

SECTION 4 - TROUBLESHOOTING

GENERAL

This section contains troubleshooting charts listing probable trouble causes and corrective procedures. Fifteen sequence of operation schematic diagrams plus a complete, detailed explanation of the operation of each Phonograph component are included in aid in isolating and correcting equipment malfunctions easily and rapidly. Use the instructions in this section in conjunction with the adjustment and repair and replacement instructions in Section 5 - Maintenance to isolate and correct Phonograph malfunctions.

TROUBLESHOOTING

It is important to troubleshoot logically so that effort is not wasted in removing and replacing the wrong parts. Most failures are caused by minor defects, such as loose connections or dirty contacts. Check the following before replacing any parts:

1. Check that all plugs are firmly seated in their receptacles.
2. Check that connector pins are not bent, broken, or pushed through the back of the connector or receptacle when mated.
3. Check that wires are not broken at connector pins.
4. Check that the area of the search unit commutator board that mates with harness edge connector is clean and intact. Make sure that the connector is firmly seated.
5. Check that commutator segments are clean and that all wiper blades are properly positioned on their respective commutator segments.

CREDIT COMPUTER TROUBLESHOOTING

PRELIMINARY CHECK

In order to isolate a problem in the credit system, perform the following preliminary check. Observe phonograph functions step by step to identify the specific problem area, then proceed to Table 4-1 Credit Computer Troubleshooting Charts for specific solutions.

1. Check the setting of the program switches in the Credit Computer to make sure they are set to the desired price of play program. Also make sure the premium price switches in the selector are set to the desired position. The "test switch" (in the selector premium pricing switch bank) must be set to the "normal" position.
2. Deposit nickels, one at a time, to reach the required credit level for standard play. Check to see that the "Make Standard Selection" lamp does not light until a sufficient number of nickels have been deposited.

NOTE

IF LAMP DOES NOT LIGHT WHEN CORRECT CHANGE IS ACCEPTED, CHECK LAMP; CHECK CREDIT COMPUTER EDGE CONNECTOR.

3. Make a standard selection. The "Make Standard Selection" lamp must go out and no further selections can be made.

NOTE

IF THE DESIRED PRICE PROGRAM IS 2/25¢ OR 3/25¢, IT IS NECESSARY TO DEPOSIT 25¢ (5 NICKELS) BEFORE THE CREDIT LAMP LIGHTS. IT IS NECESSARY TO MAKE 2 (OR 3) STANDARD SELECTIONS TO CANCEL CREDIT.

4. Next deposit nickels and dimes to reach the required credit level to obtain bonus play (25¢ or 50¢ typically). Check to see that the "Make Any Selection" lamp lights, in addition to the "Make Standard Selection" lamp.
5. Make standard selections or a combination of standard and premium selections as indicated by the price of play card. The "Made any Selection" lamp goes out when premium credit no longer exists. The "Make Standard Selection" lamp goes out when standard credit no longer exists. Make sure proper credit is established for the total coin deposit.
6. Repeat the above procedure for checking credit and cancel operation at each credit level shown on the price card. Use combinations of coins (i.e. nickels, dimes and quarter) to achieve the desired deposit.
7. Establish credit on the phonograph. Interrupt power by turning the scan switch off, power switch off, etc. If the power interruption is greater than one second duration, credit must be erased. This is the method used to remove credit during test and/or troubleshooting.
8. Push the manual credit button. Credit must be established as though a 25¢ deposit had been made. Remove credit.

TABLE 4-1. CREDIT SYSTEM TROUBLESHOOTING

CHART 1 - NO CREDIT ESTABLISHED WHEN COINS ARE INSERTED

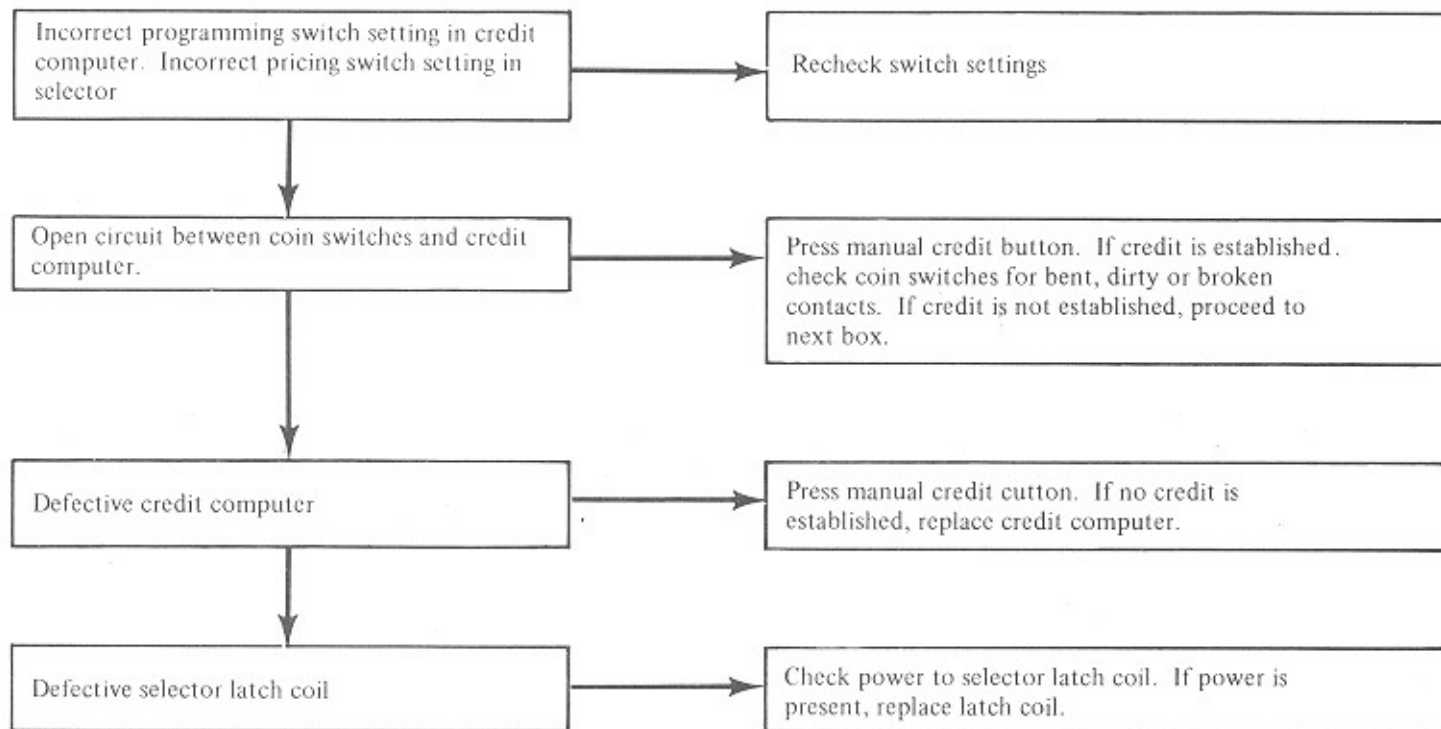


CHART 2 - TOO MUCH CREDIT ESTABLISHED WHEN COINS ARE INSERTED

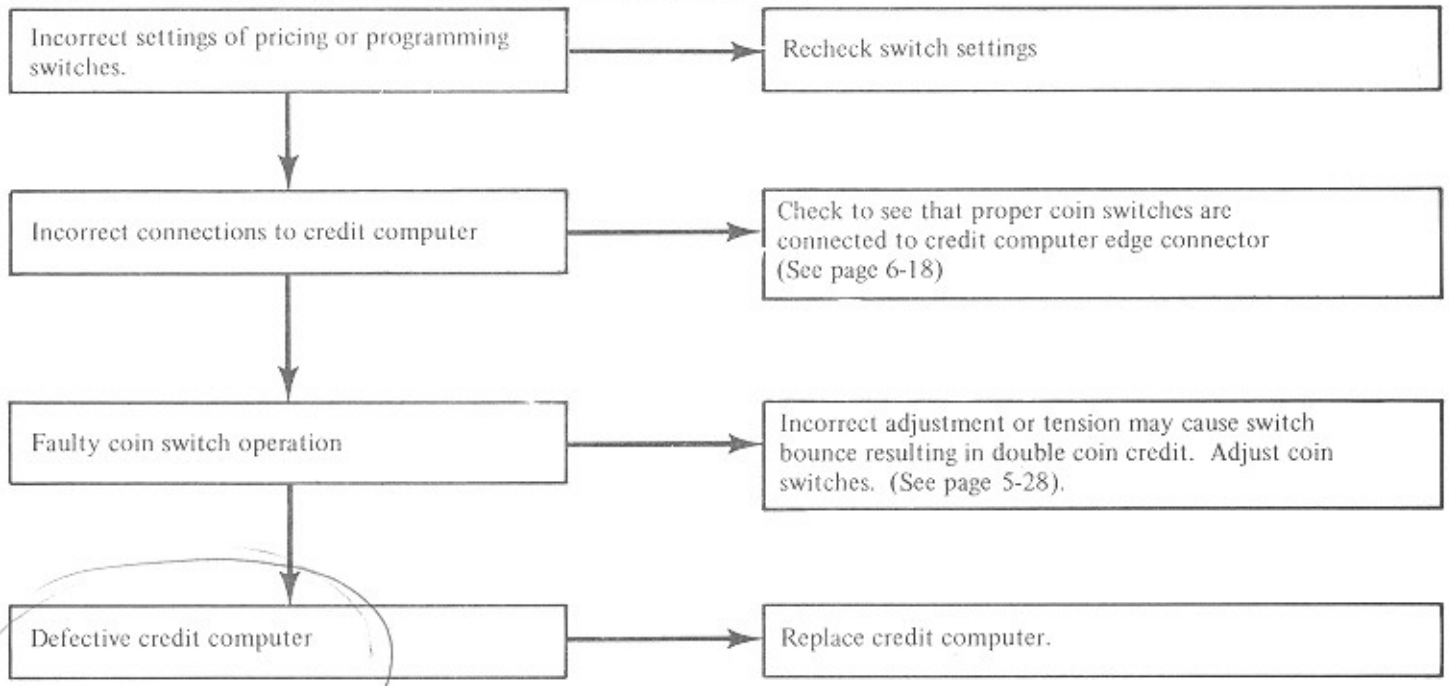


CHART 3 - INSUFFICIENT CREDIT FOR COINS INSERTED

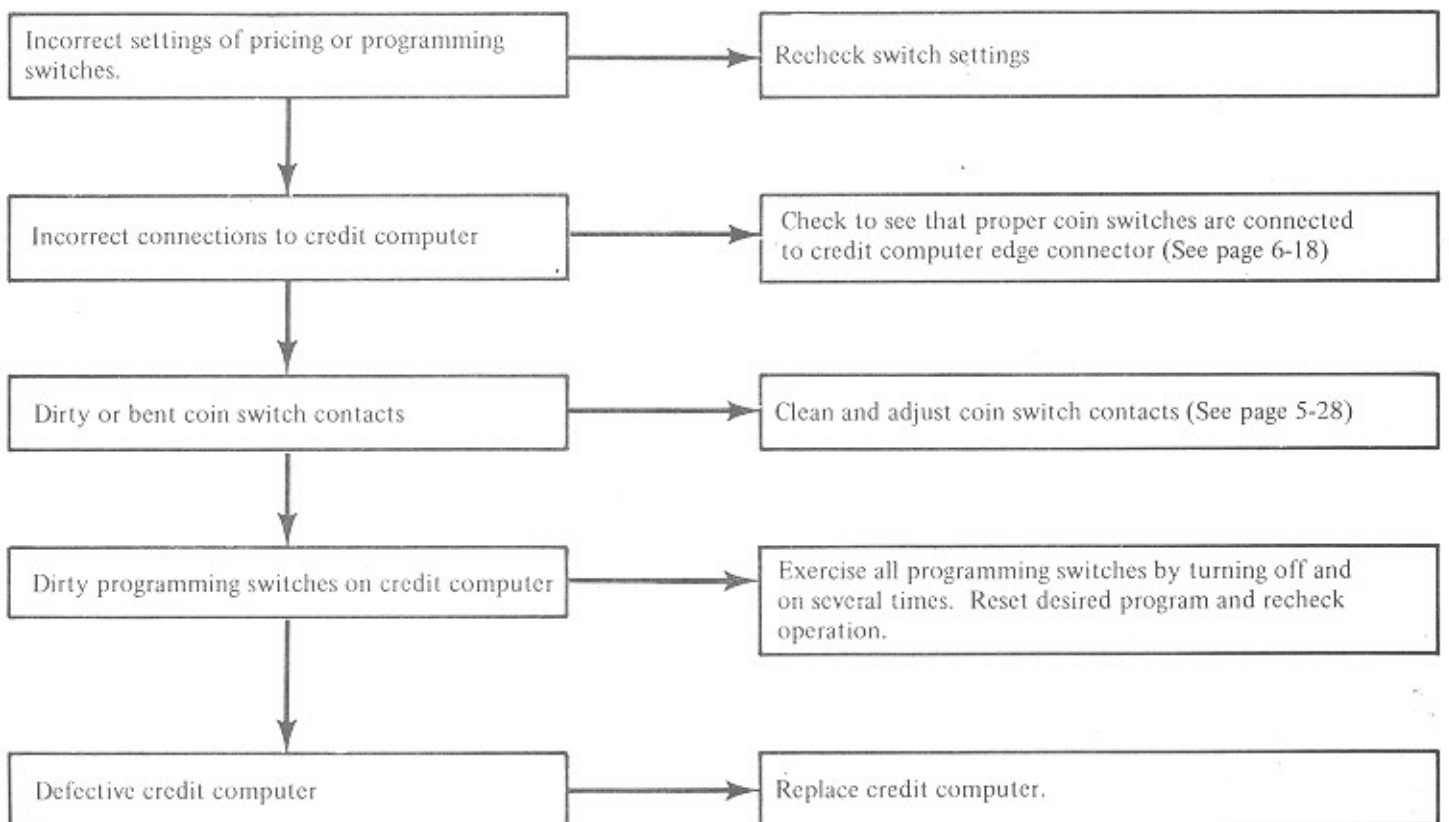


CHART 4 - CONTINUOUS FREE PLAY

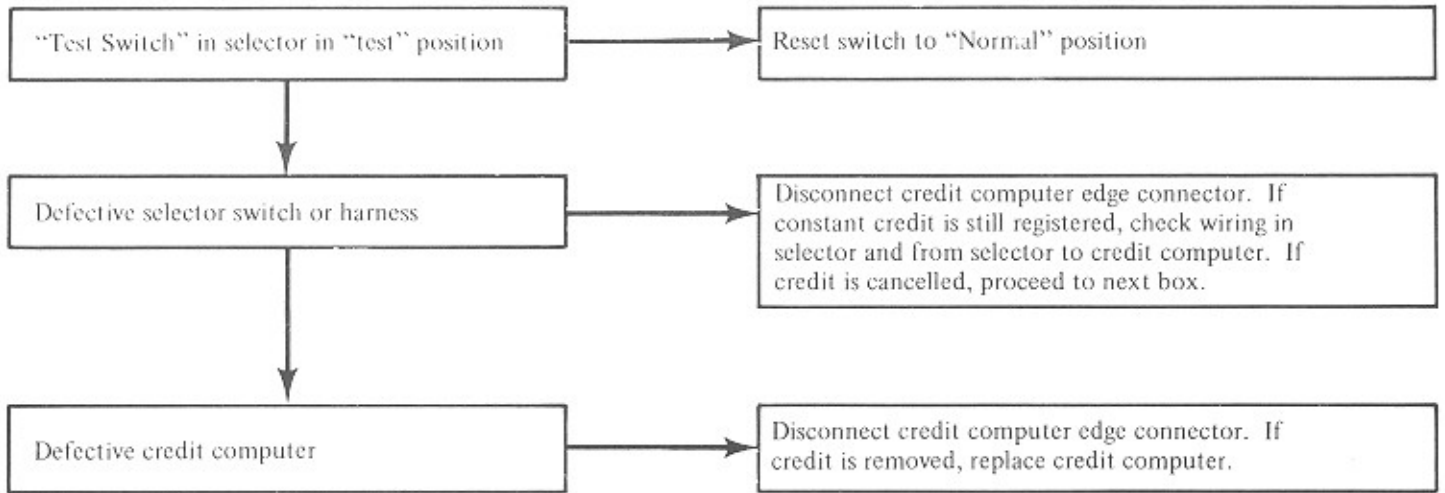
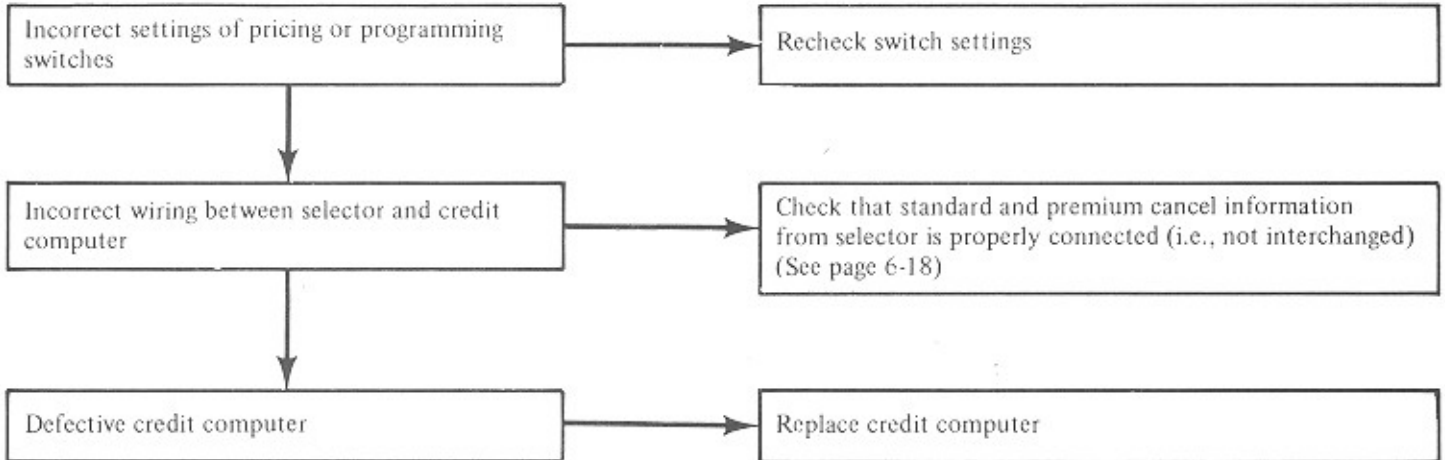


CHART 5 - IMPROPER CANCEL OPERATION WHEN SELECTIONS MADE



TROUBLESHOOTING CHARTS

The possible malfunctions of the Phonograph, their probable causes and remedies are listed in tables 4-2 through 4-4. The TROUBLE column contains specific failures. Each failure has one or more corresponding causes in the PROBABLE CAUSE column. If more than one probable cause and remedy are listed for a particular trouble, perform the procedures in the REMEDY column in the order listed.

