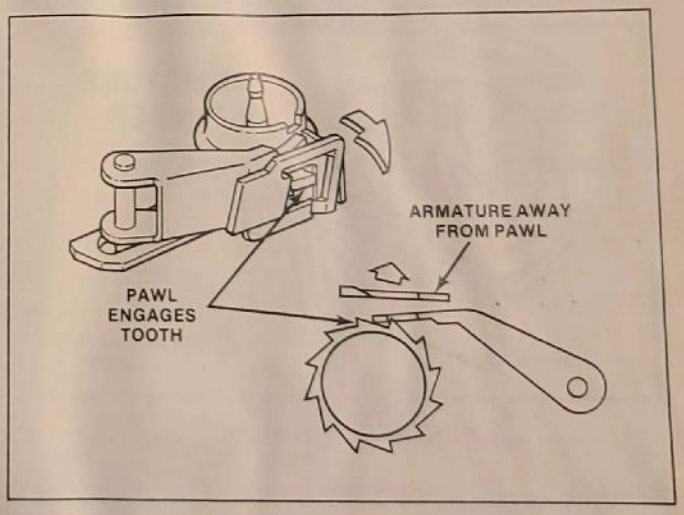

Fig. 22 Pump — Engaged

Moving the wheel one tooth frees the tang on the piston actuator plate from the ramp on the wheel (fig. 23). Spring pressure moves the piston into the cylinder and the first squirt of fluid occurs. Each time the cam follower moves back and forth, the piston pumps another squirt of fluid and the ratchet wheel moves another tooth.

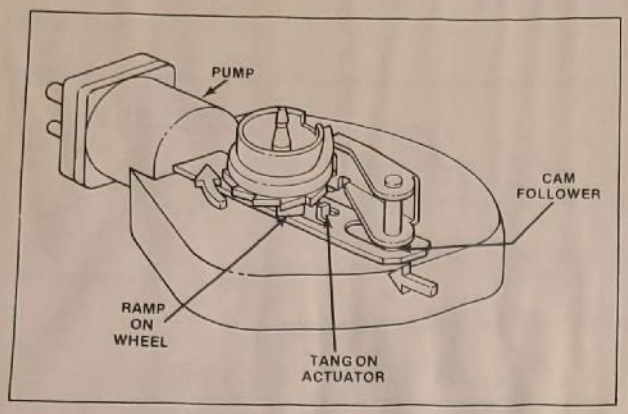

Fig. 23. Pump Piston Operation

The pump shuts itself off automatically. As the ratchet wheel approaches its starting point, a ramp on the wheel begins moving the armature back to its starting point (fig. 24). On the twelfth tooth, the armature drops between the pawl and the toothed wheel. The ramp on the wheel traps the piston actuator and everything stops.

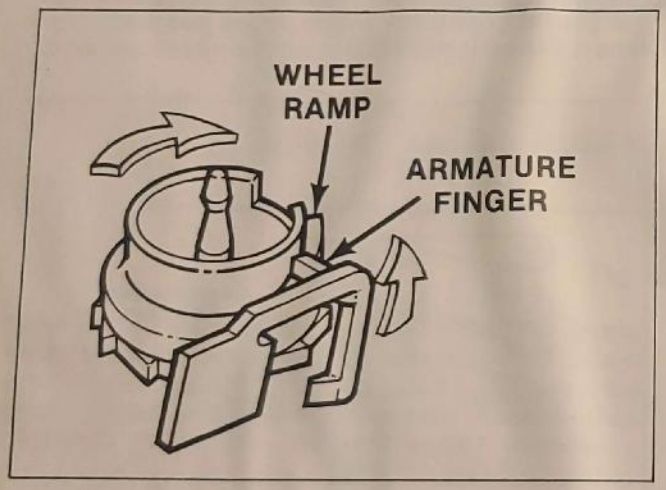

Fig. 24. Armature

REPAIR

Several components of the permanent magnet motor can be replaced. Components inside the gearbox cannot be serviced.

Park Switch Replacement

The park switch can be replaced on the vehicle without tools. Disconnect the park switch wire connector. Remove the plastic dust cover from the motor assembly. Then depress the lock tab and remove the park switch (fig. 25). When installing the replacement switch, be sure the lock tab is fully latched.

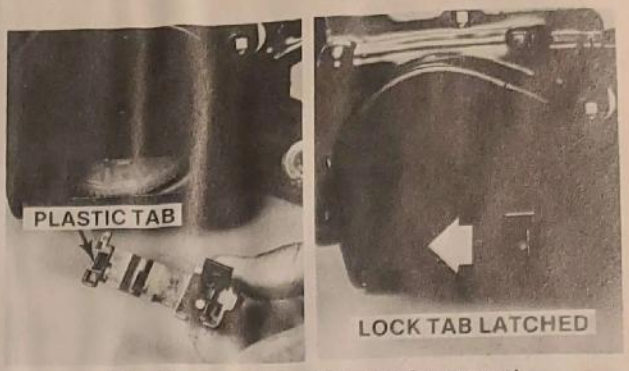

Fig. 25. Park Switch Replacement

Armature or Brush Assembly Replacement

The brush assembly may be serviced separately. It must also be removed to gain access to the armature.

Removal

1. Bend brush holder retaining tabs for clearance (fig. 26).

Fig. 26. Brush Holder Removal

2. Turn crank arm clockwise. This forces armature against brush holder and pushes it out.
3. If armature requires service, grasp commutator end and pull. Permanent magnets will offer resistance to moving armature.

Installation

1. Slide armature fully into motor housing. Magnets will tend to pull armature aside, but it will eventually bottom out.

2. Release tension of brush springs by hooking ends into notches provided (fig. 27). Push brushes fully into housings.

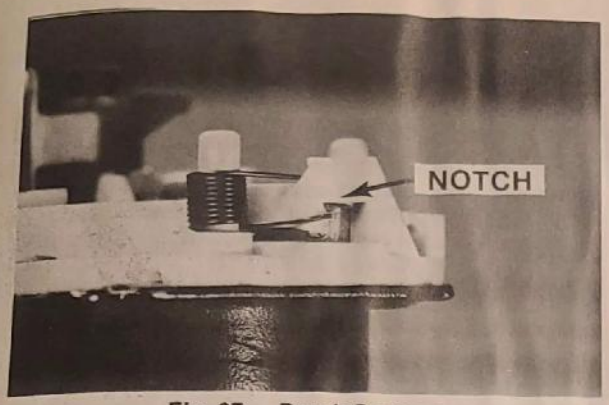

Fig. 27. Brush Springs

3. Be sure armature is meshed with crank arm gear. Then turn crank arm clockwise until commutator is sticking out of housing. Slip end cap/brush holder onto commutator. Be sure connector is aligned with slot in housing.
4. Release brush springs. Use small screwdriver (fig. 28). Be sure all three brushes seat against commutator. Then lower end cap and armature into housing. Bend retaining tabs back into place.

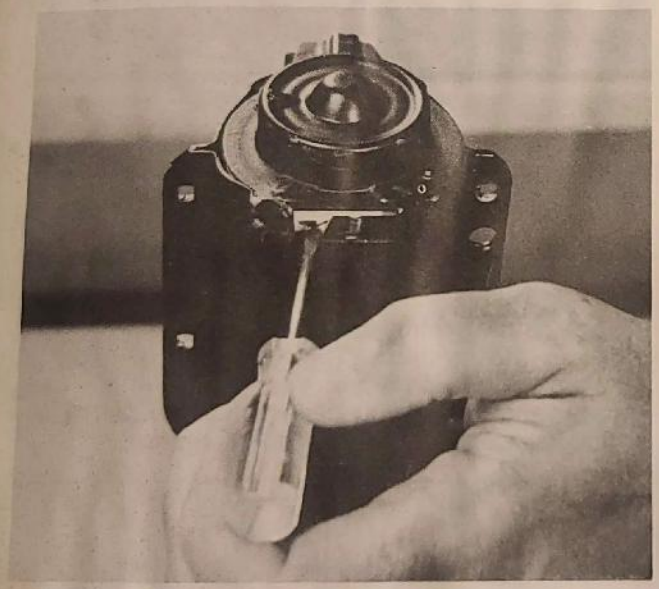

Fig. 28. Freeing Brush Springs

Crank Arm, Spacer and Seal Replacement

1. Clamp crank arm in vise. Loosen and remove retaining nut.

CAUTION: Failure to use vise may result in gearbox damage.

