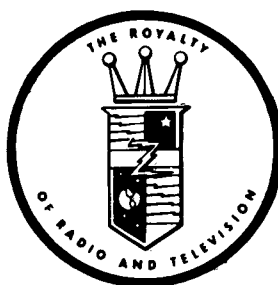




**SPACE-COMMAND**



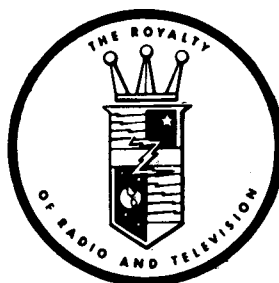
**200 SERIES**

**400 SERIES**

**SERVICE MANUAL**



**SPACE-COMMAND**



**200 SERIES**

**400 SERIES**

# **SERVICE MANUAL**

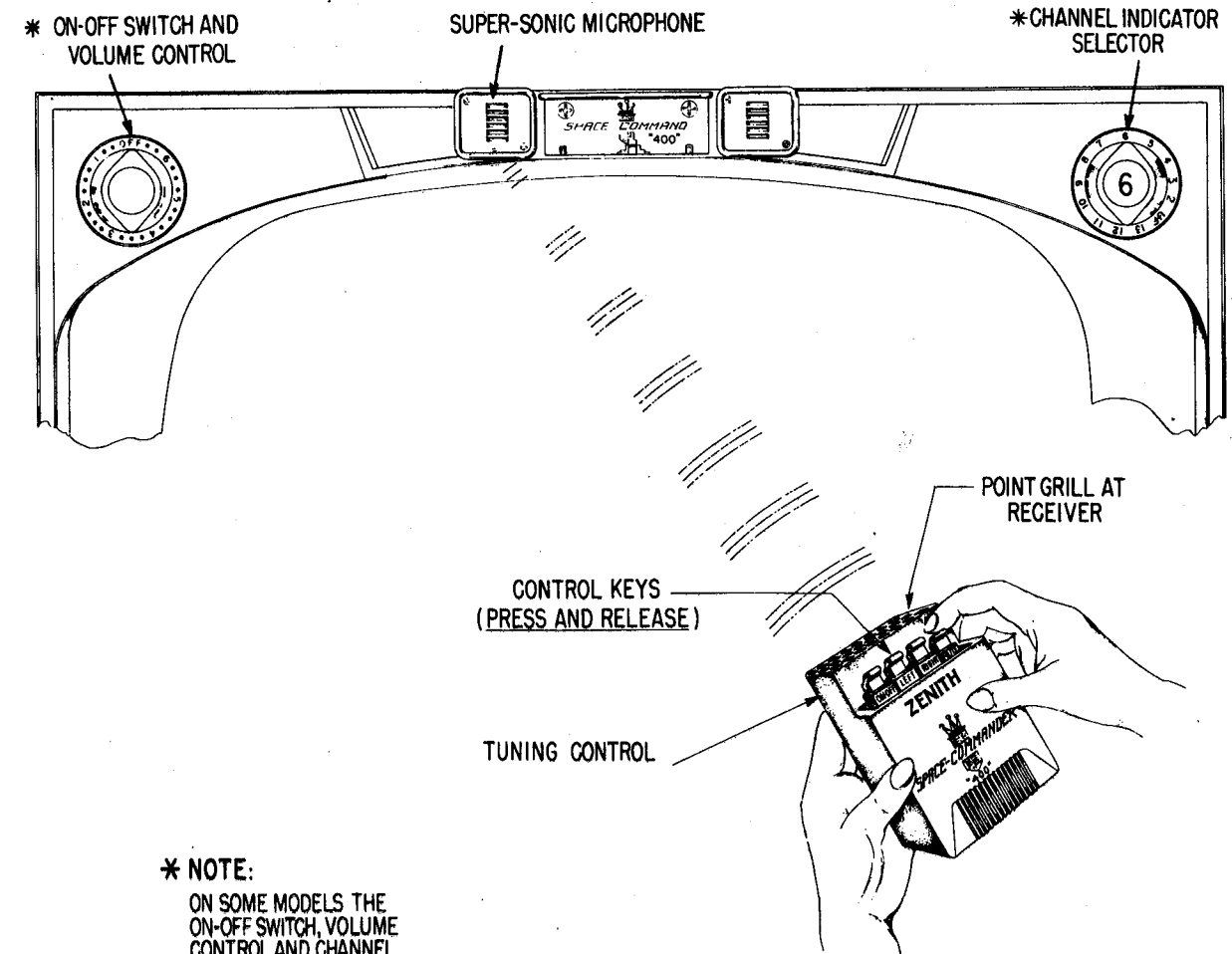


Figure 1—Controls

## TECHNICAL INFORMATION

This manual contains the necessary information for the service technician to maintain and service the SPACE-COMMAND.8 tube "400" series and the 5 tube "200" series remote control units.