TABLE 4-2. SLUG REJECTOR AND SELECTION SYSTEM TROUBLESHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
Valid coins fail to pass through slug rejector into cash box. Coins remain jammed in rejector.	Dirt or foreign matter clogging coin passages in rejector	Refer to coin rejector service manual for cleaning procedure. Clean in accordance with instructions.
	Scavenger binding, rejector out of adjustment.	Refer to coin rejector service manual for adjustment procedure.

TABLE 4-2. SLUG REJECTOR AND SELECTION SYSTEM TROUBLESHOOTING (CONTINUED)

TROUBLE	PROBABLE CAUSE	REMEDY
Valid coins accepted, credits are established, pushbuttons do not latch in.	Latch coil not operating. Select pulse and latch relay R1 not picking up.	Check coil for continuity. Check relay contacts for closure. Replace relay or coil if necessary.
	Select pulse and latch relay R1 contacts broken, dirty, or out of adjustment. R1 not picking up after credit is established.	Clean and adjust relay contacts.
	Open circuit between credit unit and select pulse and latch relay R1. R1 not picking up after credit is established.	Check for open circuit. Refer to sequence of operation, page 4-10.
Pushbuttons latch in but release prematurely; no selection played.	Select pulse and latch relay R1 time delay circuit giving short pulse.	Check diode on selector assembly. Check relay R1 for dirt between core and armature. Replace parts if necessary.
Pushbuttons latch in; no further action.	Open circuit to search unit motor.	Check wiring. See page 6-16.
Pushbuttons latch in, search unit motor starts, but runs continuously.	Open circuit in selector assembly, wiring from pushbutton switches to search unit printed board segments.	Check wiring against selector assembly wiring diagram. See page 6-15.
	Contacts on mechanism control relay R dirty, broken, or out of adjustment.	Check mechanism control relay R for proper operation. Replace if necessary. This relay is nonrepairable.
Selection is registered, magazine rotates one complete scan cycle and stops. No record is played.	No circuit through stop switch.	Check wiring to stop switch. See page 6-5.
	Selected pin not pushed far enough; select coil not properly positioned.	Check inside and outside row select coils for proper operation. Adjust select coil arm assembly. See page 5-27.
Wrong selection is played every time.	Search unit select coil arm assembly out of adjustment.	Adjust search unit select coil arm assembly. Check search unit wiper adjustment. See page 5-25.
	Stop switch out of adjustment.	Check stop switch alignment. See page 5-5.
	Stop switch gear not properly installed.	Check stop switch gear alignment. See page 5-6.
One particular letter or number, in combination with all letters and numbers, will not register.	Open circuit in the particular letter or number wiring.	Check for dirt on search unit commutator board or wiper contacts. Clean with alcohol, if necessary. To locate the open circuit, make 20 selections in the following order: A1, B1, C2, D2, E3, F3, G4, H4, J5, K5, L6, M6, N7, P7, Q8, R8, S9, T9, U0, V0. This test combination will determine which letter or number has an open circuit.
Search unit motor energized but does not run.	Search unit gears binding.	Check for dirt or foreign matter lodged in gear teeth. Check backlash adjustment. See page 5-20.
	Tip of select coil plunger hung up on side of pin, excessive backlash causing select coil arm overtravel.	Adjust search unit gears for proper backlash. See page 5-20.

TABLE 4-2. SLUG REJECTOR AND SELECTION SYSTEM TROUBLESHOOTING (CONTINUED)

TROUBLE	PROBABLE CAUSE	REMEDY
Only one selection is made but two selections play.	Select coil plunger hitting two adjacent pins; select coil arms out of adjustment, or overtravel caused by excessive gear backlash.	Adjust select coil arm assembly. Adjust search unit gears for proper backlash. See pages 5-20 and 5-27.

TABLE 4-3. RECORD CHANGER MECHANISM TROUBLESHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
All selections register properly but magazine does not rotate.	Scan Assembly not operating	Check scan coil for open, check for binding linkage.
	Scan switch defective or out of adjustment .	Check scan switch for proper operation, adjust switch position.
	Diode D-1 open.	Check by shorting across diode.
	Cam switch CS2 faulty or out of adjustment.	Check switch for proper operation or adjust switch position.
	Magazine detent coil open or binding detent linkage.	Check coil for continuity, free linkage.
	Relay contact 1 & 9 faulty.	Check relay, replace if necessary.
	Detent switch faulty or out of adjustment.	Check switch for proper operation or adjust switch position.
	Magazine motor faulty or drive gears binding.	Check motor and gear train for proper operation.
Scan linkage operates, magazine completes one scan cycle and stops - no record is played. Stop switch jumps pins.	No circuit through stop switch	Check stop switch and wipers on back of stop switch.
	Diode D-2 defective.	Check diode.
	Short circuit in 50 MFD capacitor.	Check capacitor resistance.
	Faulty mech. relay. (R)	Replace relay.
	CS5 cam switch defective or out of adjustment.	Check cam switch for proper operation - replace if necessary, adjust switch position.
	Short circuit on common side of magazine detent coil.	Check detent coil circuit.
Magazine stops at proper selection, but record transfer assembly does not operate. Relay (R) picked up.	Open circuit to transfer motor.	Check relay contacts 6 and 10, 7 and 11, for proper operation.
	Defective transfer motor.	Check motor, replace if necessary.
Transfer arm stops in mid travel between magazine and turntable. Phono power is on.	Cam switch CS2 faulty of out of adjustment.	Check for proper operation of switch. Replace if necessary. Adjust as required.
	Open circuit breaker in junction box.	Check for short or overload condition. After correcting condition, reset circuit breaker.

TABLE 4-3. RECORD CHANGER MECHANISM TROUBLESHOOTING (CONTINUED)

TROUBLE	PROBABLE CAUSE	REMEDY
Transfer arm moves each record selection from magazine to turntable and back without being played, all other functions normal.	Diode D-3 shorted.	Check for short.
	Short circuit in cancel line, cut off switch or automatic cancel circuit.	Check for short.
	Cam switches CS-4 or CS5 faulty or out of adjustment.	Check switches - adjust or replace if necessary.
	Needle height improperly adjusted.	Adjust height of needle.
Wrong side of record plays; selection is improperly registered.	Center slip ring wiper broken or out of adjustment.	Adjust or replace.
	Left side switch in stop switch assembly faulty.	Check left side switch - replace if necessary.
	Toggle switch coil open or linkage binding.	Check coil and linkage. Replace or free if necessary
	Diode D-3 open.	Check diode.
	Cam switch CS4 faulty or out of adjustment.	Check switch, replace or adjust if necessary
	Mechanism relay (R) contacts 5 and 9, not making connection.	Check relay - replace if necessary.
Wrong record played, selection is properly registered.	Stop switch gear out of adjustment.	Align 200 mark on stop switch gear with step in search unit mounting bracket. See page 5-6.
	Stop switch out of alignment.	Align stop switch. See page 5-6.
Selections play over and over, pins not being reset.	Slip ring wipers No. 2 or 3 broken or out of adjustment.	Adjust or replace slip ring wiper blade assembly.
	Cam switch CS3 or CS4 faulty or out of adjustment.	Check switches - replace or adjust if necessary.
	Reset pawl out of adjustment.	Adjust reset pawl. See page 5-5.
Magazine scans continuously after last selection is played.	Detent coil plunger binding or detent assembly out of adjustment.	Manually operate plunger to check that the detent pawl locks the detent wheel. Adjust or replace if necessary.
	Scan switch faulty or out of adjustment.	Check switches, repair or replace if necessary.

TABLE 4-4. SOUND SYSTEM TROUBLESHOOTING

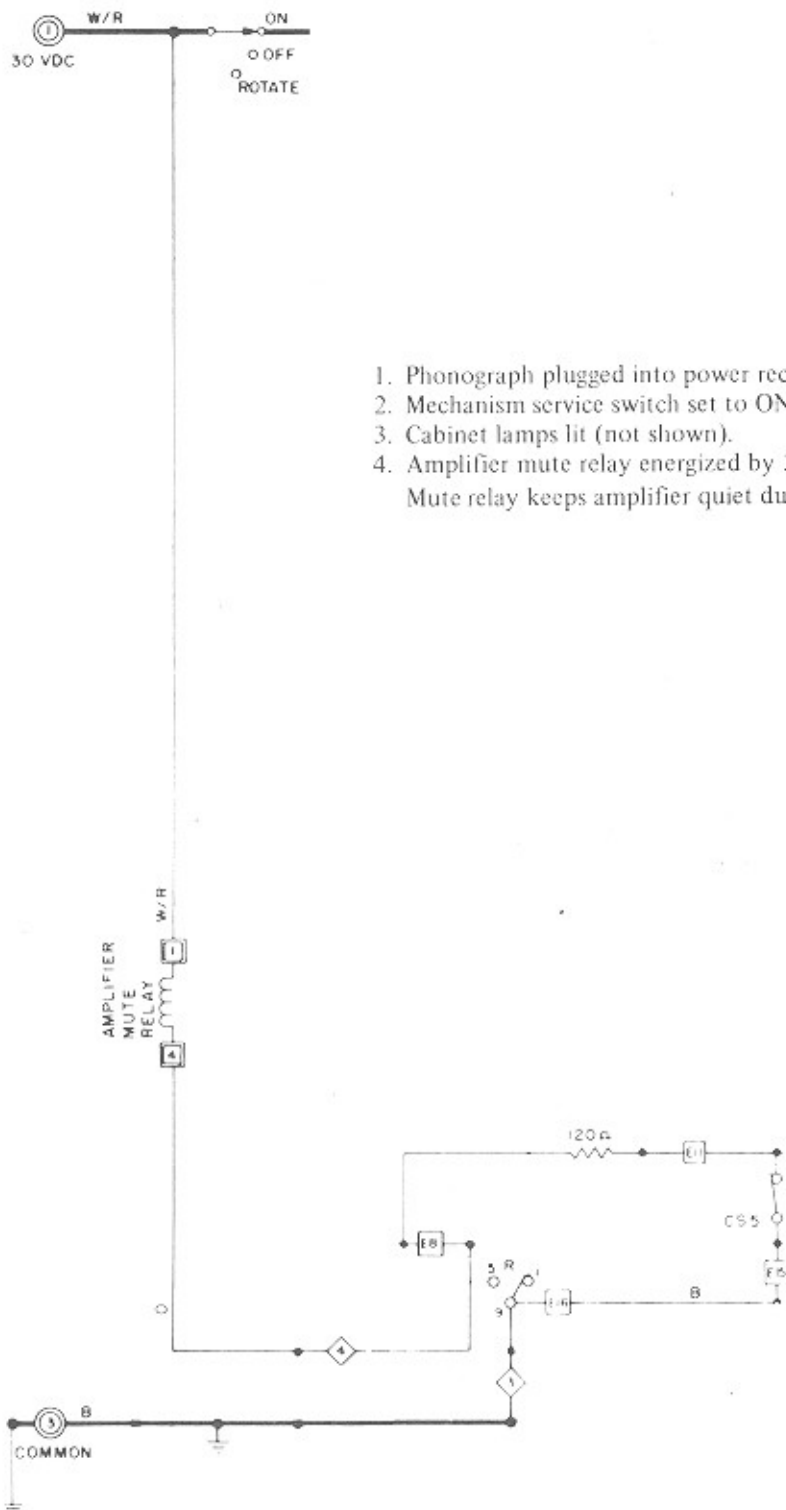
TROUBLE	PROBABLE CAUSE	REMEDY
No sound. Phonograph mechanical operation normal.	Amplifier circuit breaker open.	Check for short or overload condition which caused breaker to open. Reset breaker after this condition is corrected.
	Faulty mute relay	Check operation of mute relay; replace if necessary. This relay is nonrepairable.
	Cartridge leads broken or shorted.	Check that both cartridge leads are intact and that all connectors and plugs are firmly seated.
Partial or distorted sound.	Damaged stylus	Carefully check stylus, replace if necessary.
	Incorrect remote speaker hookup.	Check remote speaker connections. See page 2-5.
	Defective output transistors in either channel.	Check output transistors. Replace if defective.
	Partial short in local or remote volume control. Incorrect speaker hookup. Incorrect remote volume control hookup.	Check volume control and speaker connections as shown in sound system connection diagram. See page 2-5.
Low volume apparent in one channel.	Cartridge defective	Replace cartridge if necessary. Check by substituting a cartridge that is known to be good.
	Faulty preamplifier board.	Replace preamplifier board.
	Blown DC fuse on driver board	Blown fuse on driver board will indicate a shorted output transistor. Replace fuse and transistor. See page 5-30
	Faulty driver board.	Replace driver board.
	Balance control not properly adjusted.	Adjust balance control for equal sound from each stereo channel. See page 2-3.
Constant high volume, cannot be adjusted at volume control.	Short in volume control circuit.	Check wiring. See sound system connection diagram. See page 2-5.
Excessive record scratch evident through speakers.	Scratched or worn records.	Replace records.
	Damaged stylus.	Check stylus force. Replace stylus.
	Treble range control set too high for condition of records.	Reduce treble range control setting. See page 2-3.
Intermittent sound.	Speaker lines shorted	Check for shorted or partially shorted speaker lines.
Excessive hum-low volume.	Broken shield on cartridge leads.	Be sure that shielding or wires are not broken at any point between the cartridge and amplifier input plug.

SEQUENCE OF OPERATION

To enable you to read the sequence of operation while simultaneously viewing the sequence diagrams and complete schematic, spread foldout page 6-3 out to the right.