2. Slide spacer off shaft. Then pull rubber seal off.
3. Install replacement seal with flat side away from gearbox. Slide spacer onto shaft (fig. 29).

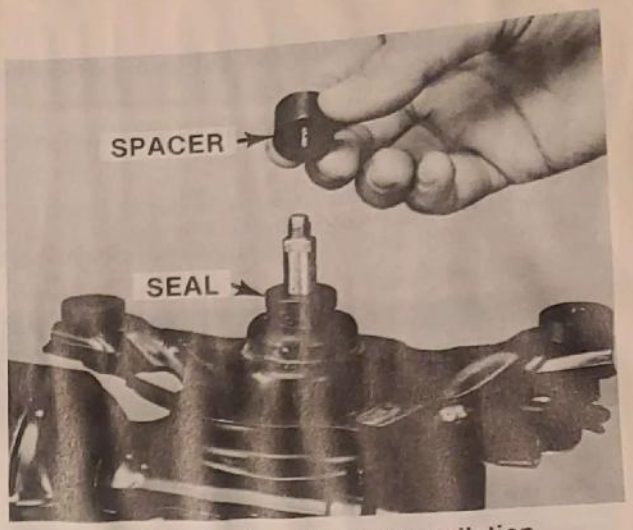

Fig. 29. Seal and Spacer Installation

4. Be sure motor is in parked position. Then install crank arm pointing away from motor housing. Be sure to use vise to tighten crank arm nut.

Washer Pump Service

On truck applications, refer to figure 30 for replacement of washer pump components. These items are available as service parts.

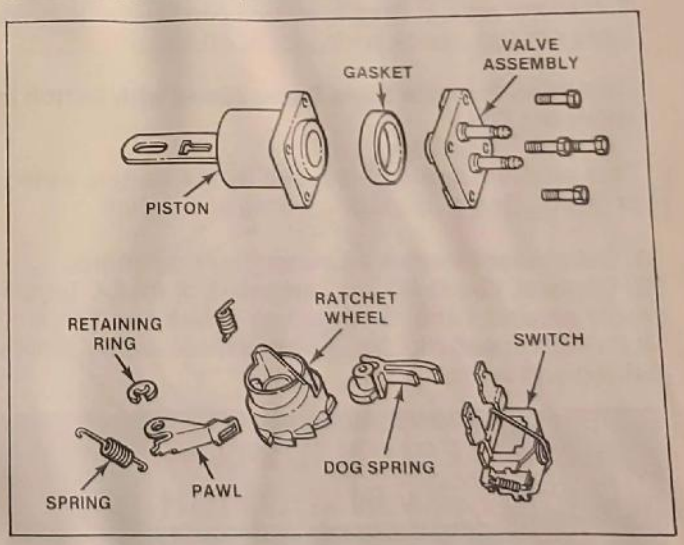

Fig. 30. Washer Pump Components

The valve body can be serviced on-vehicle. Remove the motor to service piston assembly and related parts.

DIAGNOSIS

NOTE: Your service manual includes complete diagnosis procedures. Several of them are outlined here.

Condition 1: Motor Shuts Off, but Blades Stop Randomly on Windshield

The most likely cause is the park switch stuck in the open position. Here's how to check it.

1. Unplug connector from park switch. Connect jumper wire between Terminals 4 and 5 in wire connector (fig. 31). This simulates a closed park switch.

Fig. 31. Testing Park Switch

2. Turn ignition ON and wiper switch OFF. With jumper in place, motor should run continuously. Motor won't park with test jumper connected, but it should run.
3. If motor runs in Step 2, replace park switch. If motor does not run, check wiring for open circuit.

Condition 2: Motor Runs Same Speed with Switch in HIGH or LOW

This problem could be caused by the switch, wiring, or motor. Begin by testing wiring and switch.

1. Disconnect three-wire connector from motor.
2. Connect 12-volt B+ to Terminal 1 of motor. Temporarily ground Terminal 2 for low speed and Terminal 3 for high speed (fig. 32). If both speeds are OK, check wiring and switch.

Fig. 32. Test Connection

3. If motor does not operate properly in Step 2, disassemble motor and look for low- and high-speed brushes shorted together. Repair as needed.

DELAY FEATURE

Permanent magnet motors are available with a pulse controller for a delayed wipe operation. The controller is plugged in between the column switch and the instrument panel harness. The controller interrupts the low speed circuit when the column switch is turned on. It operates as though the column switch was turned on and off automatically.

A suspected controller is diagnosed by connecting the instrument panel harness connector directly to the column switch connector. This bypasses the controller (fig. 33). If the wiper now functions normally, replace the controller.

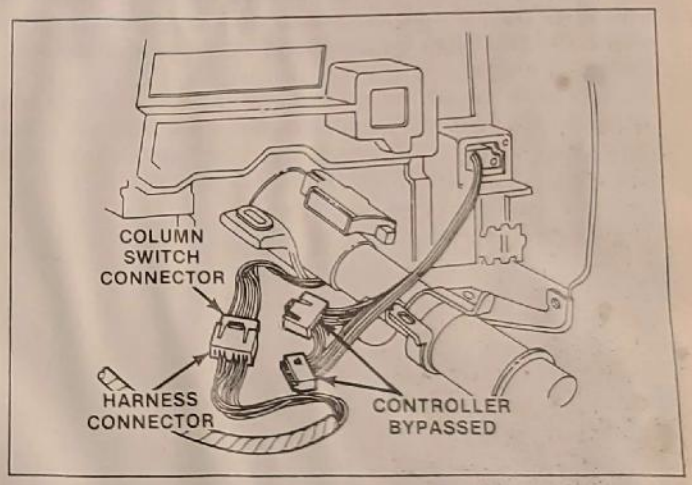

Fig. 33. Testing Delay Controller

To replace the controller, first cut the five-wire harness close to the controller (fig. 34). Then pull on the harness at the connector end. Feed the cut wires through the instrument panel clips. Route the new wiring harness *below* the steering column.

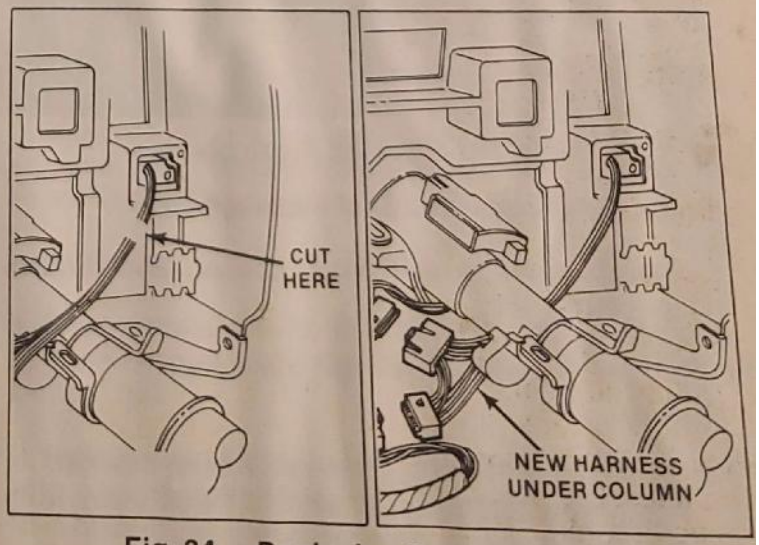

Fig. 34. Replacing Delay Controller

IMPORTANT NOTE: Chevrolet uses a family of three round motors, a non-pulse type and two pulse types. Although they may have many similarities, we'll look at each one separately. For identification, the non-pulse type will be called the Round Motor. The two pulse types will be called the Modified Pulse and Multiplex Pulse motors.

ROUND MOTOR

OPERATION

Battery voltage is available at Terminal 2 whenever the ignition switch is on. Motor operation is controlled by providing various grounds to complete the necessary circuits.

The round motor has two speeds, controlled by a shunt circuit. This principle is discussed at length in the rectangular motor section and will be briefly mentioned here.

Because the round motor has a depressed-park (hidden wiper) feature, additional controls and circuits are needed. The most important of these is the gearbox relay. It not only controls the depressed park mode, it also provides current for all the operating modes.