Both units are similar in design except for operating frequencies and components related to the functions performed.

The SPACE-COMMAND Remote Control consists of the following units:

|                          |                                  |  |
|--------------------------|----------------------------------|--|
| 1 Remote control chassis | #S-24720<br>#S-40217             | (8 Tube Chassis)   |
| 1 Motor drive assembly   | #S-40511<br>#S-24718<br>#S-24703 | (5 Tube Chassis)<br>(8 Tube Chassis)<br>(5 Tube Chassis) |
| 1 Tuning control unit    | #S-24702<br>#S-24717             | (4 Keys)<br>(2 Keys)                                     |
| 1 Microphone             | #S-24916                         |  |

Super-sonic vibrations in the region of 40 KC are radiated from a remote tuning control when keys are pressed to mechanically vibrate each tuning rod. (Figure 1.)

These inaudible sound waves are picked up by a microphone located at the top left center of the picture tube escutcheon on the TV receiver. The microphone changes the super-sonic waves into electrical energy. (Figure 1.)

The microphone is coupled into a control chassis containing a high gain 40 KC amplifier. The control chassis contains limiter, discriminator and integrator circuits for frequency detection and noise discrimination; control tubes for relay operations and power supply. The control chassis is located within the TV receiver cabinet adjacent to the TV chassis.

The tuning rods within the tuning control unit have the following frequencies and operations:

|                       | Frequency | Function                                |
|-----------------------|-----------|---|
| Four Function Control | 37.75 KC  | Turn set "ON" or "OFF"                  |
|                       | 38.75 KC  | Mute or restore sound                   |
|                       | 41.25 KC  | Turn channel selector to the right      |
|                       | 40.25 KC  | Turn channel selector to the left       |
| Two Function Control  | 41.25 KC  | Mute or restore sound                   |
|                       | 40.25 KC  | TUNE—Turn channel selector to the right |

A motor drive assembly is mounted on the rear of the turret tuner and turns the tuner drive shaft for channel selection. (Figure 7.)

An AUTOMATIC-MANUAL switch is located at the rear of the control chassis. (Figure 2.) It is provided to disengage the control chassis and motor drive assembly circuits for manual operation in the event of remote control failure.

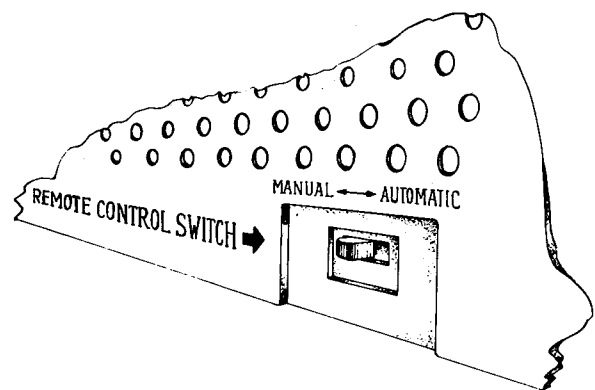


Figure 2—Automatic-Manual Switch at Cabinet Rear

## Control System

Block diagrams Figures 4 and 5 show the control systems.

## THEORY

### Microphone

(Figures 12, 16 and 17).

The microphone used in the Zenith SPACE-COMMAND is of the high impedance condenser type designed for broad peak response at approximately 40 KC. It is capacity coupled thru C1 to the grid of 6CB6 (V1).

### Amplifier

(Figures 16 and 17).

6CB6 (V1) and 6AU8 (V2) form a three stage high gain amplifier to provide limiting at low input signals. The amplifier is tuned to 39.5 KC which is midway between the lowest frequency key, ON-OFF (37.75 KC) and the highest frequency key, Channel Selector RIGHT (41.25 KC). Resistors R4, R5 and R7 are employed to eliminate parasitic oscillation in these stages. Inductance L1 and capacitor C3 form a resonant circuit at 39.5 KC. The signal voltage developed across L1 and C3 is capacity coupled to the pentode section of 6AU8 (V2) for further amplification. L2 and C5 form a resonant plate load circuit tuned to 39.5 KC. The triode section of 6AU8 (V2) triples the frequency ( $3 \times 39.5 = 118.5$  KC) in its plate circuit. Using the 3rd harmonic in this manner improves limiter efficiency and reduces possibility of spurious oscillation.