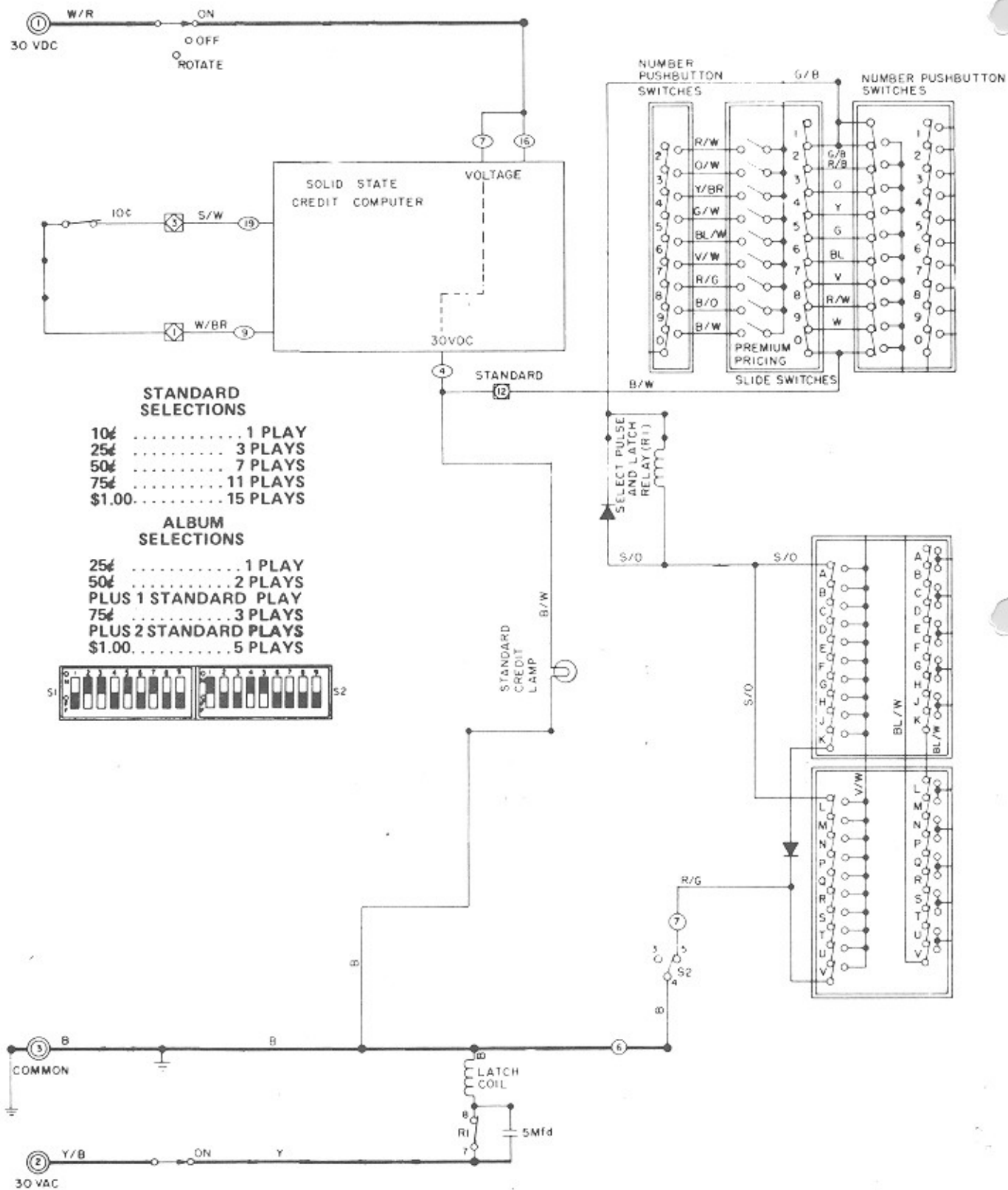
Each diagram is a partial simplified schematic of the phonograph schematic diagram, figure 6-1. Only the circuits under discussion for the particular sequence are shown. The accompanying text on each diagram explains circuit operations.

1. STANDBY



1. Phonograph plugged into power receptacle.
2. Mechanism service switch set to ON position.
3. Cabinet lamps lit (not shown).
4. Amplifier mute relay energized by 30 V.D.C. through CS5.
Mute relay keeps amplifier quiet during record transfer cycle.

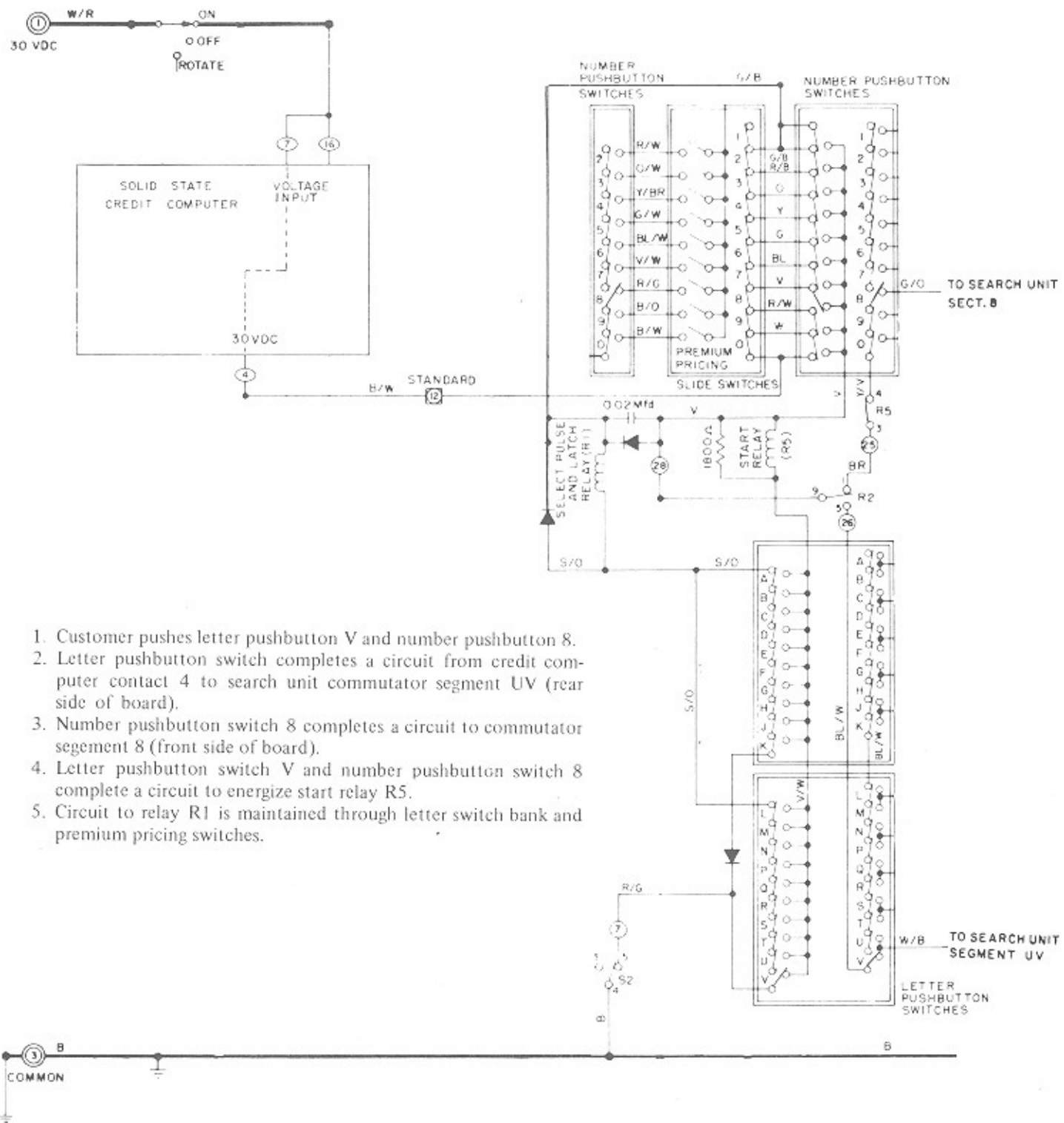
2. CUSTOMER INSERTS DIME, CREDIT ESTABLISHED



1. Assume credit computer is set for a standard price of 10¢. Dime passes through slug rejector.
2. Dime operates 10¢ coin switch lever, closing 10¢ coin switch.
3. Credit is established in the credit computer.
4. Power is applied to standard price lamp through contact 4 of credit computer edge connector.

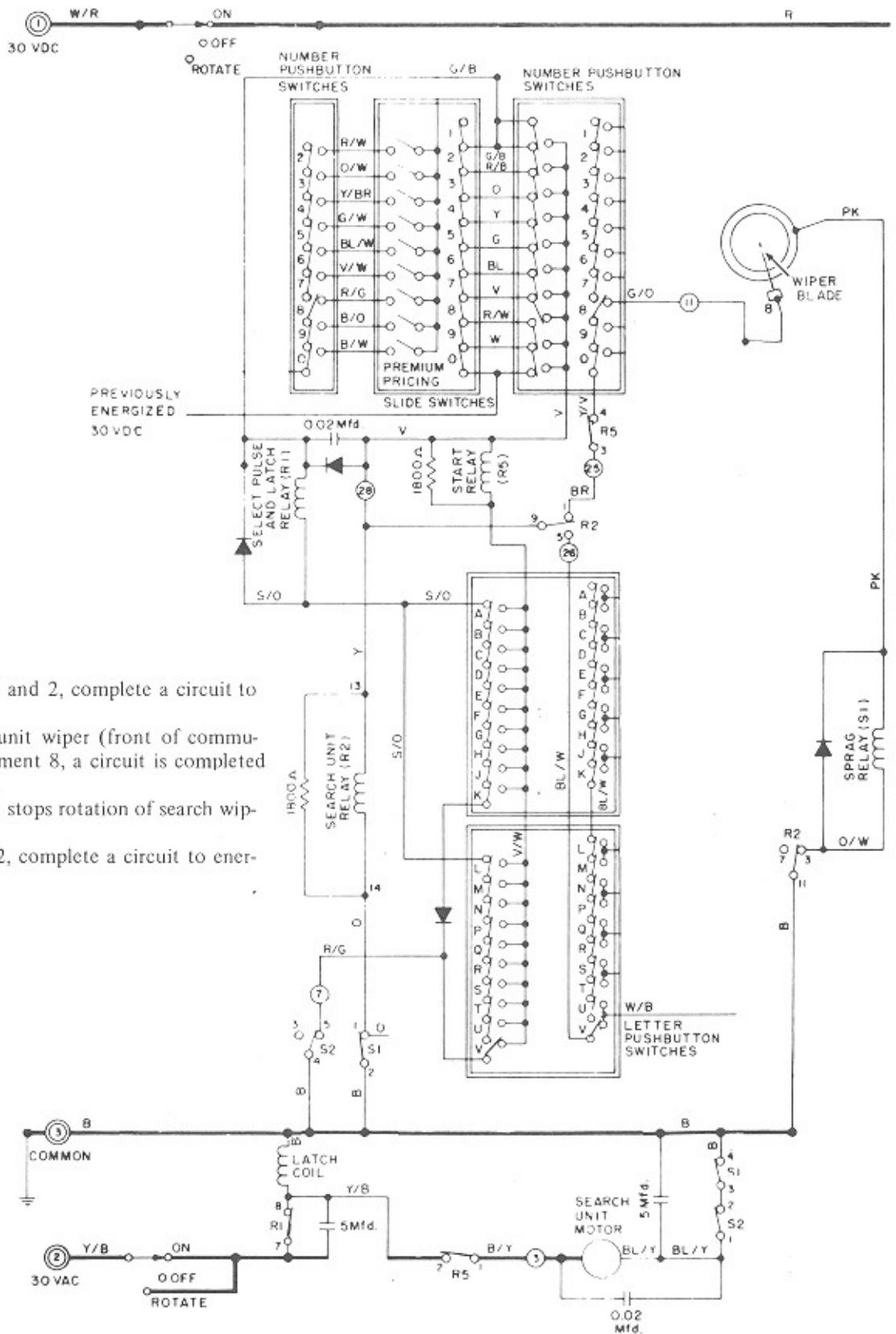
5. Select pulse and latch relay energized through number and letter pushbuttons and sprag relay S2, contacts 4 and 5.
6. Select pulse and latch relay R1, contacts 7 and 8 pull in, energizing latch coil. Pushbuttons will latch in when pressed.

3. CUSTOMER MAKES SELECTION



1. Customer pushes letter pushbutton V and number pushbutton 8.
2. Letter pushbutton switch completes a circuit from credit computer contact 4 to search unit commutator segment UV (rear side of board).
3. Number pushbutton switch 8 completes a circuit to commutator segment 8 (front side of board).
4. Letter pushbutton switch V and number pushbutton switch 8 complete a circuit to energize start relay R5.
5. Circuit to relay R1 is maintained through letter switch bank and premium pricing switches.

4. SEARCH WIPERS LOCATE NUMBER

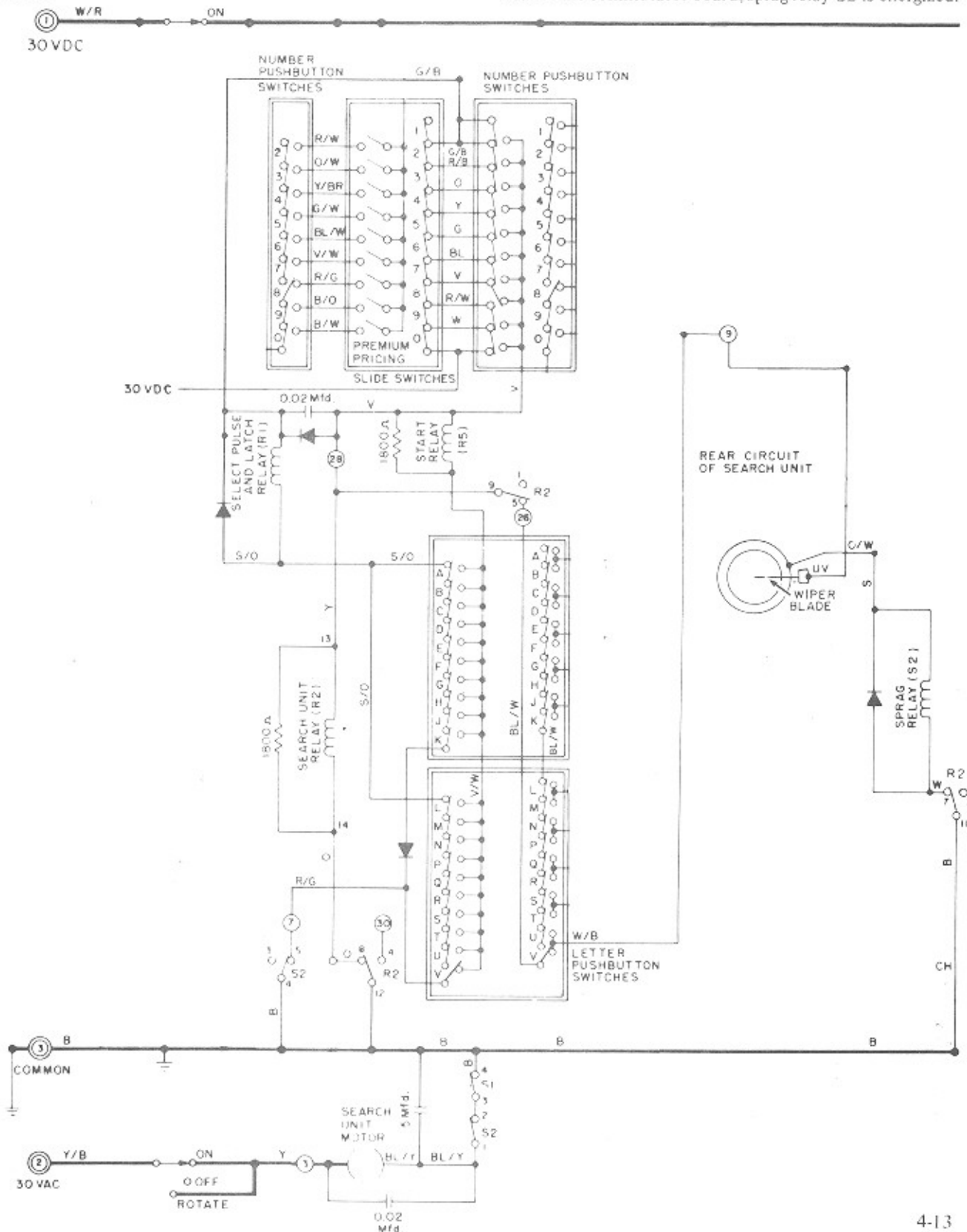


1. Start Relay R5, contacts 1 and 2, complete a circuit to search unit motor.
2. When the number search unit wiper (front of commutator board) runs onto segment 8, a circuit is completed to energize sprag relay S1.
3. The sprag tooth on relay S1 stops rotation of search wipers and select coils.
4. Relay S1, contacts 1 and 2, complete a circuit to energize search unit relay R2.

5. SEARCH CONTINUES

1. Search unit relay R2, contacts 7 and 11, transfer the common side of the circuit from sprag relay S1 to sprag relay S2.
2. Search unit relay R2, holds itself in through contacts 8 and 12.

3. Search unit relay R2, contacts 5 and 9, transfer the positive side of the selection circuit from the number pushbutton switches to the letter switches.
4. Sprag relay S1 drops out, contacts 3 and 4 energize search unit motor.
5. When the letter wiper runs onto the UV segment on the rear of the commutator board, sprag relay S2 is energized.