Depressed Park

The crank arm shaft is mounted to the gear eccentrically (off-center). Normally, the crank arm is locked to the gear and the crank arm runs in a circle (fig. 35).

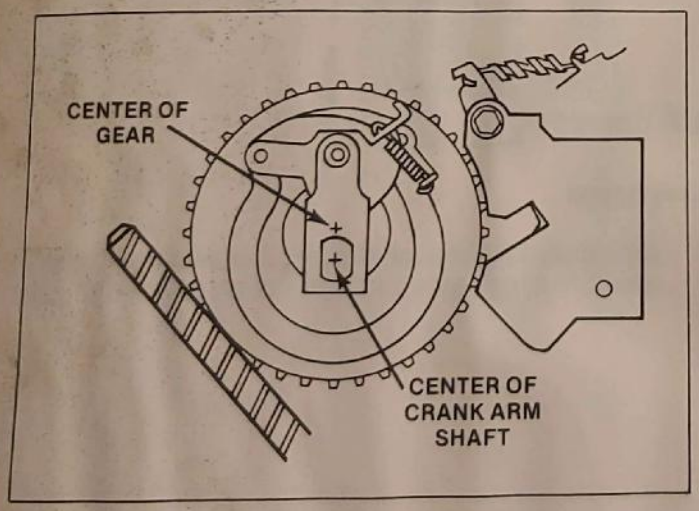

Fig. 35. Crank Arm Locked to Gear

When the control switch is turned off, the gearbox relay is de-energized. This releases a latch into the path of the gear pawl. But the relay's electrical contacts are held closed mechanically, so the motor keeps running. When the latch catches the pawl, it stops the crank arm from rotating (fig. 36).

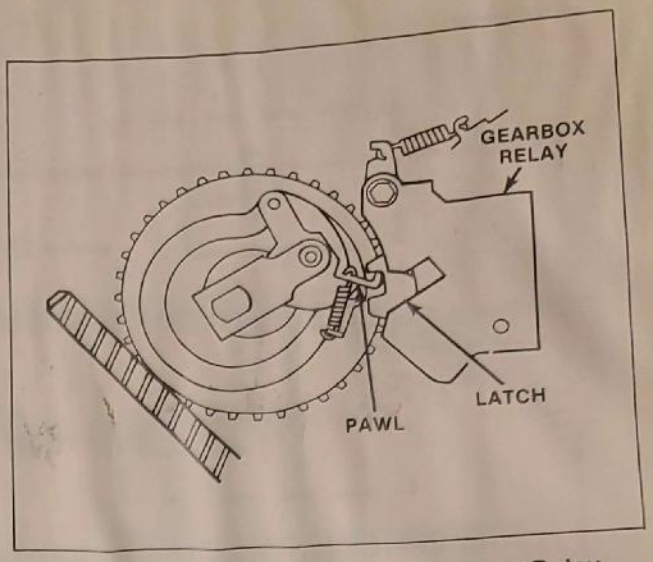

Fig. 36. Latch Released from Gearbox Relay

The gear keeps turning and forces the crank arm to move sideways (fig. 37). The sideways movement is enough to pull the blades into hiding. The pawl pushes the latch back into the relay and springs the relay contacts open. This stops the motor. When the motor is restarted, the relay holds the latch out of the way and the blades unpark.

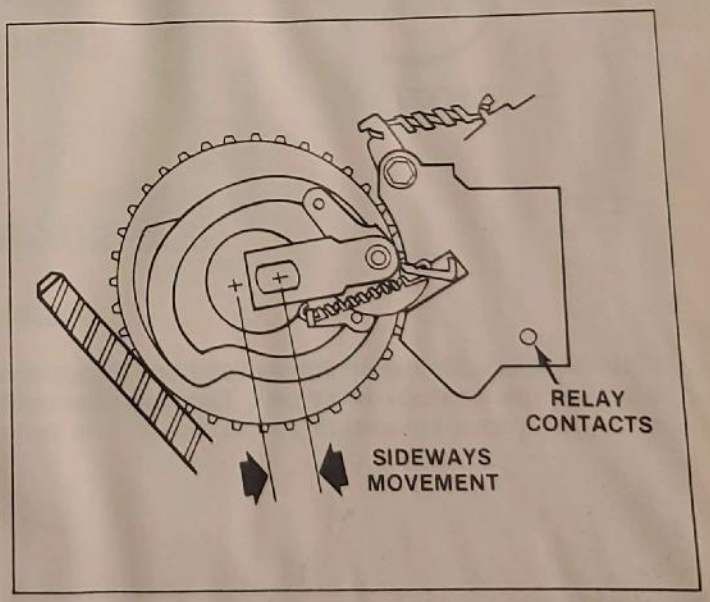

Fig. 37. Crank Arm in Depressed Position

Low Speed

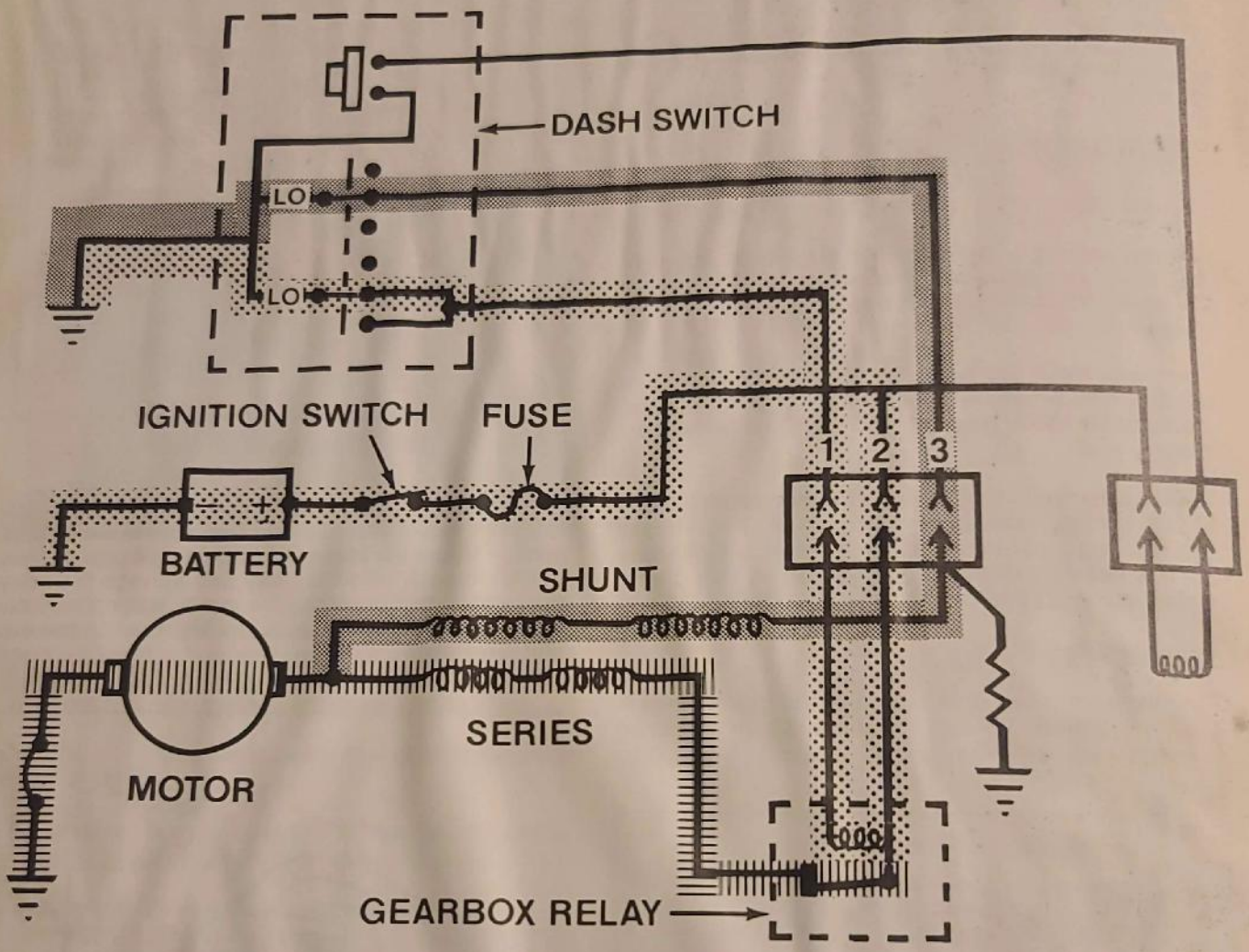

Fig. 38. Low Speed

Refer to figure 38. The control switch provides a ground path for the gearbox relay coil. The coil closes the relay and provides current to the motor. The series field grounds through the brushes and armature. The shunt field grounds through the control switch.