**NOTE:** Due to lower gain and band width requirements, resistance coupling is used between 6AU8 (V2A) and 6AU8 (V2B) in the 5 tube remote control. The mid-frequency of this amplifier is 40.75 KC. Tripling takes place in the limiter plate circuit.

### Limiter

(Figures 3, 16 and 17).

The 6BN6 (V3) circuit limits the A.C. output voltage across plate load inductances L4 and L6. Extraneous noise of greater amplitude is cut off at this point. The system assures proper control under extreme range of input signal amplitude and allows the amplifier to operate at maximum gain for greatest sensitivity.

The limiter plate circuits (L4, C12) and (L6, C20) are tuned to 122.25 KC and 114.75 KC respectively.

Plate circuit capacitor C11 balances the stray capacity in wiring and chassis components to assure that equal voltages are applied to each discriminator circuit.

The limiter 6BN6 (V3) in the 5 tube control chassis has its output circuit L3, C10 tuned to 122.25 KC.

## Frequency Discriminator and Rectifier

(Figures 3, 6, 16 and 17).

The discriminator action in the Zenith SPACE-COMMAND is similar to conventional FM circuits. Although no audio modulation is applied to the carrier signal, the principal of frequency excursion still applies since the discriminator zero or center frequency is set 1.5 KC away from the key frequencies.

### 8 Tube Control Chassis

The 6AL5 (V4) and 6AL5 (V7) form a frequency discrimination and rectifier system. L4 and L6 are primary windings with L5 and L7 the secondary windings respectively of the discriminator coils. The following chart lists the final key frequencies and the discriminator frequencies:

| Discriminator Peak Frequency (3rd Harmonic) | Key Frequency   | Discriminator Center Frequency |
|---|-----------------|--------------------------------|
| 113.25 KC                                   | ON-OFF 37.75 KC | 114.75 KC                      |
| 116.25 KC                                   | MUTE 38.75 KC   |                                |
| 123.75 KC                                   | RIGHT 41.25 KC  | 122.25 KC                      |
| 120.75 KC                                   | LEFT 40.25 KC   |                                |

**NOTE:** There is a difference of 1.5 KC between the discriminator center frequency and the third harmonic of the transmitter key frequency.

For example, if the MUTE key is pressed (38.75 KC) its 3rd harmonic (116.25 KC) will be impressed across the discriminator circuit tuned to 114.75 KC. Due to normal discriminator action, a pulsating rectified voltage across diode load resistors R25 and R21 is developed. The other keys develop a voltage in similar manner across their respective diode load resistors.

The use of a balanced discriminator effectively cancels out "ON FREQUENCY" wide band noise pulses because of their symmetrical distribution around the discriminator center frequency.