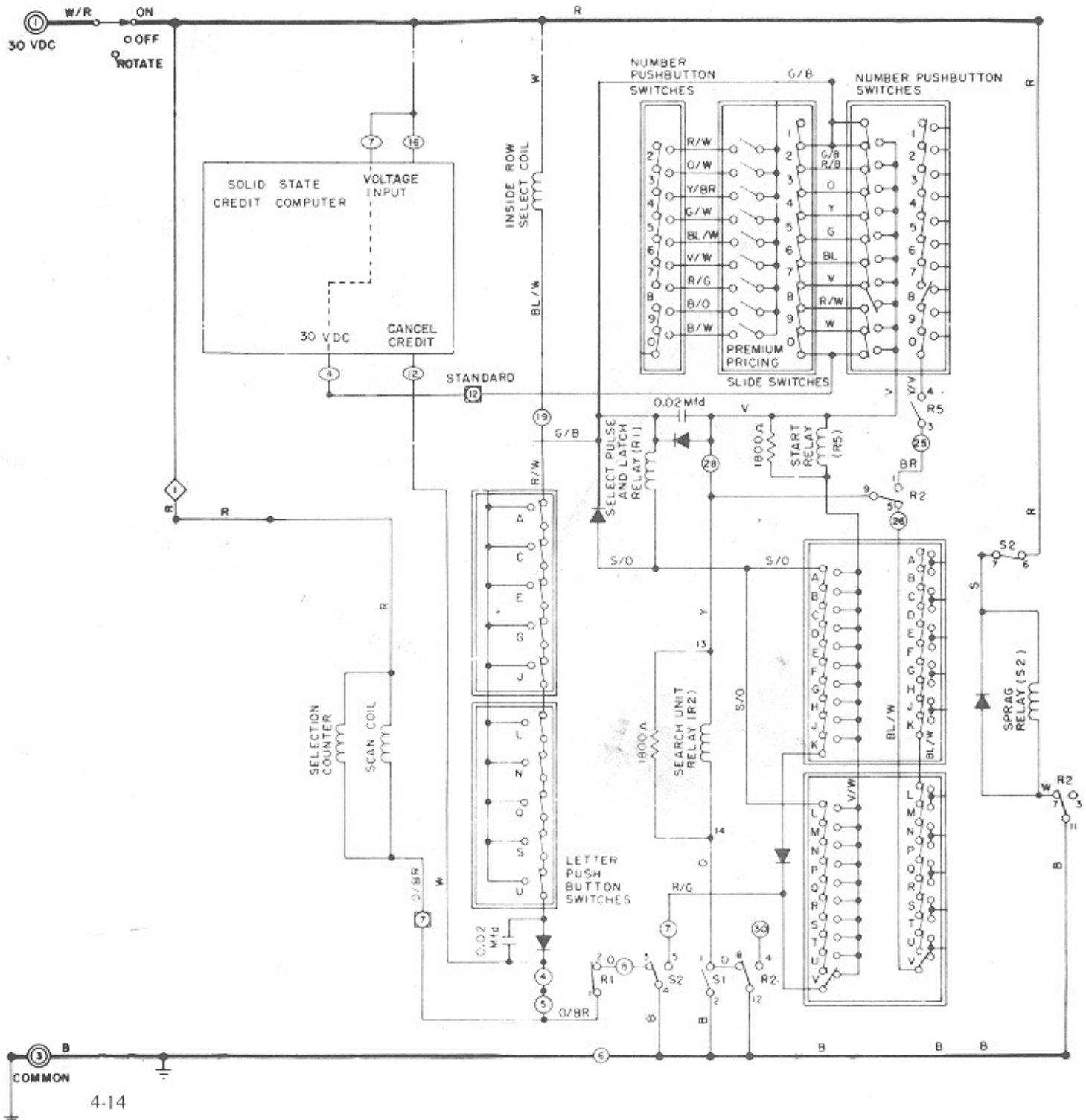


6. SELECTION REGISTERED, CREDIT REMOVED, AND SCAN CONTROL OPERATED

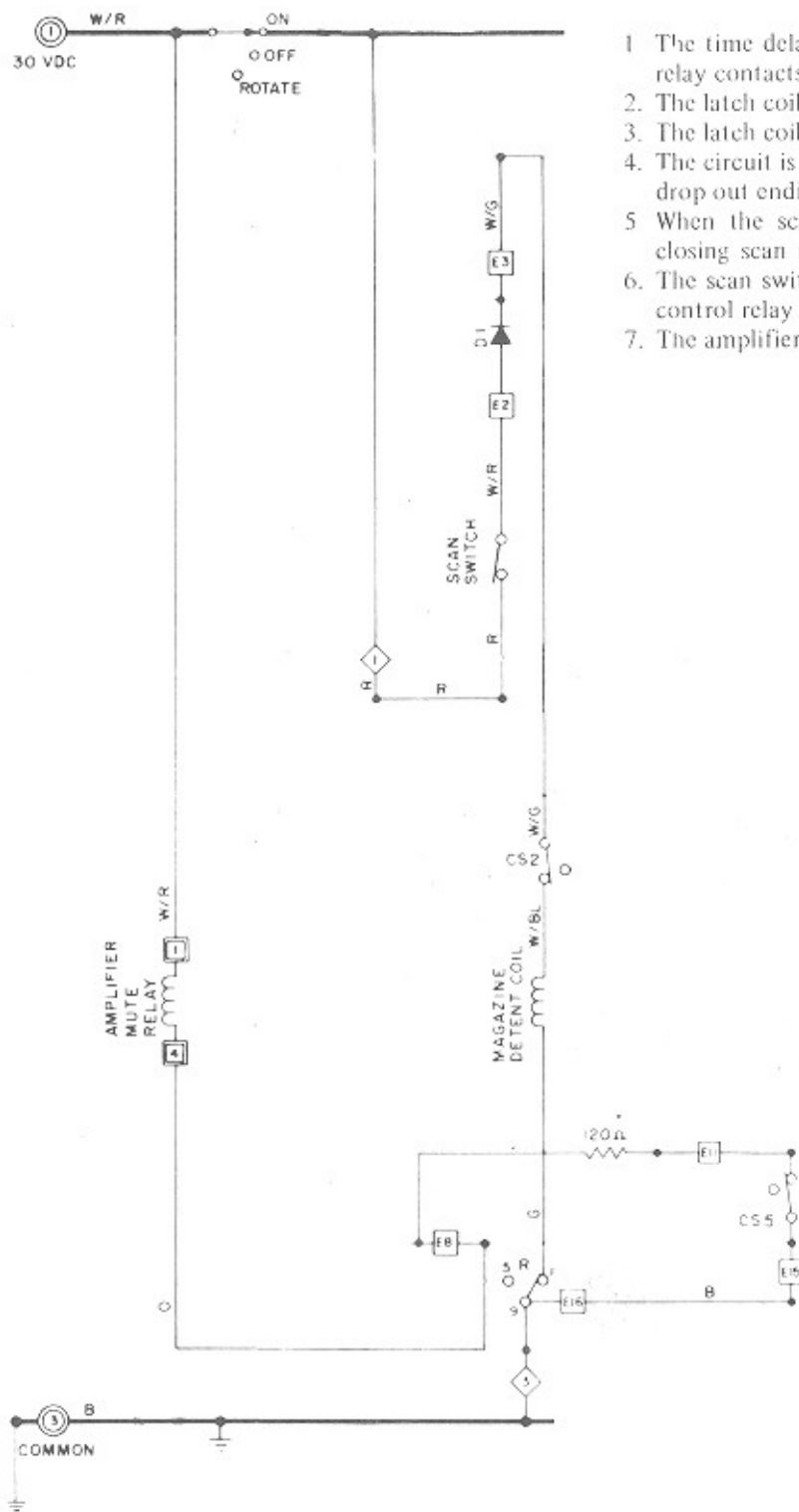
1. Sprag relay S2 locks the search wipers and select coils in place with the select coils aligned with pins representing selections U8 and V8.
2. Sprag relay S2, contacts 1 and 2, de-energize search unit motor.
3. Sprag relay S2 holds itself in through contacts 6 and 7.
4. Sprag relay S2, contacts 4 and 5, transfer, opening the circuit to select and latch relay R1. Start relay R5 drops out.
5. Select pulse and latch relay R1 is held for a short time after S2 transfers due to a diode connected across the

coil. This time delay determines the length of the select pulse. During select pulse, search unit relay R2 is held closed through number pushbuttons and R2, contacts 8 and 12.

6. Select pulse and latch relay R1, contacts 1 and 2, and sprag relay S2, contacts 3 and 4, complete a circuit to energize inside row select coil, scan coil, selection counter and contact 12 on credit computer circuit board. Circuit to credit computer cancels one standard credit.
7. Inside row select coil pushes pin into select position on the search unit pinwheel assembly.



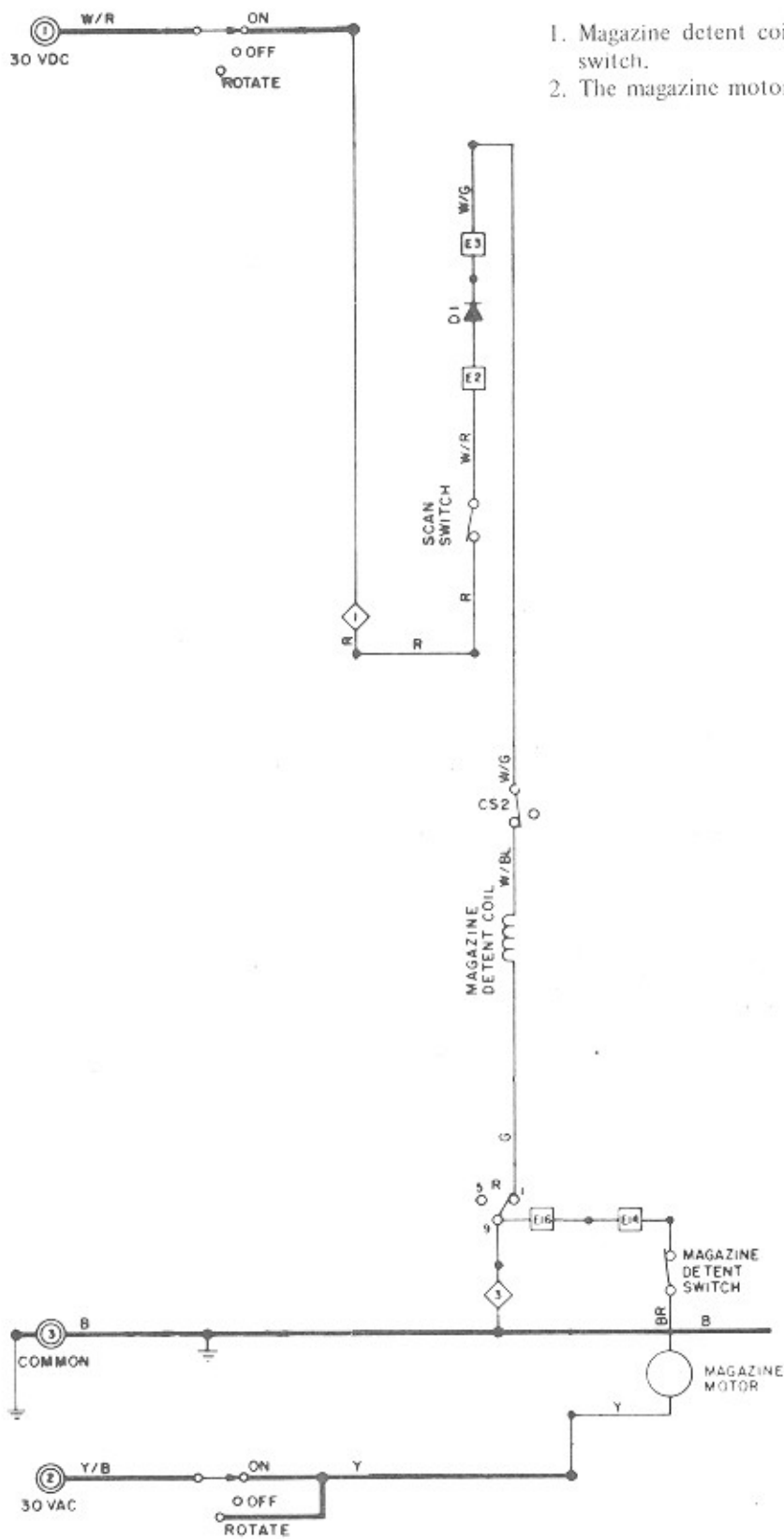
7. PUSHBUTTONS UNLATCH AND RECORD CHANGER STARTS



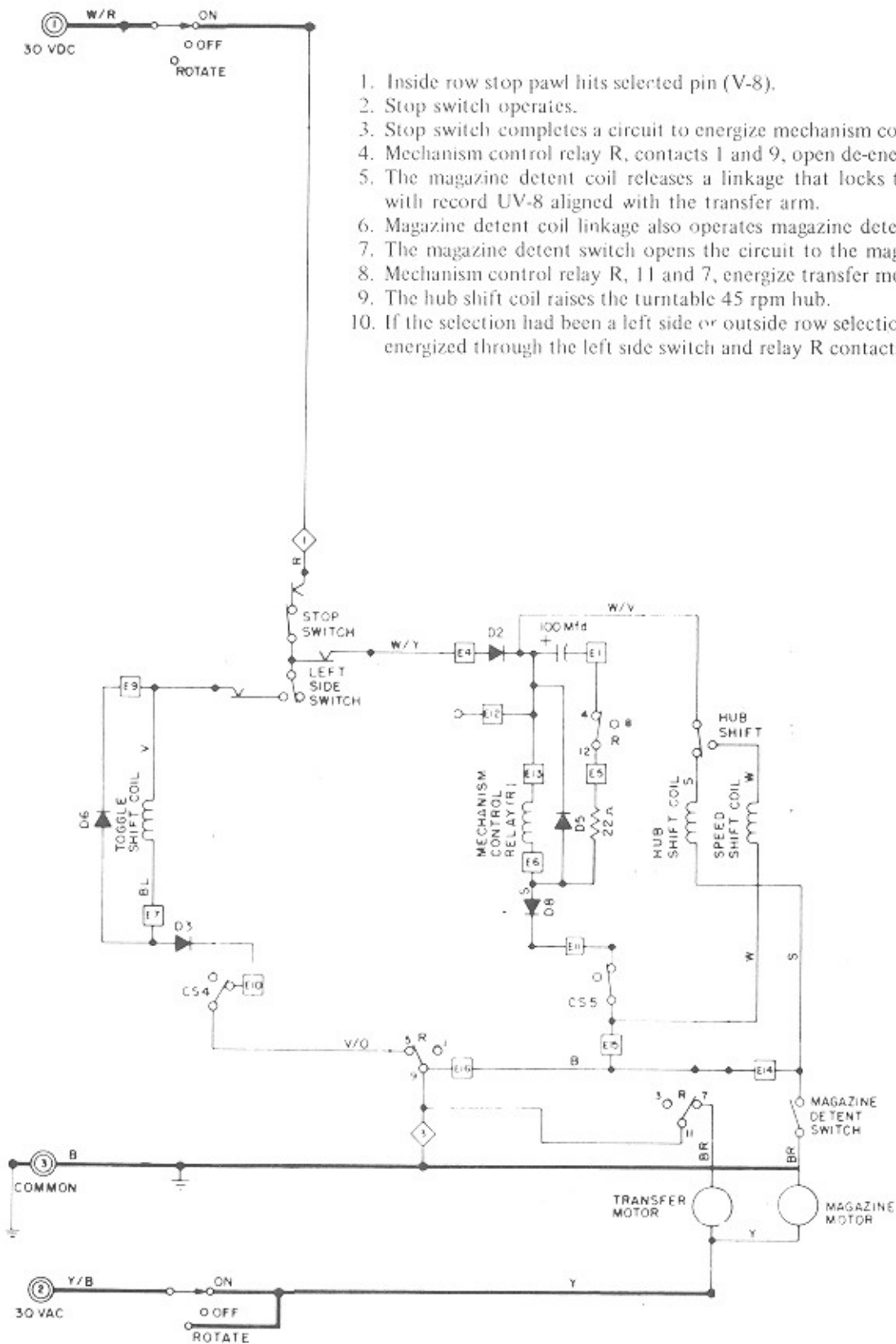
- 1 The time delay across select pulse and latch relay R1 runs out and the relay contacts transfer. This ends the select pulse.
- 2 The latch coil is de-energized.
- 3 The latch coil plunger releases pushbuttons V and 8.
- 4 The circuit is opened to search unit relay R2, sprag relay S2. The relays drop out ending the selection cycle.
- 5 When the scan coil was energized, it tripped the scan control gear, closing scan switch.
- 6 The scan switch energizes the magazine detent coil through mechanism control relay R, contacts 1 and 9.
- 7 The amplifier mute relay remains energized through cam switch CS5.

8. RECORD MAGAZINE ROTATES

1. Magazine detent coil unlocks the magazine and trips magazine detent switch.
2. The magazine motor rotates the record magazine.