High Speed

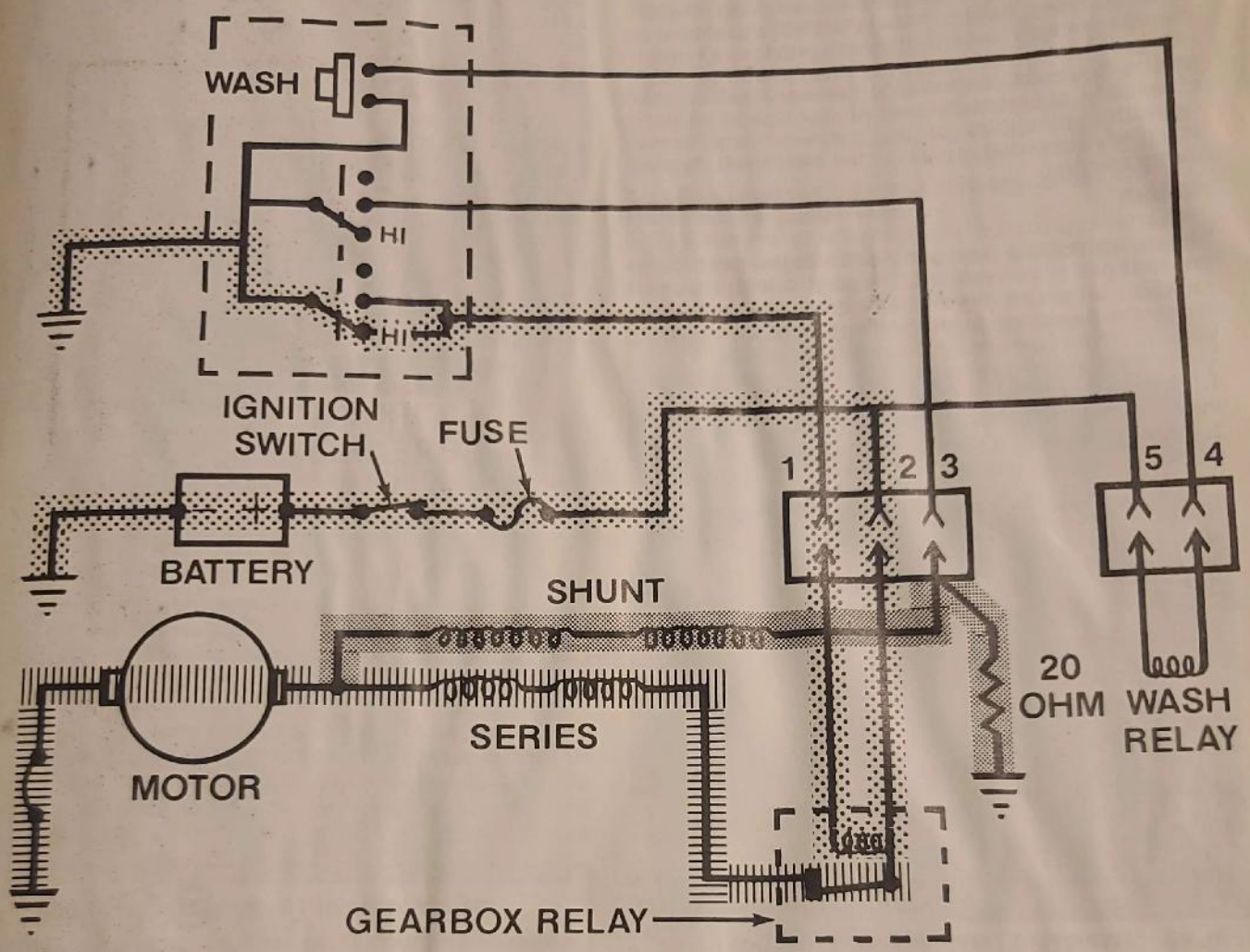

Fig. 39. High Speed

Refer to figure 39. Moving the control to HIGH breaks the ground circuit for the shunt field. Current now has to ground through the 20-ohm resistor, and the field is weakened.

Wash

Two different pumps are used with the round motor, motor-mounted and bottle-mounted. On motor-mounted types, battery voltage is always available at the wash relay. The control switch provides a temporary ground. You can trace the wash circuit for yourself in figure 39. Depressing the wash button mechanically operates the motor low speed switch. Operating principles of the motor-mounted wash pump are discussed in detail in the permanent magnet motor section.

REPAIR

The round motor is disassembled in stages, depending on what has to be repaired. They are, in order, pump removal, armature removal and drive gear removal. The entire procedure is given here. You can stop when you get to the component you want to service.

1. Remove plastic pump cover. Remove washer pump mechanism. It is attached by several screws.
2. Remove retaining screws and lift terminal board/gearbox relay out (fig. 40).

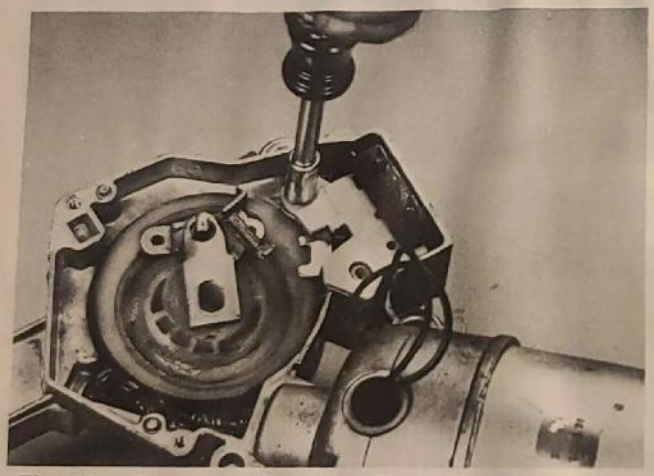

Fig. 40. Removing Terminal Board/Gearbox Relay

3. Scribe motor frame and housing (fig. 41). Remove tie bolts. Pull housing and armature free from frame. Feed excess wire into housing. Disengage armature shaft from plastic gear.

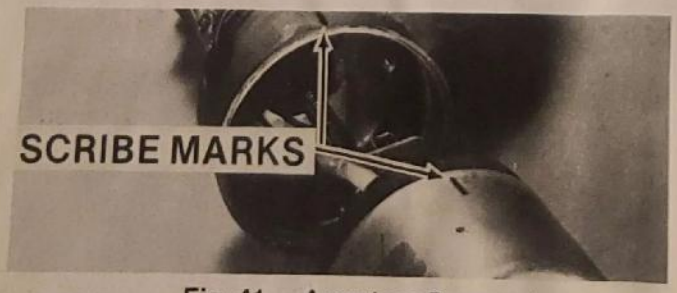

Fig. 41. Armature Removal

4. Straighten four tabs retaining brush holder. Compress brush springs and lift holder off.
5. Remove armature, as required. Test and replace, as required.
6. Inspect brushes. If worn out, replace assembly. Unsolder leads. Install replacement holder and solder. Black lead attaches to circuit breaker (fig. 42).