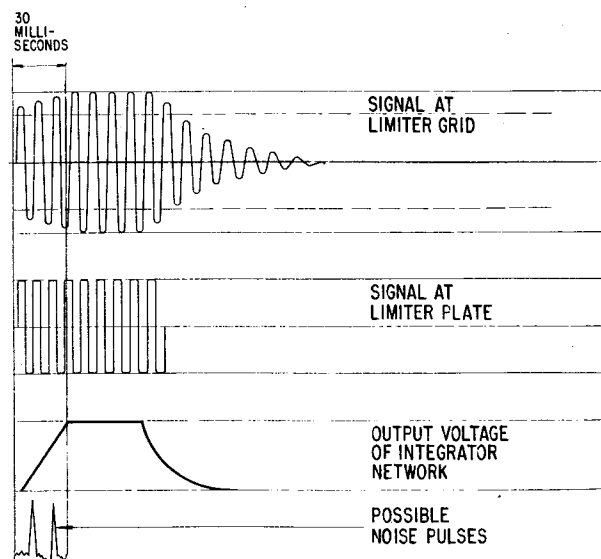


Figure 3—Signal Translation

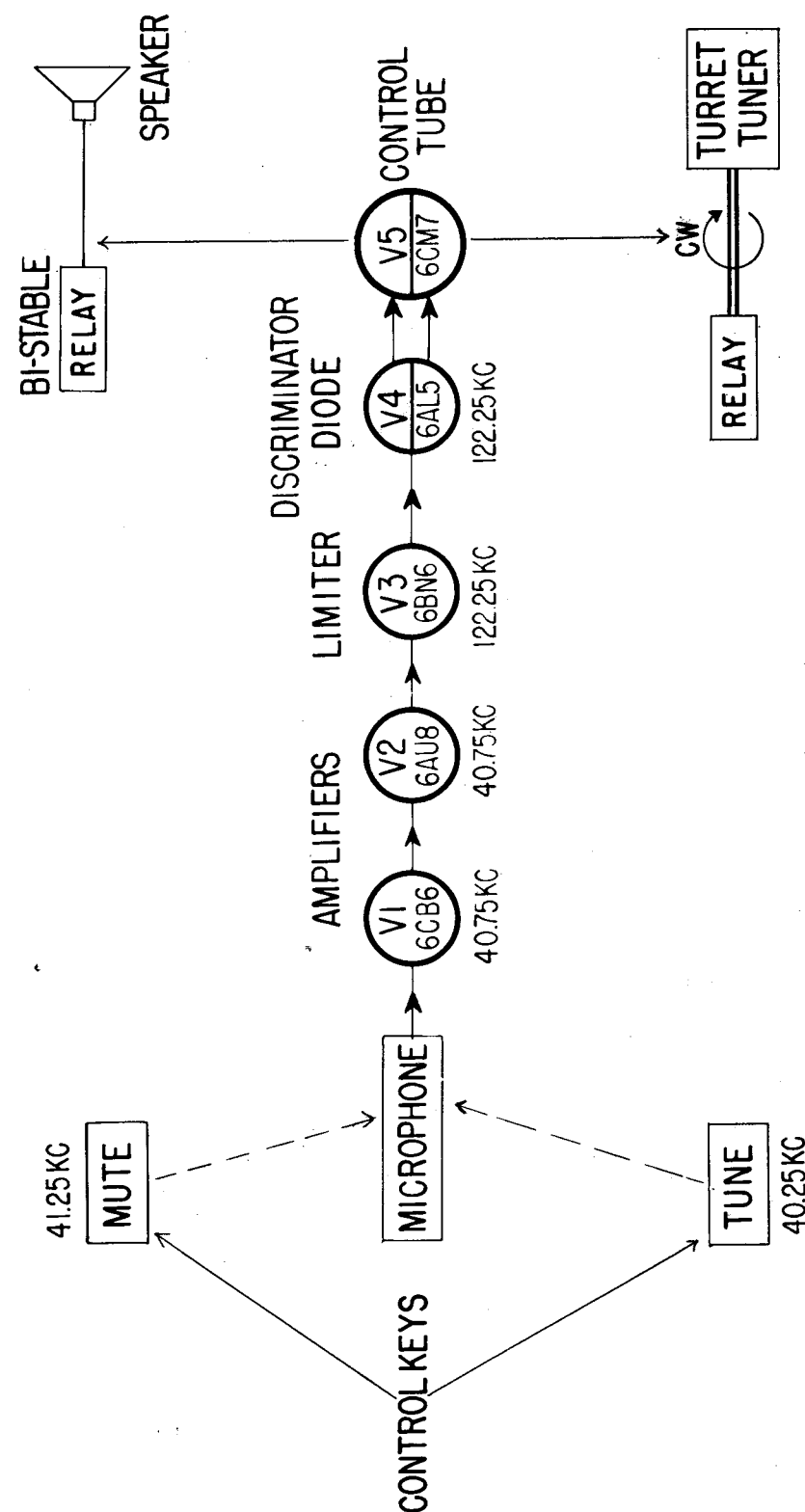


Figure 4—Remote Control Block Diagram (5 tube unit)