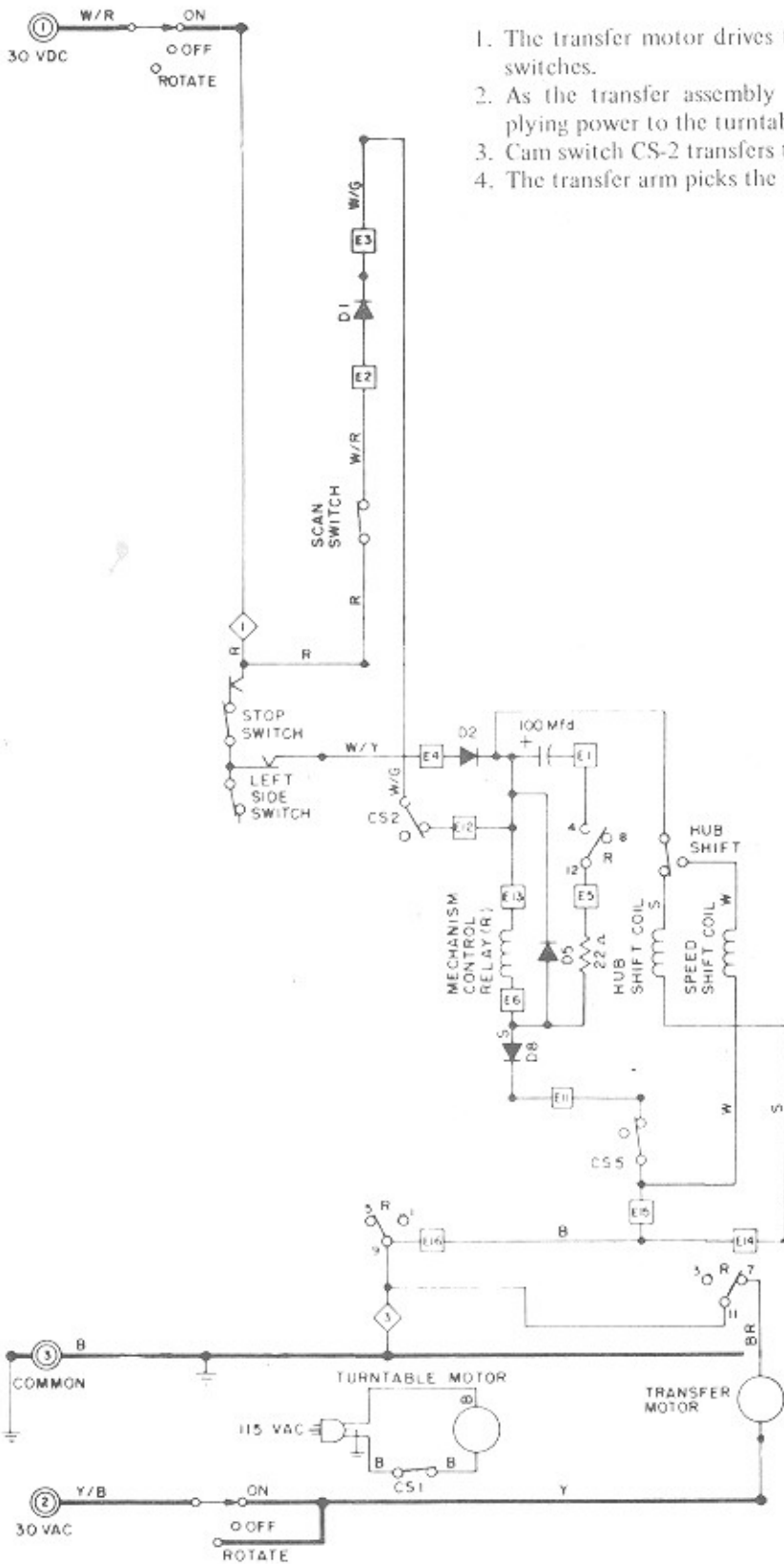
9. STOP SWITCH PAWL HITS SELECTED PIN-TRANSFER MOTOR STARTS



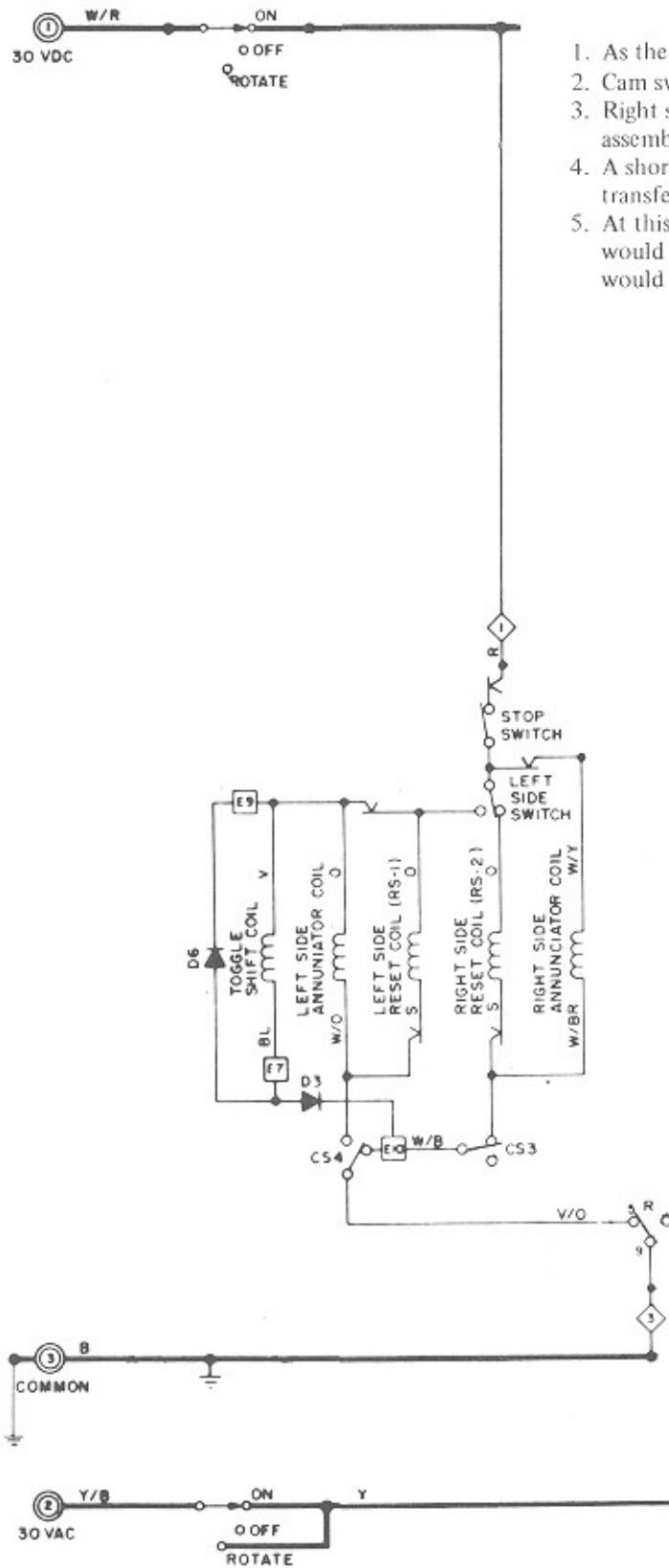
1. Inside row stop pawl hits selected pin (V-8).
2. Stop switch operates.
3. Stop switch completes a circuit to energize mechanism control relay R and hub shift coil.
4. Mechanism control relay R, contacts 1 and 9, open de-energizing magazine detent coil.
5. The magazine detent coil releases a linkage that locks the record magazine in position with record UV-8 aligned with the transfer arm.
6. Magazine detent linkage also operates magazine detent switch.
7. The magazine detent switch opens the circuit to the magazine motor.
8. Mechanism control relay R, 11 and 7, energize transfer motor.
9. The hub shift coil raises the turntable 45 rpm hub.
10. If the selection had been a left side or outside row selection, the toggle shift coil would be energized through the left side switch and relay R contacts 5 and 9.

10. RECORD PICKED UP

1. The transfer motor drives the transfer assembly and the cam that operates the cam switches.
2. As the transfer assembly begins to move, the cam closes cam switch CS-1 applying power to the turntable motor.
3. Cam switch CS-2 transfers to hold in hub shift coil and mechanism control relay R.
4. The transfer arm picks the record out of the magazine.

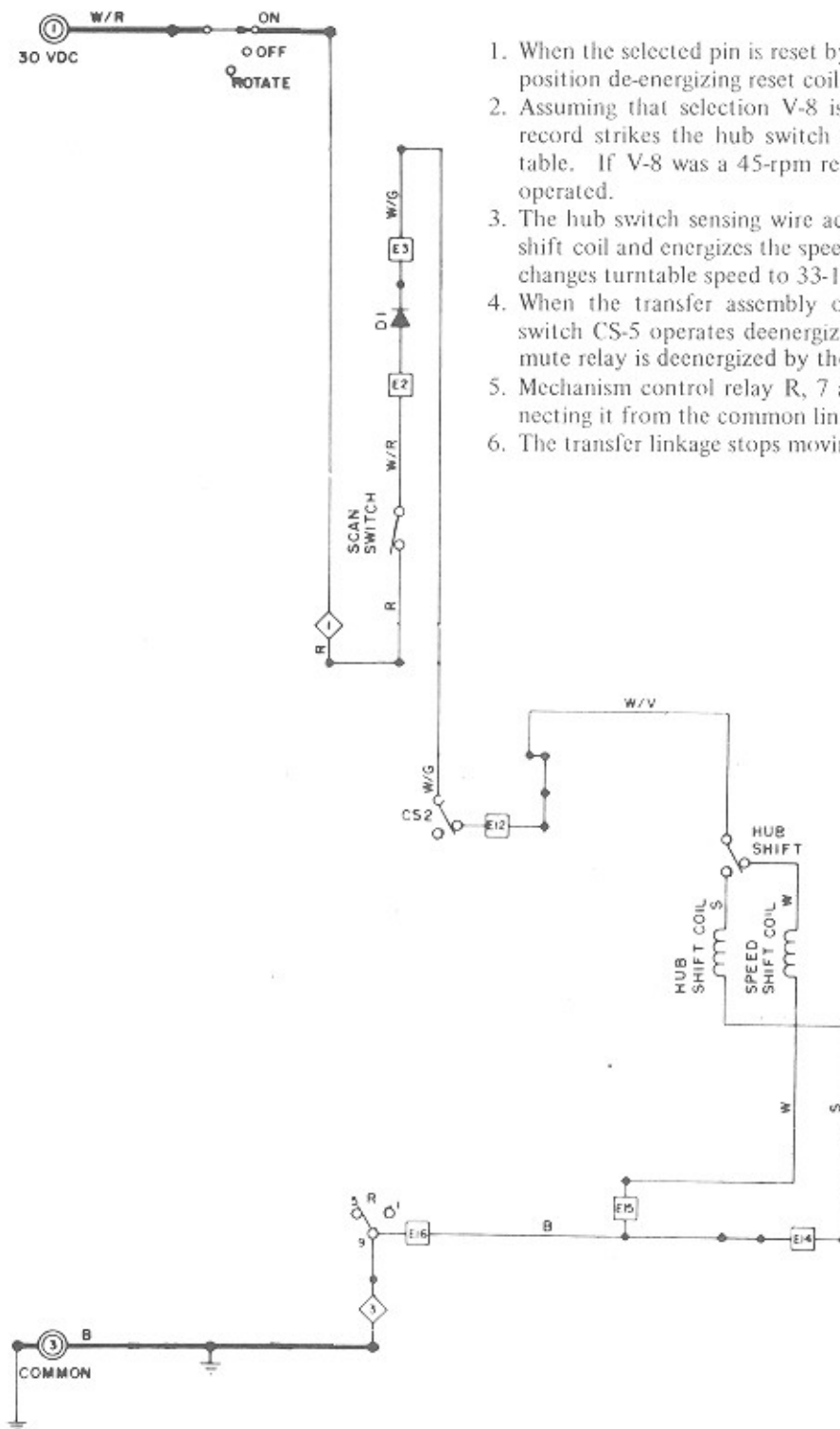


11.RECORD APPROACHES TURNTABLE



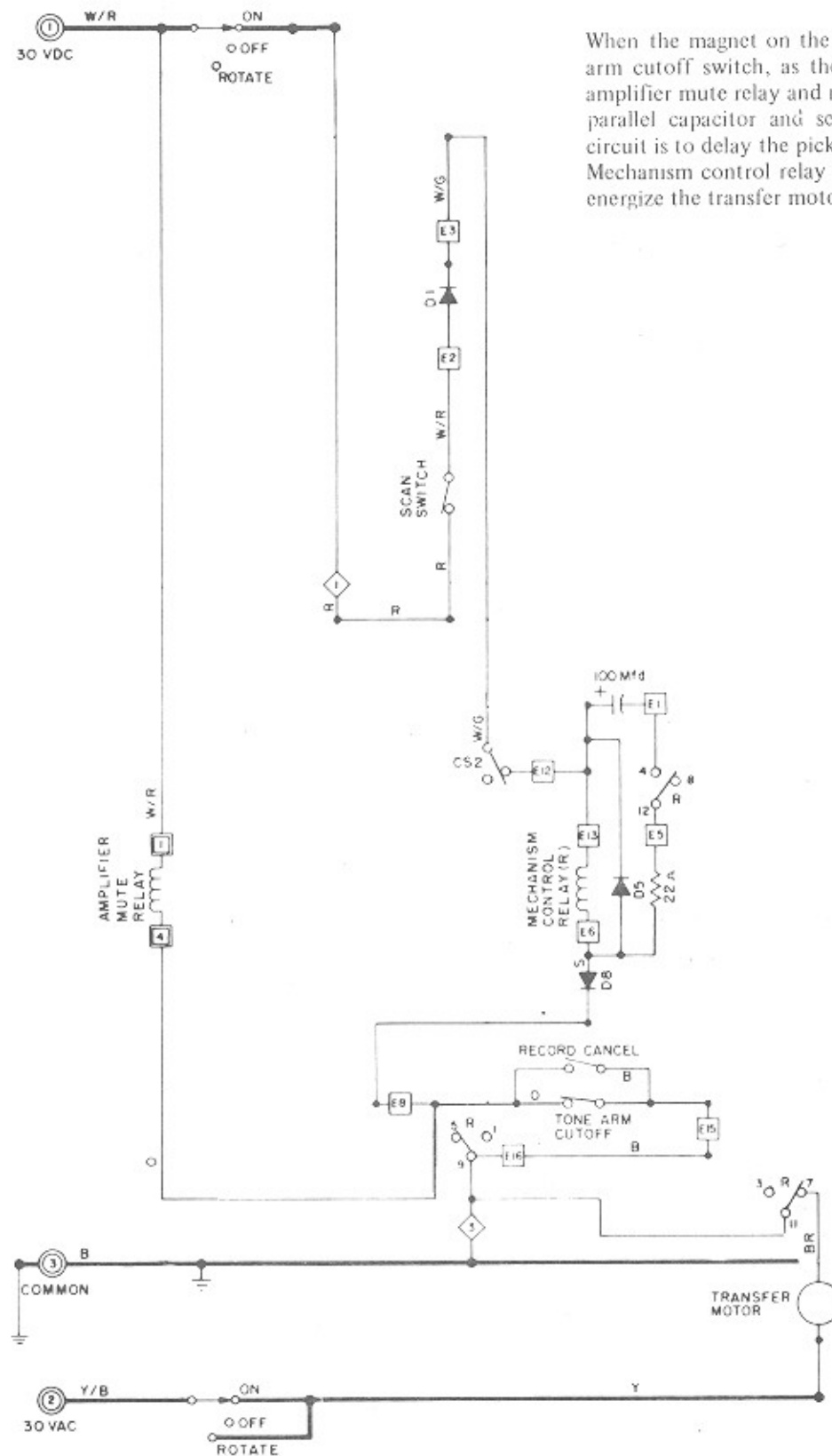
1. As the transfer motor continues to operate, cam switch CS-3 closes.
2. Cam switch CS-3 operates right side annunciator coil and right reset coil.
3. Right side reset coil plunger resets pin V-8 in the search unit pinwheel assembly.
4. A short time later, cam switch CS-3 opens and cam switch CS-4 transfers to the position opposite that shown.
5. At this time, if selection had been left hand, the toggle shift coil would be de-energized and the left side reset and annunciator coils would be operated by cam switch CS-4.