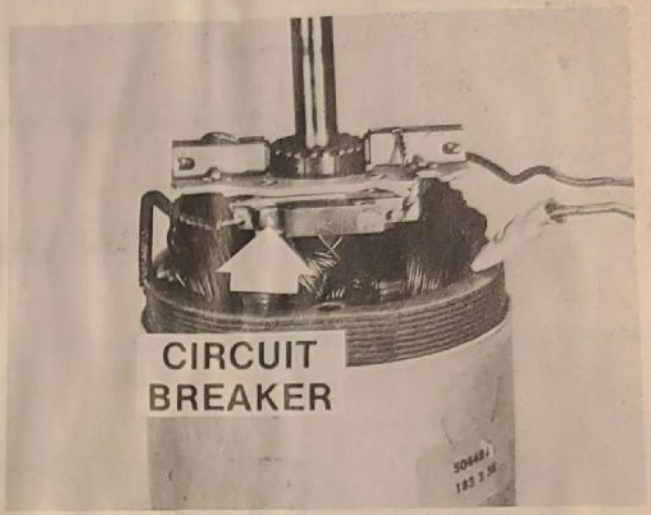

Fig. 42. Brush Replacement

7. Place crank arm in vise. Loosen and remove nut.

CAUTION: Failure to use a vise may result in gearbox damage.

8. Remove crank arm and rubber seal cap (fig. 43). Remove retaining ring with snapring pliers. Slide shim, shield and spacer from shaft. Slide gear assembly from housing. Retain inner spacer for use during assembly.

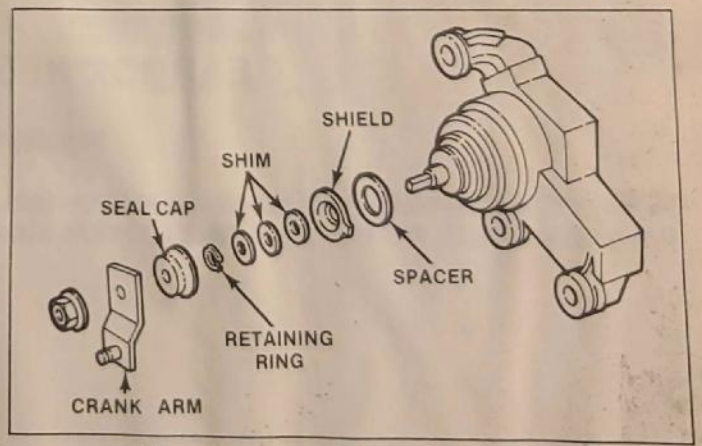

Fig. 43. Crank Arm Assembly

9. Disassemble drive pawl, lock pawl and spring from drive plate from gear (fig. 44). Obtain replacement parts as required.

Fig. 44. Disassembly of Drive Mechanism

Assembly

1. Turn drive plate upside down. Position drive pawl and lock pawl on drive plate. Slide gear down over shaft. Align pins on pawls with guide channel in gear (fig. 45).

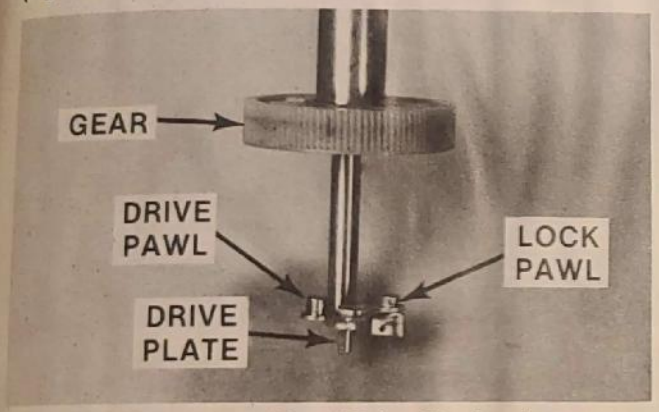

Fig. 45. Assembly of Drive Mechanism

2. Hold gear and rotate drive plate counterclockwise until guide pins fit into gear pockets (fig. 46). Install pawl spring.

Fig. 46. Aligning Guide Pins in Gear

3. Assemble shaft to housing. Refer to figure 43. Use shim washers as necessary to obtain end play of 0.004-inch. Do not install crank arm until motor can be run to park position.

NOTE: Replacement shafts have two snapring grooves. Kit will tell you which one to use.

4. Follow disassembly steps in reverse order. Do not install washer pump yet.
5. Test-run motor until it parks. Rotate washer cam to align its hole with hole in pump plate. Insert suitable pin or drill bit (fig. 47).

Fig. 47. Aligning Washer Cam

6. Install washer pump. Be sure pin on drive mechanism fits into slot in pump cam (fig. 47). Install screws. Remove aligning pin.
7. Install crank arm. Be sure to use vise.

DIAGNOSIS

NOTE: Your service manual includes complete diagnosis procedures. Several of them are outlined here.

Condition: Motor Won't Run

1. Verify condition. Refer to figure 48 for test connections. Connect 12-volt B+ source to Terminal 2. Connect 12-volt B– source to housing ground strap. Connect three-way jumper to Terminal 1, Terminal 3 and housing.

Fig. 48. Test Connections

2. If motor runs, check wiring and switch. If motor does not run, check for:

a. Open coil in gearbox relay
b. Open circuit breaker
c. Open armature
d. Open field
e. Stuck brushes
f. Open solder joint
g. Binding in latch arm.

3. To test gearbox relay, connect 12-volt B+ to Terminal 2 and ground housing (fig. 49). If motor is not in park position, depress latch arm with small screwdriver to operate relay switch. Probe black wire with pink stripes using test lamp.

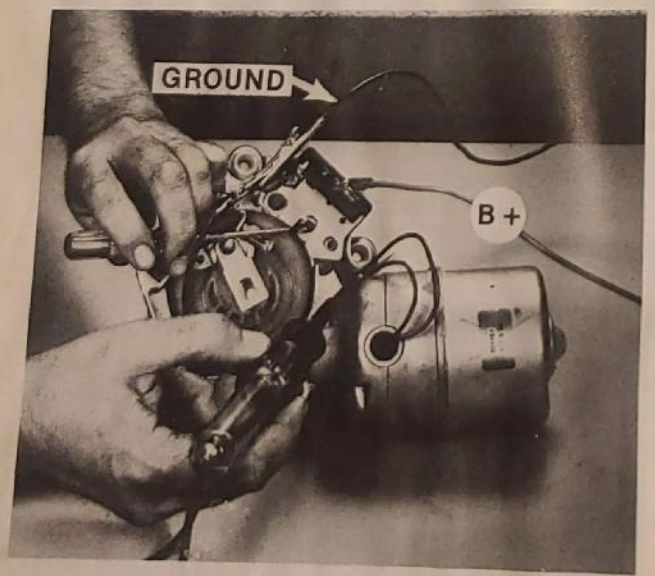

Fig. 49. Gearbox Relay Test

4. If test lamp doesn't light, replace gearbox relay. If lamp lights, open motor and check items b through g.

MODIFIED PULSE MOTOR

Except for an additional two-wire connector, it's difficult to tell a modified pulse motor from a regular non-pulse round motor. See figures 3 and 4.

Inside, the major difference is the addition of a timer circuit board and related components mounted on the washer pump housing (fig. 50). The other components are the override switch, pulse relay and holding switch. The function of these will be described later.