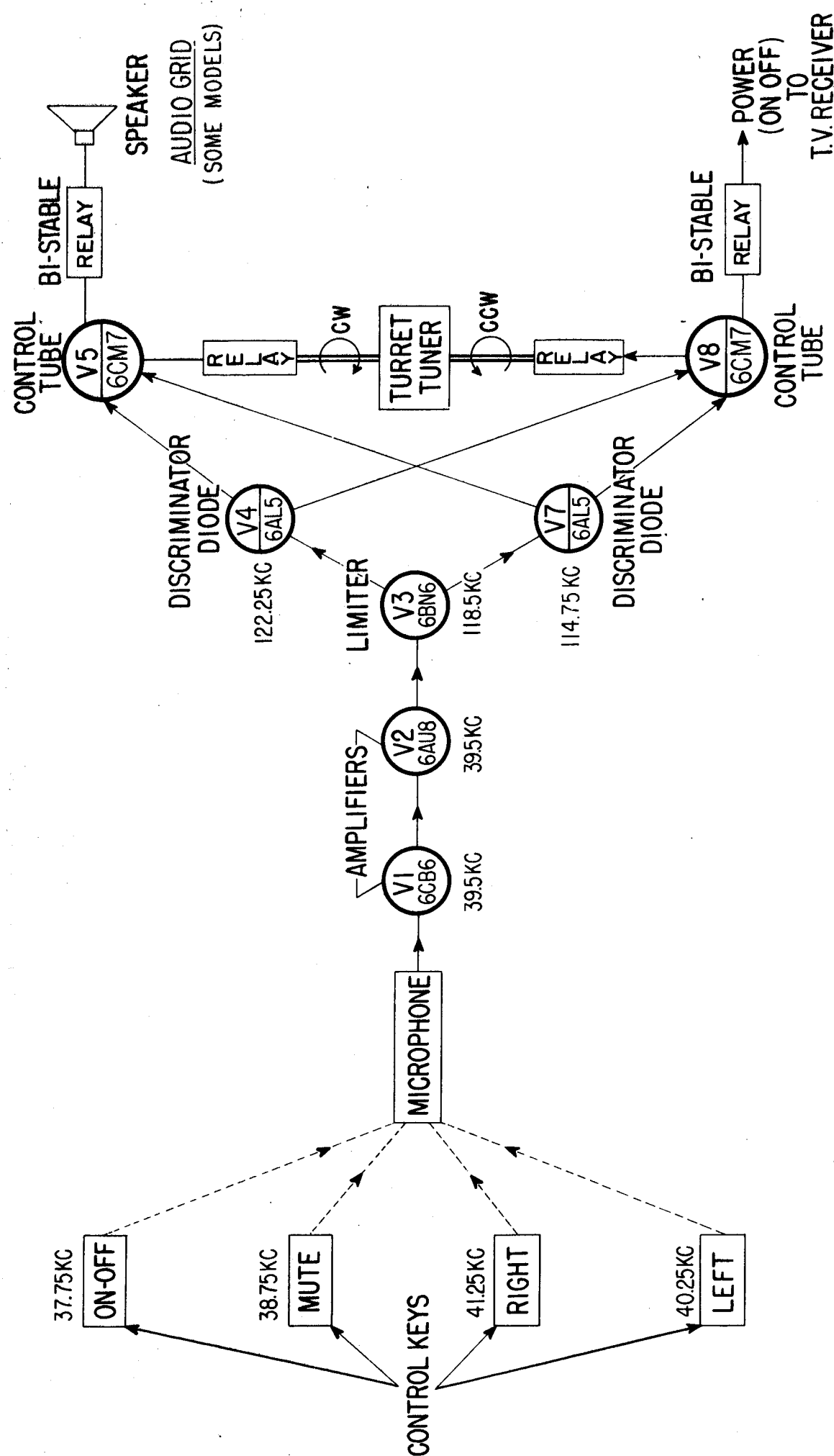


Figure 5—Remote Control Block Diagram (8 tube unit)

## 5 Tube Control Chassis

L3 is the primary and L4 is the secondary of the discriminator coil. The following chart lists the final key frequencies and the discriminator frequency:

| Discriminator Peak Frequency (3rd Harmonic) | Key Frequency | Discriminator Center Frequency |
|---|---------------|--------------------------------|
| 123.75 KC                                   | MUTE 41.25 KC | 122.25 KC                      |
| 120.75 KC                                   | TUNE 40.25 KC |                                |

NOTE: There is a difference of 1.5 KC between the discriminator center frequency and the third harmonic of the transmitter key frequency.

For example, if the MUTE key is pressed (41.25 KC) its 3rd harmonic (123.75 KC) will be impressed across the 6AL5 (V4) discriminator circuit tuned to 122.25 KC. By discriminator action a pulsating rectified voltage across diode load resistors R18 and R14 will be developed. The TUNE key develops a voltage in a similar manner across its respective diode load resistors R19 and R15.