12. RECORD PLACED ON TURNTABLE



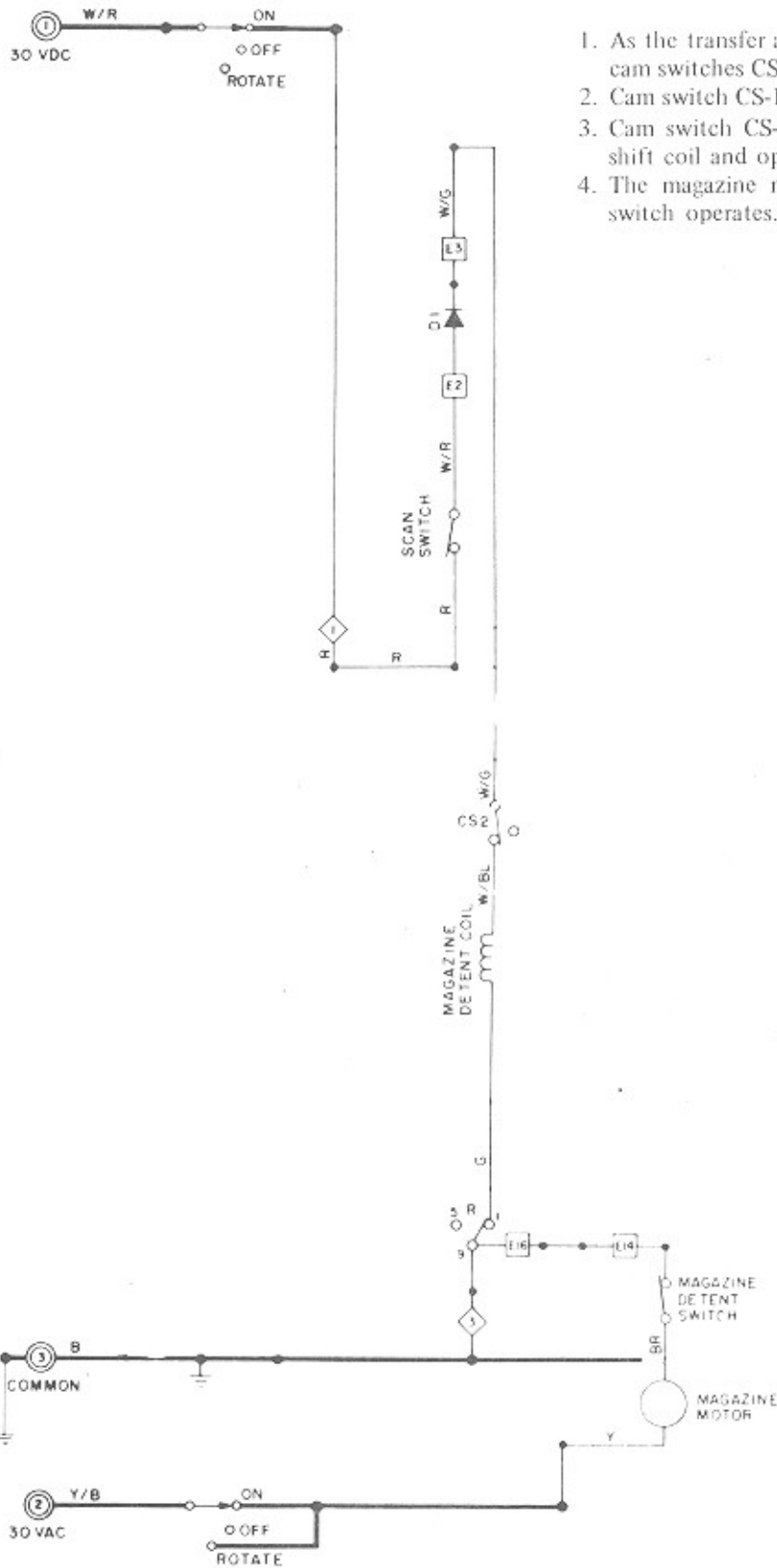
1. When the selected pin is reset by the reset coil, the stop switch returns to normal position de-energizing reset coil and right side annunciator coil.
2. Assuming that selection V-8 is a 33-rpm, 7-inch LP record, the center of the record strikes the hub switch sensing wire as the record is placed on the turntable. If V-8 was a 45-rpm record, the hub switch sensing wire would not be operated.
3. The hub switch sensing wire actuates the hub switch which deenergizes the hub shift coil and energizes the speed shift coil. This drops the large 45-rpm hub and changes turntable speed to 33-1/3 rpm.
4. When the transfer assembly operates far enough to release the record, cam switch CS-5 operates deenergizing mechanism control relay R and the amplifier mute relay is deenergized by the tone arm cutoff switch.
5. Mechanism control relay R, 7 and 11, deenergize the transfer motor by disconnecting it from the common line.
6. The transfer linkage stops moving and the record plays.

13.RECORD ENDS



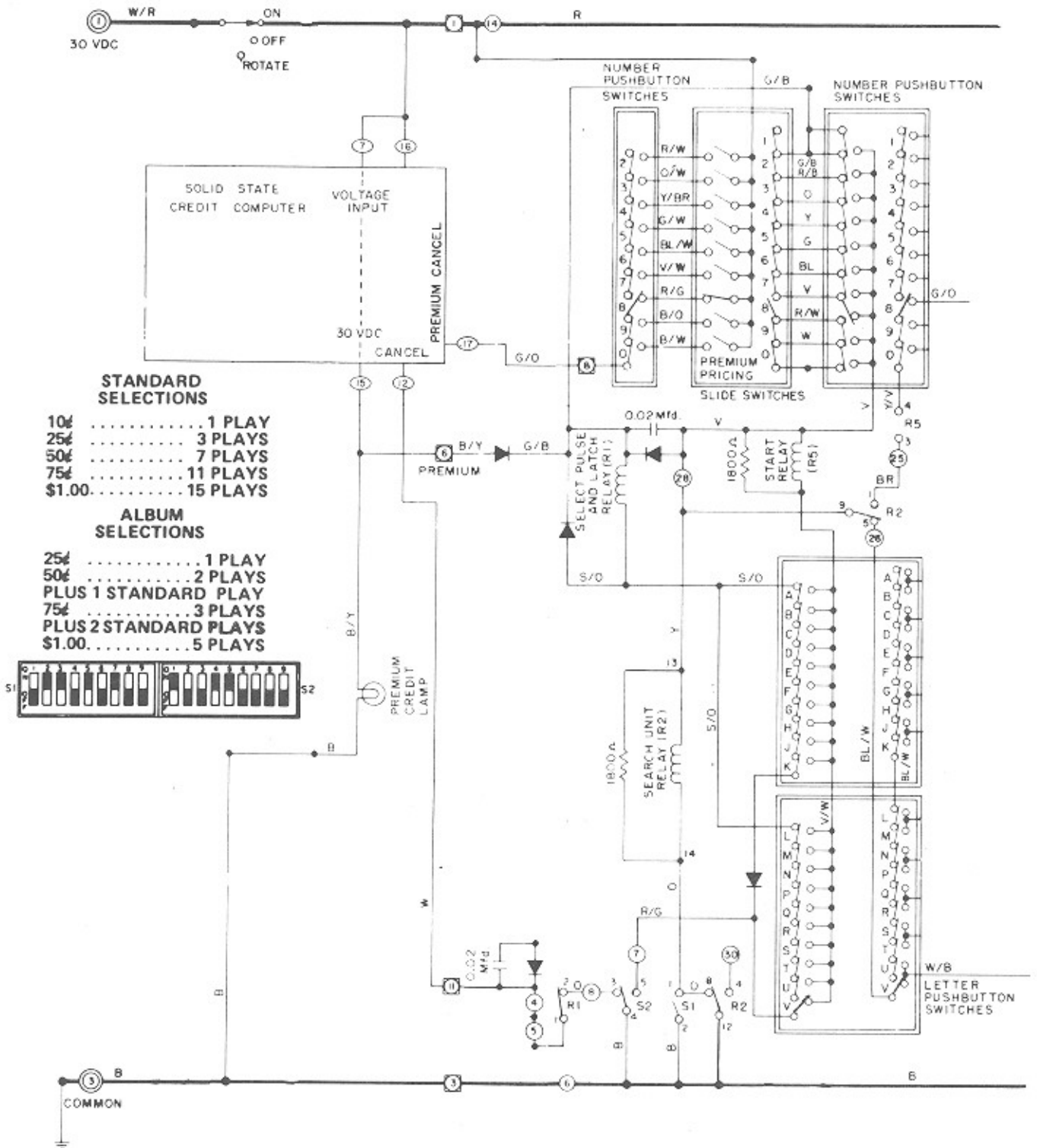
When the magnet on the underside of the tone arm operates the tone arm cutoff switch, as the tone arm tracks into the cutoff groove, the amplifier mute relay and mechanism control relay R are energized. The parallel capacitor and series resistor in the mechanism control relay circuit is to delay the pickup of the mechanism. Mechanism control relay R, 7 and 11, complete a circuit to common to energize the transfer motor.

14.RECORD REPLACED IN MAGAZINE, MAGAZINE SCANS



1. As the transfer arm places the record in the magazine, the cam operates cam switches CS-1 and CS-2.
2. Cam switch CS-1 de-energizes the turntable motor.
3. Cam switch CS-2 deenergizes mechanism control relay R and the hub shift coil and operates the detent switch.
4. The magazine motor operates until the scan control switch or stop switch operates.

15. PREMIUM PRICE AND CREDIT



1. Assume that selections 8A through 8V are all premium price. This is done by moving premium price slide switch no.8 to premium price position. Assume also that premium price has been set in the credit computer for the equivalent of three standard plays, or 25¢.
2. When the customer inserts 25¢, premium credit is established in the credit computer as in sequence 2. 30 VDC appears at contact 15 rather than at contact 4.
3. Premium credit lamp lights, and positive line is connected directly to select pulse and latch relay R1.
4. Selection occurs as in sequence 3 through 6.
5. Sprag relay S2 is energized and select pulse is applied to credit computer contact 12. Premium credit cancels through premium pricing switch 8 and number pushbutton switch 8 to credit computer contact 12.

PRINCIPLES OF OPERATION

The following paragraphs contain a brief explanation of phonograph operation. Use this text in conjunction with the troubleshooting charts and sequence of operation diagrams to isolate and correct malfunctions.

JUNCTION BOX

The junction box distributes 120-volt power to phonograph components and supplies 30-volt ac and 30-volt dc power required for phonograph operation. Power is controlled by toggle switch S1 located on the access door at the rear of the cabinet. 120-volt electrical receptacles provide for fluorescent lighting, the turntable motor, accessories, and service equipment. The primary power circuit is protected by a 10-amp circuit breaker. Transformer primary is protected by a 2-amp circuit breaker. 30-volt ac and 30-volt dc is applied to the phonograph wiring harness through a 6-circuit receptacle. Secondary circuit is protected by a 3-amp circuit breaker.

RECORD CHANGER MECHANISM

The record changer mechanism holds 100 records and plays selections on command from the selection system. Identification and location of each major component is shown below. The purpose and description of each component is explained in the following paragraphs.

Popularity Meter. The popularity meter indicates the number of times each record selection is played. The meter can register a total of 30 plays for each record. An integral plastic ring indicates 10 and 20 count points.

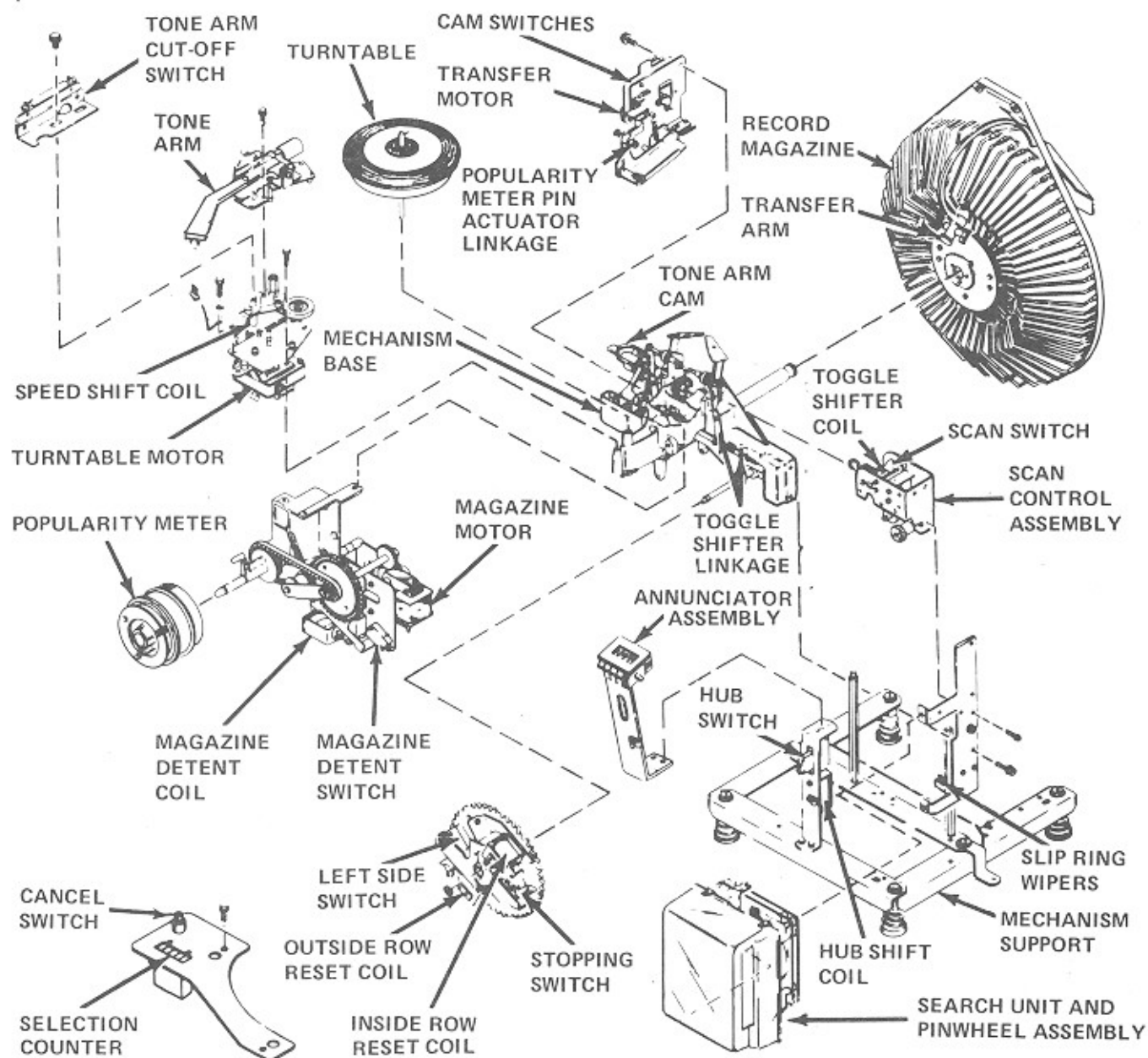


FIG. 4-1 RECORD CHANGER MECHANISM MAJOR COMPONENTS

Selection Counter. The selection counter is mounted to the left of the turntable and accumulates the total number of plays on the phonograph.

Annunciator Assembly. The annunciator assembly indicates the letter and number of the selection being played. It is mounted on the annunciator bracket located on the front of the record changer mechanism. The annunciator consists of a geared letter wheel, a geared number wheel and a solenoid-operated shutter mechanism.

Magazine, Belt and Transfer Arm. The record magazine stores 100 7-inch 33 or 45 rpm records in a circular cage. A seamless belt around the cage keeps records in position when they are at the bottom of the gripper bow bracket, above the cage. The rollers permit the transfer arm to clear the belt when removing and returning records to the magazine and also maintain belt tension.

Scan Control Assembly. The scan control assembly contains a scan coil, a micro-switch and a mechanical linkage. The assembly is mounted on the search unit bracket. When the scan coil is energized, the scan switch closes and the magazine motor starts. The scan control assembly also controls the length of scanning after all selections have played.

Search Unit and Pinwheel Assembly. The search unit and pinwheel assembly is a component of the selection system. It pushes pins on a pinwheel assembly that correspond to record selections. Refer to the selection system description for a complete explanation of search unit components and operation.

Stop Switch Assembly The stop switch assembly causes the record magazine to stop at the desired selection, determines which side of the record is to be played, and starts the transfer motor. It is mounted on the right side of the record changer mechanism directly behind the search unit.

Magazine Motor and Detent Assembly. This assembly operates the record magazine and popularity meter and locks the magazine in position. It is located at the center of the record changer mechanism, directly under the record transfer arm. The magazine motor and gear box, located behind the mounting plate, rotates the gears that operate the record magazine, stop switch gear, and popularity meter drive. The solenoid operated detent assembly locks the magazine in position.

Tone Arm Assembly. The tone arm assembly plays records after they are positioned on the turntable by the record transfer arm. The tone arm contains a stereo cartridge with a diamond stylus that is designed to track at four to five grams pressure. The stylus plugs into the cartridge for easy replacement. A seven-pin receptacle on the tone arm assembly mates with a plug to connect the cartridge to the pre-amplifier via 4-conductor shielded cable.

Turntable Motor and Plate Assembly. The turntable motor and plate assembly consists of the turntable motor and associated components necessary to rotate the turntable. The turntable motor rotates a rubber idler wheel, mounted on a spring-loaded idler arm. The idler wheel contacts the inner

rim of the record turntable. The turntable has heavy mass to reduce wow and flutter. Its upper surface is a rubberized pad to prevent records from slipping and to avoid record damage.

Automix. Automix operation enables the phonograph to play both 33 and 45 rpm records in any order. Automix components consist of a speed shift coil, a hub shift coil and a trip wire and switch on the turntable hub.