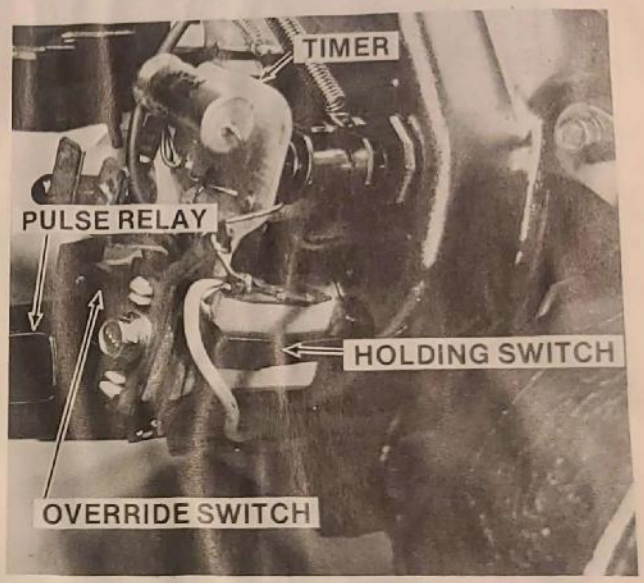

Fig. 50. Timer and Related Components

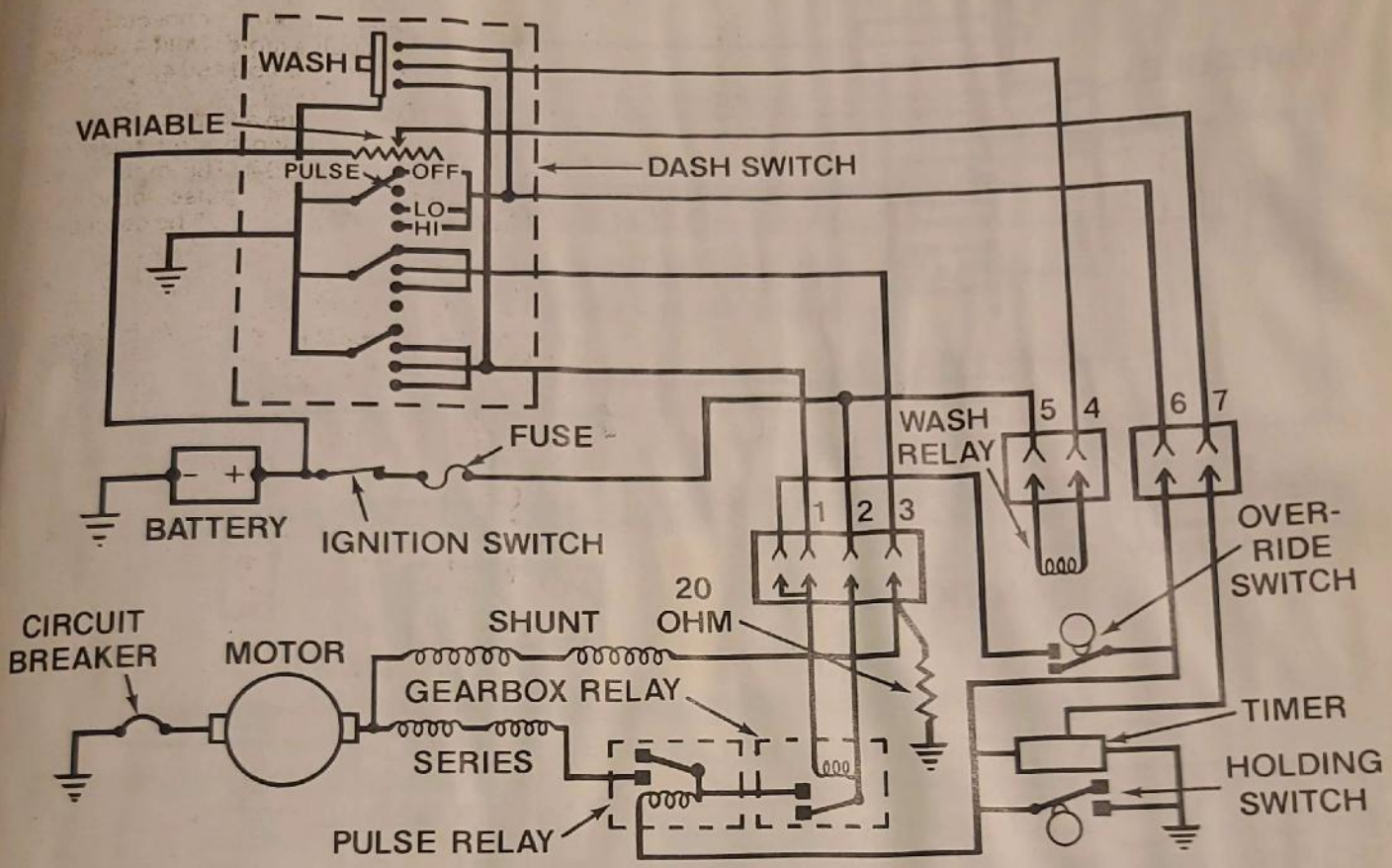

Fig. 51. Modified Pulse Motor Schematic

Refer to figure 51. If you compare this circuitry with figure 38, you'll see that the modified pulse motor is wired similarly to the round motor. Low and high speeds depend on the gearbox relay to supply current to the series field, shunt field and armature. But notice that a second relay is used. It is called the pulse relay. If the pulse relay was ever opened when the motor is running, the motor would stop immediately until the pulse relay closed again. This is exactly how the delay feature works.

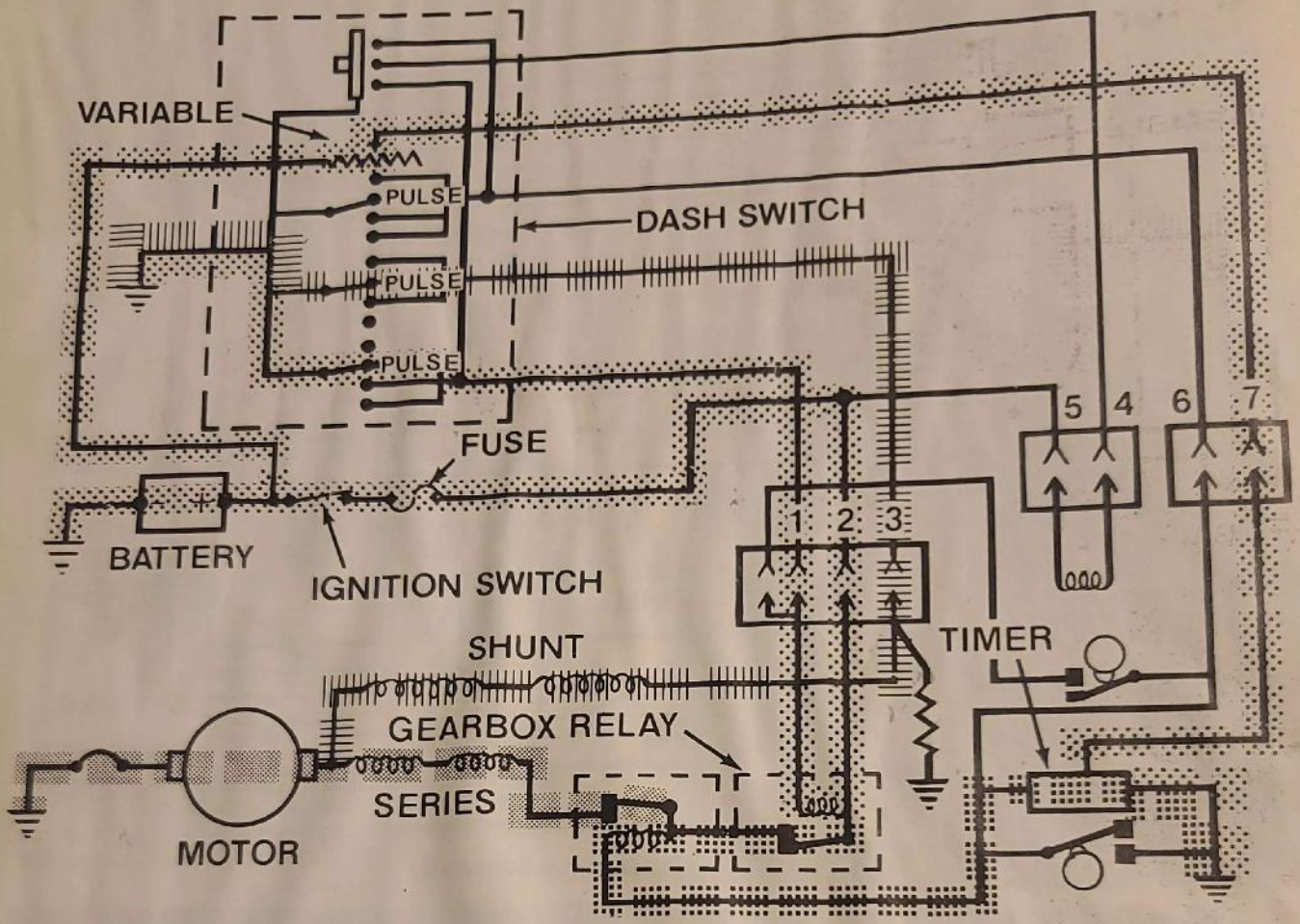

Fig. 52. Timer Schematic

Refer to figure 52. The timer circuit provides a method of opening and closing the pulse relay circuit at the right times. Notice the control switch, in the DELAY position, provides ground for the gearbox relay and the shunt field. This ensures that the motor will remain unparked and will operate at low speed. But the pulse relay prevents motor operation until the timer closes the pulse relay circuit. Timer operation is shown in dotted lines.