Cam Switch and Motor Assembly. (See figure 4-2)

The cam switch and motor assembly consists of the transfer motor and gear box, a switch cam, and five cam switches. A nylon cam operates cam switches CS-1 through CS-5. The function of each switch is described in Table 4-5.

SWITCH	FUNCTION
CS-1	Controls turntable motor.
CS-2	Magazine motor interlock during record transfer stops record transfer in magazine.
CS-3	Operates outside row reset coil.
CS-4	Operates toggle shift and inside row reset coil holding circuit for cancel button.
CS-5	Stops record transfer over turntable.

TABLE 4-5. CAM SWITCH FUNCTIONS

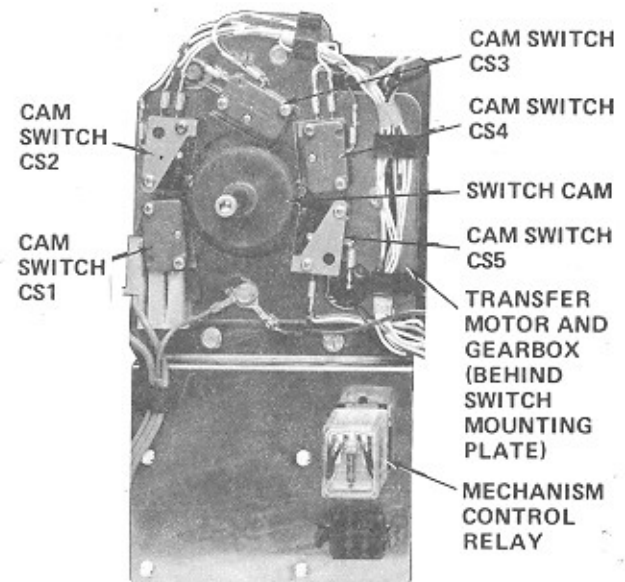


FIGURE 4-2. CAM SWITCH AND MOTOR ASSEMBLY COMPONENTS

SELECTION SYSTEM

The selection system provides a means for the customer to choose desired selections after credit is established. The selection system consists of a selector assembly and a search unit. The purpose and description of each selection system component is explained in the following paragraphs.

Selector Assembly (See figure below) The selector assembly is located above the title panel. It contains three pushbutton switch banks, a latch coil, a select pulse and latch relay, and a start relay. The pushbutton switch banks are designed A through V (no I, no O), and 1 through 0. Each pushbutton completes a circuit to a corresponding search unit commutator segment.

The latch coil mechanically latches the pushbutton switches until the search unit pushes a pin in the pinwheel assembly. Select pulse and latch relay R1 controls power to the latch coil. A delay in relay drop out due to a diode in parallel with the relay coil determines the length of the select pulse to the search unit. The select pulse permits the scan coil, and select coil to operate.

Start relay R5 completes the circuit to the search unit when both a number and letter pushbutton are operated. It also performs an interlock function in the number pushbutton circuit.

Search Unit. (See figure below) The search unit pushes pins that correspond to record selections. These pins are detected by the record changer mechanism stop switch pawl. The search unit is located on the record changer mechanism right side. The front side of the search unit printed circuit board represents the 10 numbers in the phonograph selection system. The rear side represents the 20 letters. The search unit motor drives search wipers, a sprag wheel, drive gears, and

select coil arm assembly. The motor is energized after the letter and number pushbuttons are latched on the selector assembly. When a selection is made, the search unit motor rotates the number and letter wipers on the circuit board. Each wiper searches the commutator board until the wiper blades find the hot segments that represent the desired selection. When the number wiper runs onto the "hot" segment, sprag relay S1 is energized. Sprag relays S1 and S2 keep the wiper assemblies from moving beyond the "hot" segments.

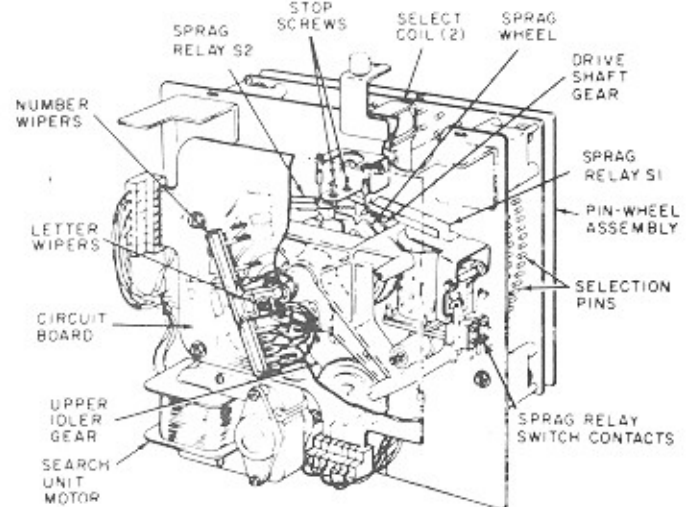


FIGURE 4-4. SEARCH UNIT MAJOR COMPONENTS

When relay S1 is energized, the large tooth at the end of the relay armature engages a notch in the sprag wheel, quickly stopping the wiper assembly. The hot side of the selection circuit is then transferred from the number side of the circuit board to the letter side by search unit relay R2.

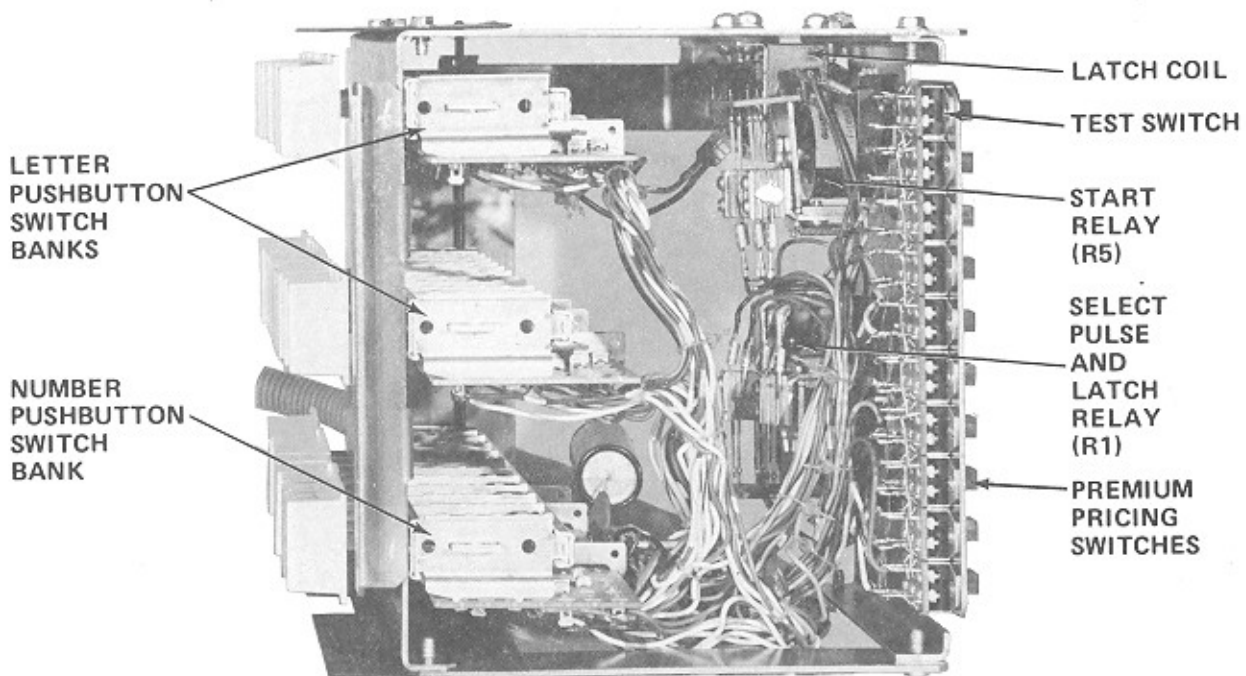


FIGURE 4-3. SELECTOR ASSEMBLY COMPONENTS

The letter wiper continues to rotate a short distance on the rear of the board. When the letter wiper runs onto the "hot" segment sprag relay S2 is energized. Relay S2 operates in a similar manner to S1, quickly stopping the letter wiper on the commutator segment. Relay S2 also de-energizes the search unit motor and energizes one of the two select coils that have been positioned by the pinwheel assembly.

The select coil plunger pushes one of the pins in the pinwheel assembly, corresponding to the chosen selection. The pinwheel assembly contains two rows of 100 1/2-inch long pins, mounted in a circular pattern. The inside row corresponds to right side selections while the outside row corresponds to left side selections. The pin is reset by a reset coil, mounted on the record changer mechanism stop switch.

The stop screws provide an adjustment of the clearance between the armature teeth of their respective sprag relays and the sprag wheel high points when the relays are de-energized.

CREDIT AND PRICING SYSTEM

The credit and pricing system validates coins deposited in the phonograph coin slot and establishes credit for record play. The system consists of a slug rejector and coin switches, premium pricing switches, and a credit computer. The identification and location of each component is shown in figure below. The purpose and description of each major component is explained in the following paragraphs.

CREDIT COMPUTER

The Rowe credit computer is a solid state credit system developed specifically for jukebox operation. Located on the middle of the rear wall of the phonograph, the credit computer accumulates credit for deposits up to 255 standard plays. There are no moving parts to wear out and no bonus relays, 2 quarter adapter, pulse chopper, 2 quarter wheel or such parts required. See "Setting Prices" in Section 2 for additional information.

Input signals are applied to the CS (coin switch) 1, CS2, CS3, CS4, and CS5 leads of the custom MOS circuit through appropriate interface circuits. One programming switch (S1-3) within credit computer permits these input signals to be weighted 1, 2, 5, 10, 20 (i.e. nickel, dime, quarter, half dollar, dollar) or to be weighted 1, 2, 4, 8, 16 (some foreign coin ratio such as 50 pf, 1DM 2 DM).

If programming switch S1-3, is off and coin switch closure on CS3 input line occurs, credit is established which is 5 times greater than minimum coin value. (i.e. 5 pulses stored). When a switch closure occurs on CS4 credit is established which is 10 times greater than minimum coin value (i.e. 10 pulses stored) etc.

As coins are deposited in acceptable denominations and in any sequence, deposits are weighted, by connection to specific input terminals, and deposit credit is accumulated (i.e. held in escrow).

Basic price of play can be established by setting additional programming switches (S2-5, S2-6, S2-7) within computer.

Basic price of play can be set to 1, 2, 3, 4, 5, 6, 8 or 10 times the minimum coin value (MCV). When weighted for American money, price of play can be set to 5¢, 10¢, 15¢, 20¢, 25¢, 30¢, 40¢, or 50¢.

When accumulated deposit credits equal or exceed the programmed price of play, credit chip provides an output signal to light standard play credit lamp ("Make Standard Selection"). It also energizes the selector latch solenoid enabling phonograph selector.

When a standard selection is made by phonograph patron a "standard cancel" signal is generated which is applied to appropriate input of credit chip (through necessary interface circuit). The "Cancel" signal cancels or erases appropriate number of minimum coin value (MCV) pulses equivalent to programmed price of play. (If set for 25¢ price of play, a standard cancel signal will erase 5 MCV pulses.)

If an over deposit is made (assume 55¢ deposited by mixed coin denominations, and 25¢ standard price) a standard selection may be made, which leaves 30¢ credit held in escrow. As long as credit remaining still equals or exceeds programmed price of play, credit computer permits an additional selection to be made. If a second "standard" selection is made, 5 additional MCV pulses (25¢) are cancelled. When the remaining MCV deposit credits are less than programmed price of play, credit chip removes the latch solenoid signal and removes the signal which lit "standard credit" lamp in the phonograph. Since two standard play selections were made (totalling 10 MCV pulses) and 55¢ was deposited (totalling 11 MCV pulses) one MCV pulse (5¢) remains in storage. If additional coin deposits (nickels or dimes) accumulate an additional 20¢, these deposits and the 5¢ held in escrow will enable another "standard play" selection.

In addition to the ability to set standard price to 5¢, 10¢, 15, 20, 25, 30, 40, or 50¢ it is possible to add bonus plays at predetermined levels of deposit by setting additional programming switches (S2-8, S2-9). First bonus level may be set to 2, 3, 4, or 5 times the MCV (i.e. 10¢, 15¢, 20¢, or 25¢). When first bonus level has been programmed, a second, third, and fourth bonus level exists at 2, 3, and 4 times the level at which first bonus level occurs. For instance, when American coinage is used, the first bonus level is set to 25¢ (5MCV). This means that when 25¢ has been deposited it is possible to provide bonus plays, in addition to the standard play procedure. Since additional bonus levels are possible at 2, 3, and 4 times the first bonus level, it is possible to add bonus plays at the first bonus level (25¢), and at 50¢, 75¢ and \$1.00 accumulated deposit levels. From 0 to 3 bonus plays may be added at first (25¢) and third (75¢) bonus levels. From 0 to 7 bonus plays may be added at second (50¢) and fourth (\$1.00) bonus levels. Bonus plays are accumulated in another memory register within credit chip.

When programmed for standard play credits and bonus plays, record selection process cancels bonus plays first. When sufficient phonograph selections have been made to

cancel all accumulated bonus plays, subsequent record selections erase the appropriate number of MCV pulses.

When a bonus play is provided, it is necessary to deposit sufficient coinage totaling the standard play price, before an additional standard play is added. For example, if standard price was programmed for 15¢, deposits totalling 15¢ would result in one play credit (15¢ or 3 MCV pulses stored). If one bonus play was programmed at 25¢, then patron would get one play for the first 15¢ deposit and a bonus play for inserting enough money to reach the (1st) 25¢ bonus level. Having provided a bonus at the 25¢ accrued deposit, it now requires additional coin deposits of 15¢ to receive next standard play credit. (Which would occur at 40¢ total deposit). If no bonus credit was provided at 25¢, the first 15¢ would provide a standard play and the over-deposit (10¢ extra) would remain in escrow. Insertion of an extra 5¢, would then add to the 10¢ deposit in escrow to provide a second standard play.

It is also possible to accommodate premium (album) priced records through programming switches. When selections are made which are "premium" priced, the cancel signals will erase 2, 3, 4, or 5 accumulated play credits, depending on programming switch settings. Depending on the "premium" price programmed, credit chip has a premium selection output to enable premium selections and to light premium credit lamp ("Make any Selection"). When insufficient credit exists for "Premium" price programmed, premium selections are inhibited and "Make any Selection" lamp goes out.

The Credit Computer also provides an output signal which can be used with an (accessory) item - the Print-Out Money Meter. The money pulse signals from Credit Computer occur for each deposit, and appear as a series of pulses of Minimum Coin Value (MCV). For example, when a nickel is deposited (minimum coin value) a single MCV pulse is provided to the money meter. When a dime is deposited, two (MCV) pulses occur. When a quarter is deposited, five (MCV) pulses occur. These pulses are registered by the money meter.

Slug Rejector and Coin Switches. The slug rejector takes good coins and rejects slugs and bad coins. It takes nickels, dimes, quarters and half-dollars.

The coin switches establish credit in the credit computer. They are located at the bottom of the slug rejector. They are operated by the coins as they fall into the cash box. A good coin moves the switch lever, closing the switch and completing a circuit to the credit computer board.

Premium Pricing Switches. The premium pricing switches are located on the selector assembly. Each switch represents one number selection group and may be set for premium (album) price or regular price as desired. A test switch is also provided. This switch can be used as a "free play" switch.

SOUND SYSTEM

The phonograph sound system translates stylus vibration into electrical voltage, amplifies the voltage and the speaker converts it into sound. The sound system consists of a stylus and cartridge, a stereo preamplifier and amplifier unit, a speaker system, a volume control and an output transformer package. Identification and location of each major component is shown in figure 4-5. The purpose and description of each major component is explained in the following paragraphs.

Stylus and Cartridge The stylus and cartridge convert mechanical movement into equivalent electrical voltage. The unit is mounted on the record changer tone arm. This output voltage is transmitted through shielded cable to the pre-amplifier.

Preamplifier and Amplifier (See page 4-29). The preamplifier units amplify phonograph cartridge output and drive the speaker system. The latest concepts in silicon transistor circuitry are designed into the 64-watt stereo system. It delivers a full 32 watts rms power per channel. Its wide frequency response and low distortion assure good record reproduction. The unit incorporates automatic volume control (AVC) and automatic quality control (AQC).

The output stage is coupled to the speakers. Treble range and bass boost controls are provided on the preamplifier chassis to compensate for differences in room acoustics. A mute relay silences the amplifier while a record is being transferred to or from the turntable. Preamplifier circuitry is completely solid state for durability and long service life.

Protection is included for voltage transients, excessive heat and accidental shorting of speaker leads.

Preamplifier. The preamplifier board is the same for both the 64 and 120 watt amplifiers. It is a component part mounted on the power amplifier.

The preamplifier amplifies the phonograph cartridge ac output voltage to drive the power amplifier. The preamplifier consists of two identical, independent audio channels. Right channel component designations end in the letter R, while left channel components end in the letter L. Treble range and bass boost controls are provided to enable adjustment of frequency contour. All components are mounted on a single printed circuit board.

64 Watt Amplifier. The 64 watt power amplifier features Darlington output stages and a fully regulated and surge protected power supply. Driver boards, one for each channel, plug in for ease of replacement and are completely interchangeable between channels or in other 64 watt amplifiers.

Integrated circuit Z2 regulates the 24 volts supplied to the preamplifier board. The input signal from the pre-amplifier is coupled through R28, C18, and C17 to differential amplifier 97. Transistors Q5 and Q6 are connected as regulators to arrest any input signal in excess of 5 volts. Resistor R28 protects Q5 and Q6.

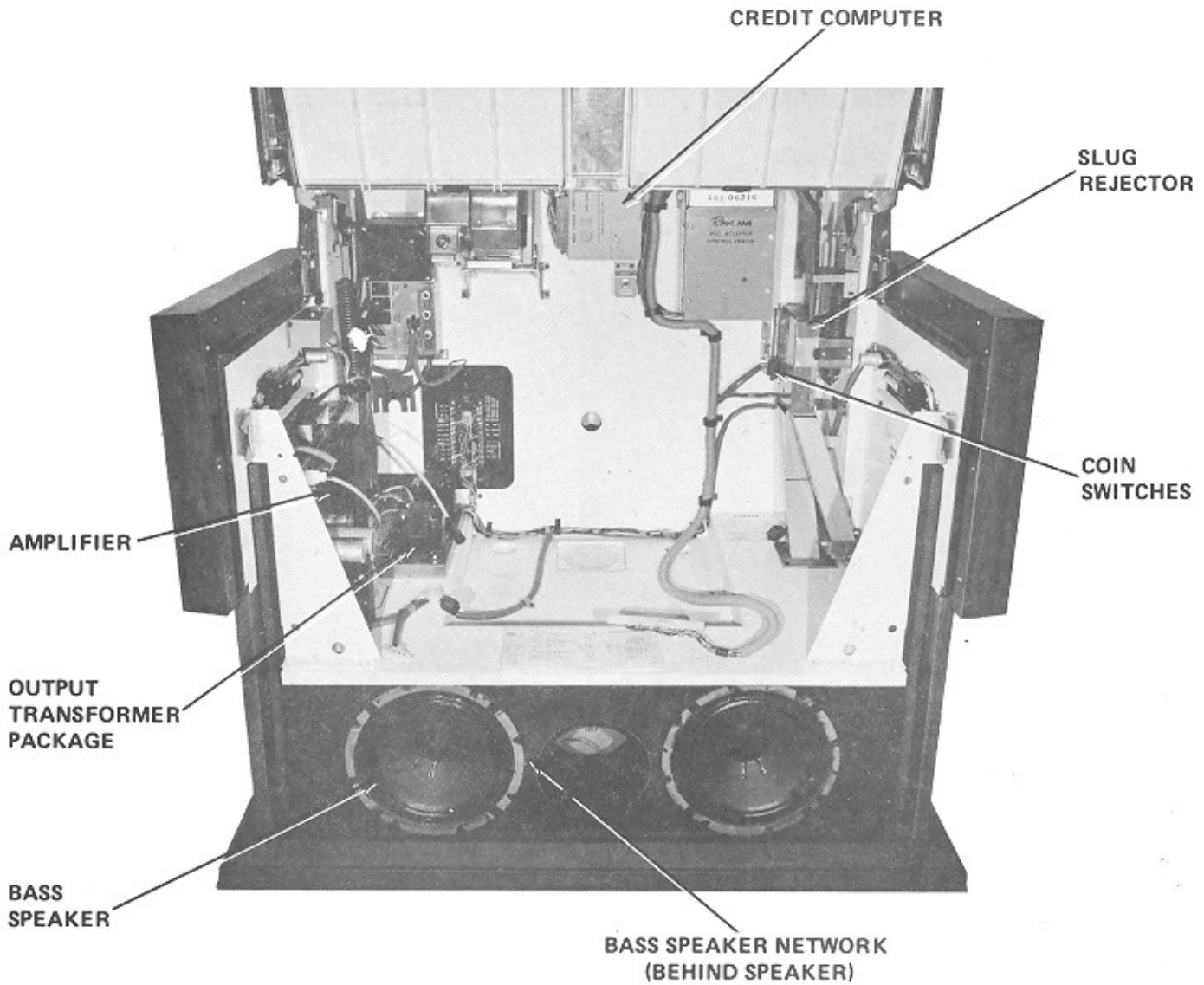
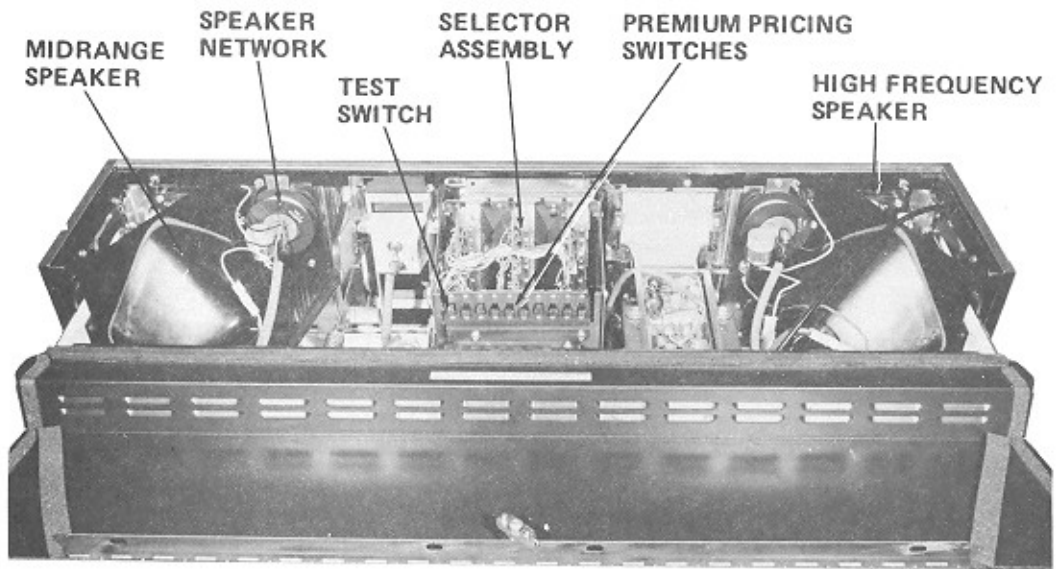


FIGURE 4-5. CREDIT SYSTEM AND SOUND SYSTEM COMPONENTS

Differential amplifier Q7 provides drive to driver transistor Q8 and sets the D.C. voltage at the output to zero enabling the amplifier to be coupled directly to the speakers.

Transistor Q8 functions as a high gain, common emitter driver with transistor Q9 performing as a current limiting device. Transistor Q8 handles the full load voltage swing to the output transistors but is isolated by resistors R11 and R19. These resistors protect Q8 in the event of an output transistor failure.

Capacitor C8 and resistor R21 provide A.C. feedback to differential amplifier Q7 from transistor Q8. Resistors R20 and R21 provide both A.C. and D.C. feedback to Q7 from the output signal delivered to the load, achieving maximum stability under all load conditions. Resistor R20 provides isolation between the driver A.C. feedback and the output load. To reduce turntable rumble, capacitors C17 and C18, and resistor R27 form a bandpass filter which attenuates signals below 50 Hz.

Power output devices Q1 and Q2 are mounted on a heat sink. These complementary darlington devices, although more reliable than conventional designs are fused to prevent damage to driver board components. See page 5-29 for

troubleshooting and replacement data on these devices.

Resistor R19 and regulator Z1 maintain the output transistors in class AB mode.

Driver board transistor Q4 is part of the positive clamp circuit. Output device Q1 draws current through resistor R2. Driver board transistor Q4 drops the base of output device Q1 to below R2, limiting current to a safe value. Driver board transistor Q3 acts on the negative signal component in the same manner as positive clamp Q4.

Output Transformer Package (See figure 4-7). The transformer package enables the amplifier to operate 70-volt speaker lines for extension speakers, and provides Rowe/AMI Stereo Sound. The package consists of two output transformers, a power level control, and associated parts, mounted on a single chassis. The chassis sits on the floor of the cabinet, left of the mechanism. The unit is electrically connected between the amplifier and speaker system. Output transformer secondary connections are brought out to terminal strips to allow operation with low-impedance extension speakers. A 6-position switch, at the center of the chassis, controls phonograph speaker level relative to extension speaker level.

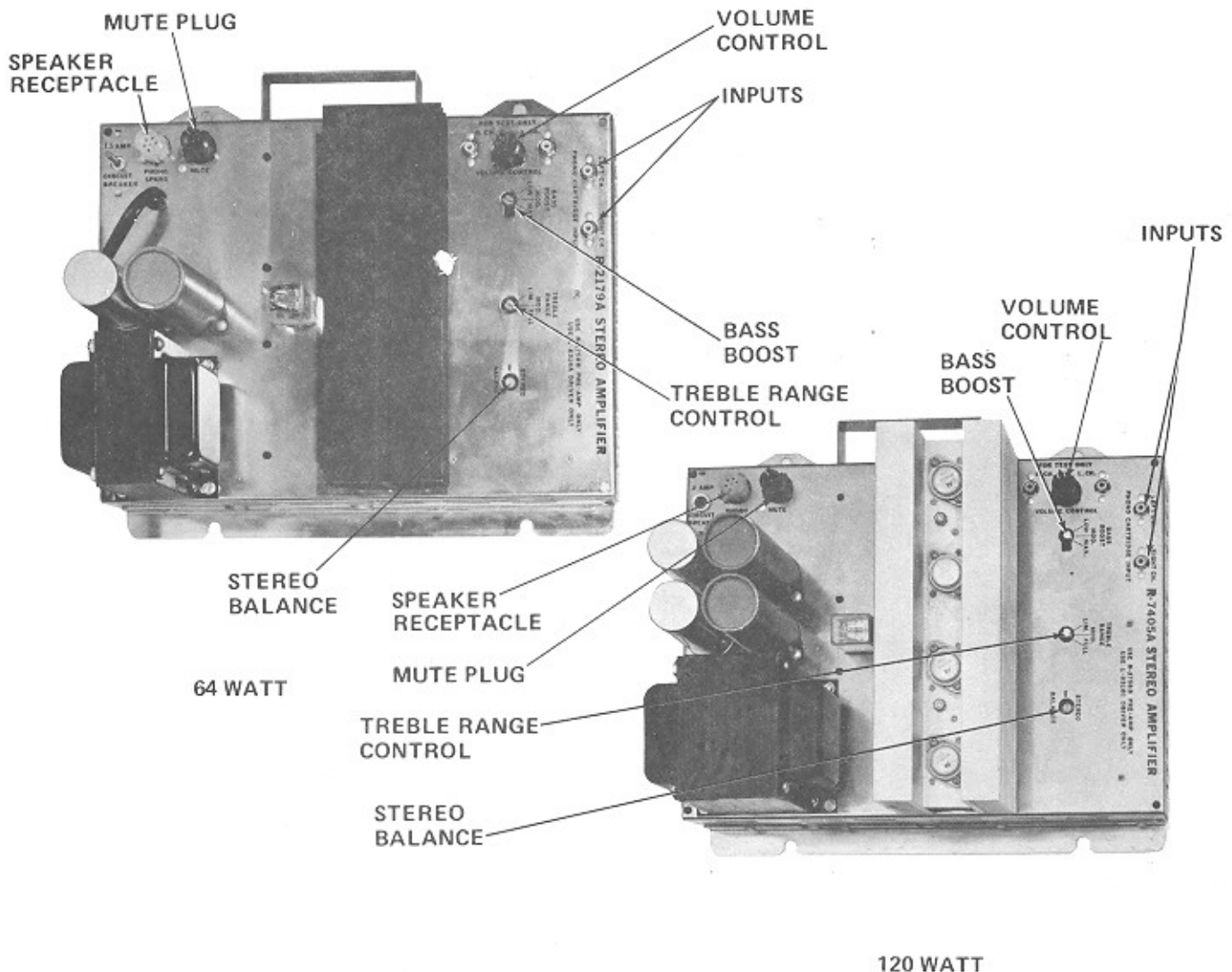


FIGURE 4-6. STEREO AMPLIFIERS COMPONENTS

Speaker System. The speaker system consists of two 10-inch low frequency speakers, two 6-inch mid-range speakers, two 3-inch tweeters for high frequencies, and coupling capacitors.

The 10-inch, heavy duty speakers are mounted in a duct-tuned enclosure at the bottom of the cabinet. The 6-inch mid-range speakers and the 3-inch tweeters are mounted at

the top of the cabinet.

Two-Wire Volume Control. A Rowe/AMI first, the two-wire volume control simplifies large, complex installations and saves cost. Redesigned preamplifier circuitry permits remote volume control operation using two unshielded wires. Any wires can be used - there are no special requirements for conductor size or shielding.

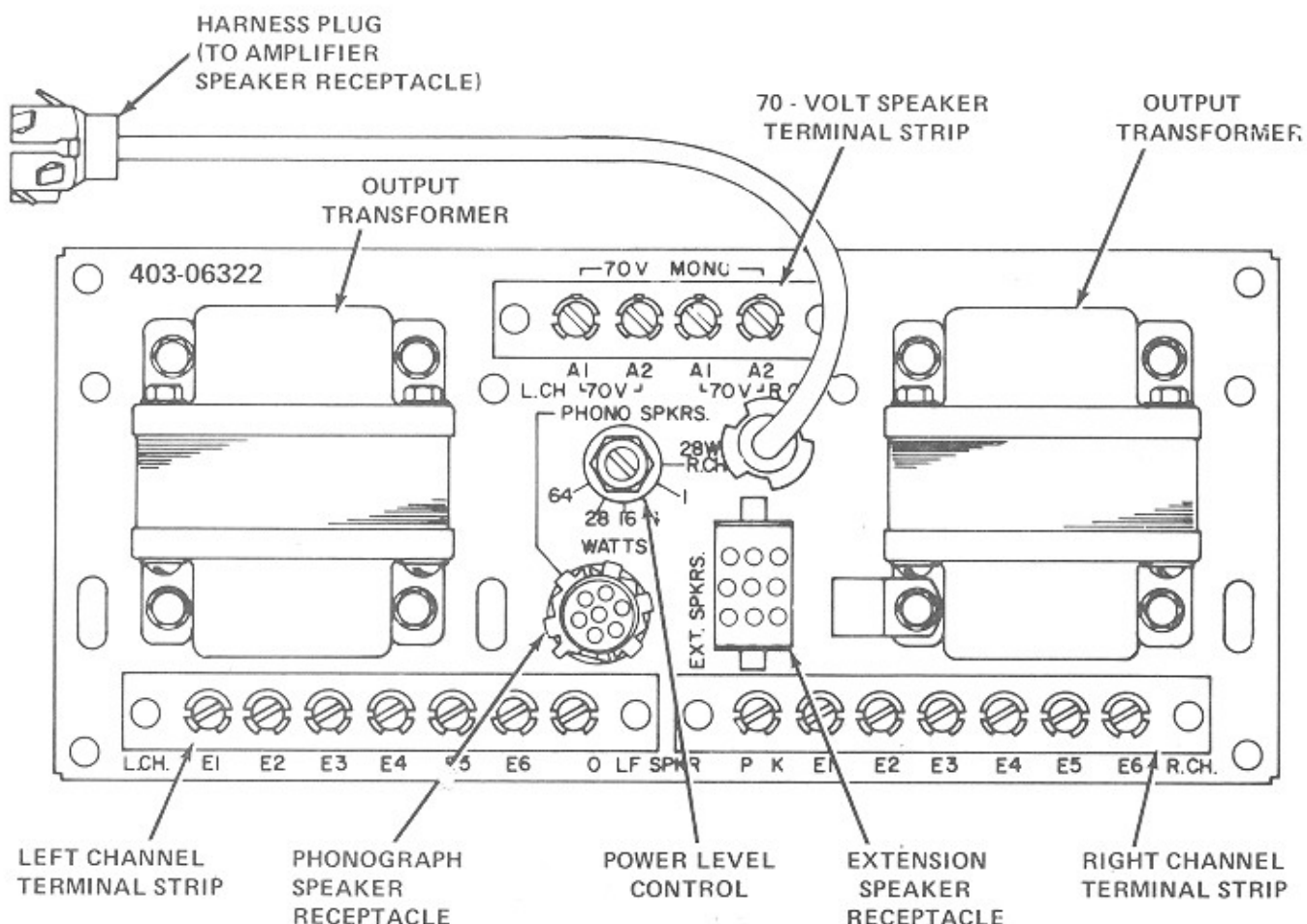


FIGURE 4-7. OUTPUT TRANSFORMER ACCESSORY PACKAGE