The timer can remain tripped only long enough for the motor to start running. As soon as the motor starts, the cam-operated holding switch closes, providing an alternate ground path for the pulse relay (fig. 53). The motor continues running until the wipers make one sweep and the holding switch is again cam-opened. Because the gearbox relay remains energized, the wiper blades do not go into the park (hidden) position. Everything is now stopped until the timer trips again and starts another cycle.

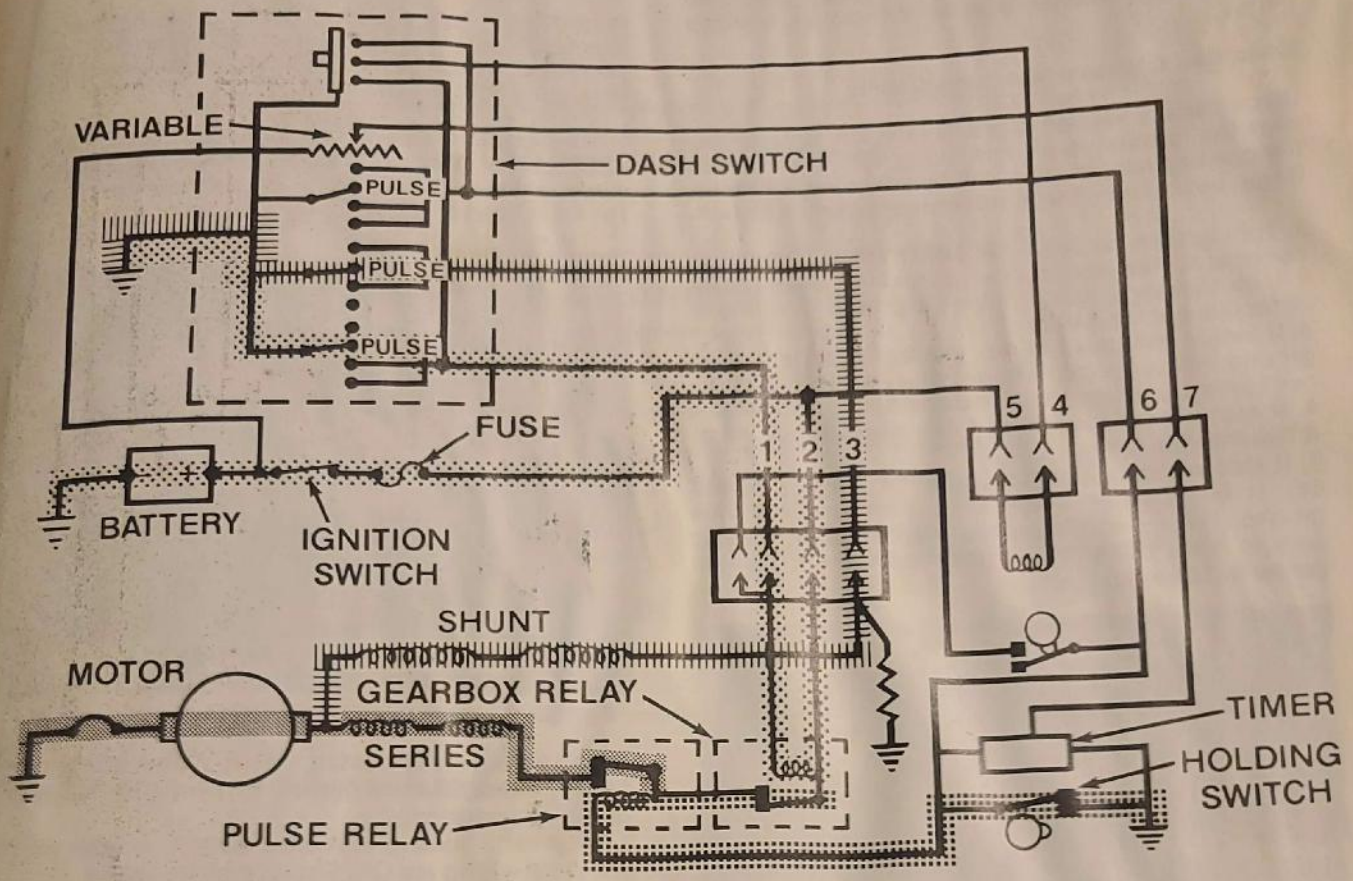

Fig. 53. Holding Switch Operation

Wash

The modified pulse motor uses the motor-mounted washer pump. But it has some special features not provided with non-pulse motors. For instance, if the wiper is off when the washer is turned on, the washer sprays several times. The wiper continues for several extra drying wipes, then shuts off automatically. If the wipers are already on, the washer sprays several times and the wipers continue wiping. They do not shut off. In the delay mode, operating the washer temporarily overrides the delay. After the wash cycle is over, the delay mode resumes.

These special features are possible because of the override switch. It is closed by the rotating toothed wheel in the washer pump. The override switch provides a temporary ground path for the gearbox relay circuit regardless of control switch position. When the washer shuts off, the override switch opens. Refer to figure 51 and trace the override circuit for yourself.

REPAIR

Repair of the modified pulse is nearly the same as the round motor. The washer pump, the armature, the brushes and the parking gear are all the same. The difference is the addition of the timer board and pulse relay.

Timer Board Replacement

One screw attaches the timer board and pulse relay. The override switch and holding switch are built into the timer board. When installing a timer board, align the two pins at the base of the mount with the holes in the washer pump. Install the screw. Follow the schematic for wire connections.

DIAGNOSIS

NOTE: Your service manual includes complete diagnosis procedures. Several of them are outlined here.

Condition 1: Wipers Run Continuously

Since battery voltage is available at the motor whenever the ignition is on, the motor can run any time the gearbox relay is energized by grounding its circuit. Begin by isolating the motor from the control switch.

1. Turn ignition on and wiper switch off. Pull wire from Terminal 1. This wire provides ground for gearbox relay.
2. If motor stops, look for short to ground in wiring or defective control switch.
3. If motor continues to run, gearbox relay is getting ground inside motor. Remove plastic cover. Disconnect green wire from small extension of Terminal 1.
4. If motor continues to run, replace gearbox relay. It has internal short.
5. If motor stops, check override switch (fig. 51 and 54). It is probably stuck shut, providing full-time ground. Timer mounting screw may be loose, causing cam to miss contact with override switch. Tighten screw to 14 inch-pounds.

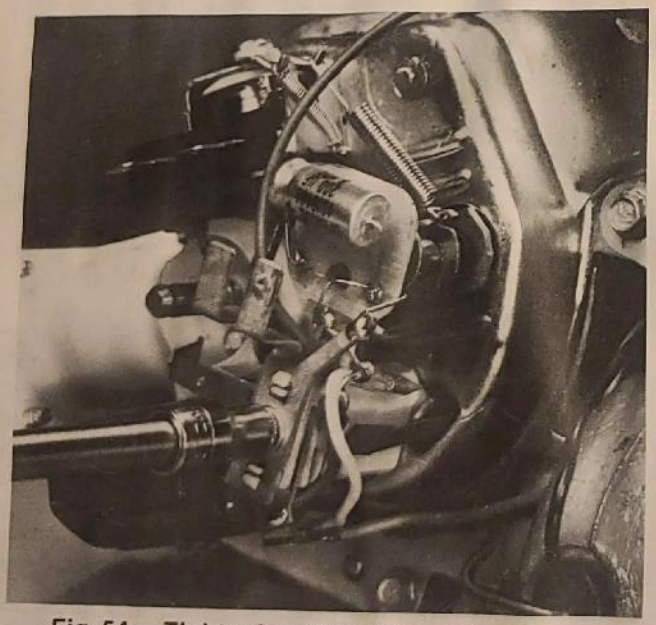

Fig. 54. Tightening Timer Mounting Screw

Condition 2: Wiper Runs OK in HIGH Speed but Not in DELAY or LOW

Remember, LOW speed is actually DELAY set to minimum delay, so motor runs continuously. If DELAY is gone, LOW will be, too. If HIGH speed still works, here's how to proceed.

1. Turn ignition ON and put wiper switch in middle of DELAY position. Pull delay connector from Terminals 6 and 7. Connect voltmeter between connector Terminal 7 and ground (fig. 55).

Fig. 55. Testing Variable Resistance for Voltage

2. If no voltage is indicated, check switch and wiring. Battery voltage is not getting to Terminal 7 through variable resistance.
3. If up to 12 volts is indicated, switch, variable resistance and wiring are OK. Replace timer board.

MULTIPLEX PULSE MOTOR

On the outside, the multiplex pulse motor and the modified pulse motor are the same except for the wire connectors. See figures 4 and 5. The modified pulse used seven terminals, while the multiplex motor needs only six.

Internally, they're similar except for the timer circuit which is all new. So is the dash switch.

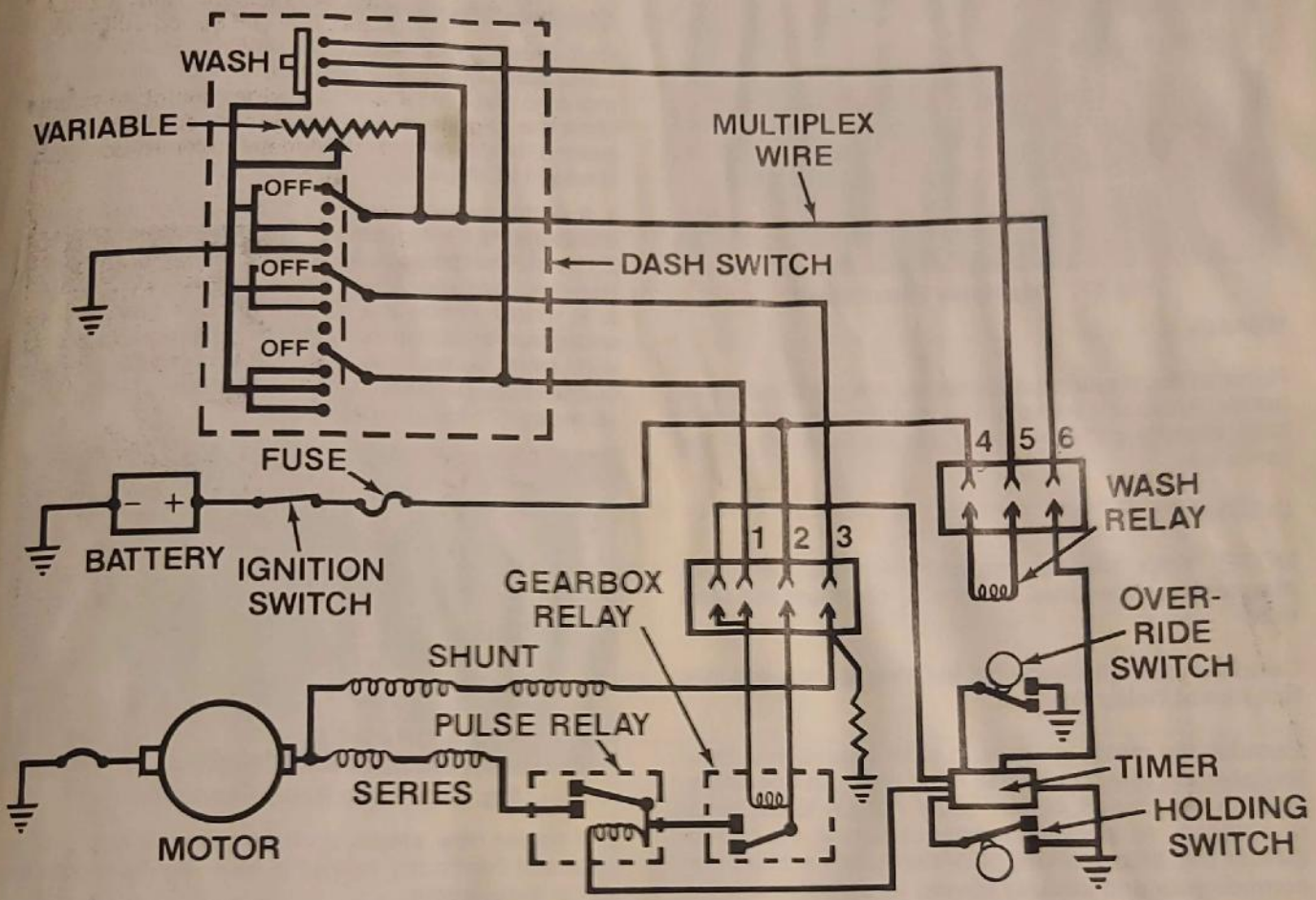

Fig. 56. Multiplex Pulse Motor Schematic

Refer to figure 56. If you compare this diagram with figure 51, you'll see there are some similarities with the modified pulse system. Low and high speeds are controlled by the series and shunt fields. Park is accomplished by the gearbox relay. Delay operation is controlled by turning the pulse relay on and off by the timer.

The holding switch is used to provide a temporary ground path after the timer trips, providing one wiper sweep per pulse. All these features are similar to the modified pulse system.

There are also some important differences. For instance, operating current for all modes is provided through Terminal 1 on the motor. The dash switch serves only as a ground point for the various circuits.

Another difference is the timer (fig. 57). It is larger and has more circuits passing through it. The pulse relay circuit passes through the timer on its way to ground at the dash switch in LOW and HIGH positions. In the DELAY position, this same wire is connected to the variable resistance where it provides an operating signal for the delay timer. Since this one wire serves two purposes, it's called the "multiplex" wire.

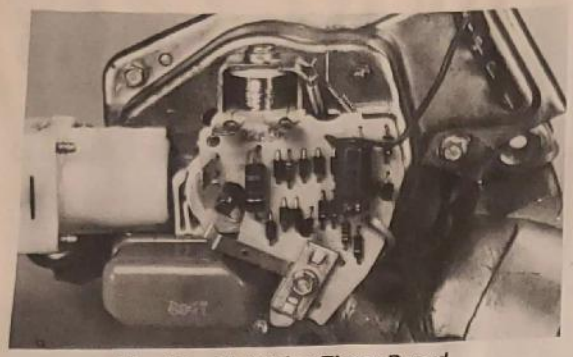

Fig. 57. Multiplex Timer Board

REPAIR

Refer to the repair procedures for the modified pulse motor. Although some of the multiplex components look slightly different, they are all serviced in the same way.

DIAGNOSIS

NOTE: Your service manual includes complete diagnosis procedures. Several of them are outlined here.

Condition 1: Motor Runs OK in Other Modes, but Will Not Run in Delay Position.

Because the motor operates in other modes, you know the gearbox relay and pulse relay are both operating. If either relay failed, current could not get to the fields or armature. At least the normal circuits in the control switch are also working. Concentrate on checking components and circuits having to do only with the delay mode.

1. Pull three-wire connector from washer pump. Set ohmmeter to one-megohm scale. Connect ohmmeter between ground and connector Terminal 6. It is at right angle to Terminals 4 and 5 (fig. 58).

Fig. 58. Testing Multiplex Circuit

2. Move delay control. If ohmmeter needle moves, delay switch is OK. Replace timer.
3. If ohmmeter needle does not move, replace switch. Variable resistance is defective.

Condition 2: Motor Runs Continuously in Delay Mode

Remember what makes the delay circuit work. The timer turns the pulse relay on and off allowing the motor to start and stop. The timer gets its information from the variable resistance. If the resistance is by-passed by a short circuit, the wiper operates as though it was in LOW position.

1. Pull three-wire connector from washer pump. This disconnects timer from variable resistance.
2. If motor stops, look for short in wiring or in switch. Repair as needed.
3. If motor continues to run, remove plastic cover and connect all wires to motor. Disconnect orange wire from pulse relay (fig. 59). This wire provides connection between relay and timer. Terminal is stamped "7" for identification.

Fig. 59. Pulse Relay Connection

4. If motor now stops, replace timer. It is providing constant continuity for pulse relay so it cannot shut off for delay cycle.
5. If motor continues to run, replace pulse relay. Its contacts are stuck in closed position, preventing delay cycle from occurring.

SPECIAL TOOLS

If it is available, you can use Tester J-25079-B to test wiper motors, both on- and off-car (fig. 60). Diagnosis manuals are provided with the tester. Also, each terminal is identified with a plastic tag for ease of use.

Fig. 60. Windshield Wiper/Washer Tester J-25079-B