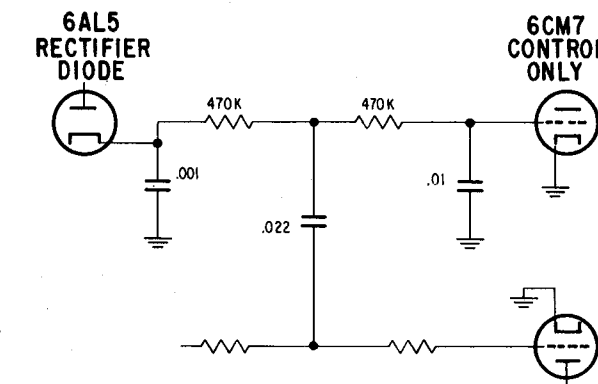


Figure 6—Integrator Network

## Integrator Circuit

(Figure 6).

The D.C. output voltages of the diode load resistors are applied to their respective integrator networks to eliminate the possibility of extraneous "ON FREQUENCY" noise pulses of short duration triggering the control tubes.

The RC values of the integrator circuit in the Zenith SPACE-COMMAND are so chosen as to pass signals of long duration and continuous duty cycle. A slow rise time or charging rate is used (approximately 30 milli-seconds). With this design any extraneous noise pulse because of its sharp rise and random frequency rate characteristics will be unable to charge up the capacitors in the integrator and therefore, will not reach a value high enough to overcome the bias on the control tubes to trigger the relays.

THE TUNED AMPLIFIER, AMPLITUDE LIMITER, BALANCED DISCRIMINATOR, AND THE INTEGRATOR NETWORK, ASSURE THAT ONLY THE SIGNAL EMITTED BY THE CONTROL KEYS WILL OPERATE THE TV RECEIVER.

## Control Tubes

(Figures 16 and 17).

Control tubes 6CM7 (V5) and 6CM7 (V8) are biased beyond cutoff by the negative 28 volt bias supply. In the 5 tube control chassis the negative bias bus is 18V DC and the control tube is 6CM7 (V5).

Tube conduction and relay operation occur when the output signal from the integrator circuit overcomes this bias. The bi-stable relays K2 and K4 "pull in" at an average 13 to 17 milliamperes of DC current and are of the sequential make and break type.

Relays K1 and K3 are the momentary contact switch type and are used to control the motor drive mechanism. They pull in at an average 8.5 to 11 milliamperes of DC current.

The mechanical operation of the relays controls the various receiver functions.

## Power Supply Network

(Figures 16 and 17).

The secondary of power transformer T1 applies 250 volts AC to one section of rectifier tube 25Z6 (V6).

The output voltage of this half wave rectifier forms a 235V DC bus for the plate circuit relays K1, K2, K3 and K4. It also supplies DC voltage to the amplifier, limiter and discriminator circuits.

The transformer is tapped at 6.3V AC for filament circuits and at 31V AC for bias supply voltage. The difference voltage (25 volts) between the taps is used as filament voltage for the rectifier tube 25Z6 (V6).

The second section of the 25Z6 (V6) is used to furnish a negative voltage for the bias supply. Resistor R29 and capacitor C18 form a filter for the bias voltage. The -28V DC voltage is applied to the control grids of 6CM7 (V5) and 6CM7 (V8) to bias the tubes to cutoff.

To prevent electrolysis of the coil windings, the relay coil and core are placed at the same 200V DC potential by resistor R34. The resistor also prevents a direct DC short to chassis if the relay frame is accidentally shorted to ground.

NOTE: The main TV chassis powers the 5 tube remote control unit.

The required bias voltage is derived from a 19 volt tap on the power transformer of the TV chassis. Selenium rectifier SE-1, resistor R28 and capacitor C21 form a rectifier filter system to provide a minus 18 volt D.C. bias for the control tubes. The control chassis 6.3V A.C. filament voltage and 235V D.C. plate voltage are also derived from the main TV chassis.

## Power Control

The AUTOMATIC-MANUAL switch (SW1) located at the rear of the control chassis controls all AC power to the unit and by-passes the mute switch to assure audio even if the mute switch is locked in MUTE position. It is set to AUTOMATIC position for remote control operation and to MANUAL for normal manual TV operation.

## "BULLS EYE" ADJUSTMENT

NOTE: IF BRACKET HOLES DO NOT LINE UP, MOVE THE DRIVE CAM AND STUD ASSEMBLY #S-24768 FOR ACCESS TO TUNER OSCILLATOR ADJUSTMENT SCREW

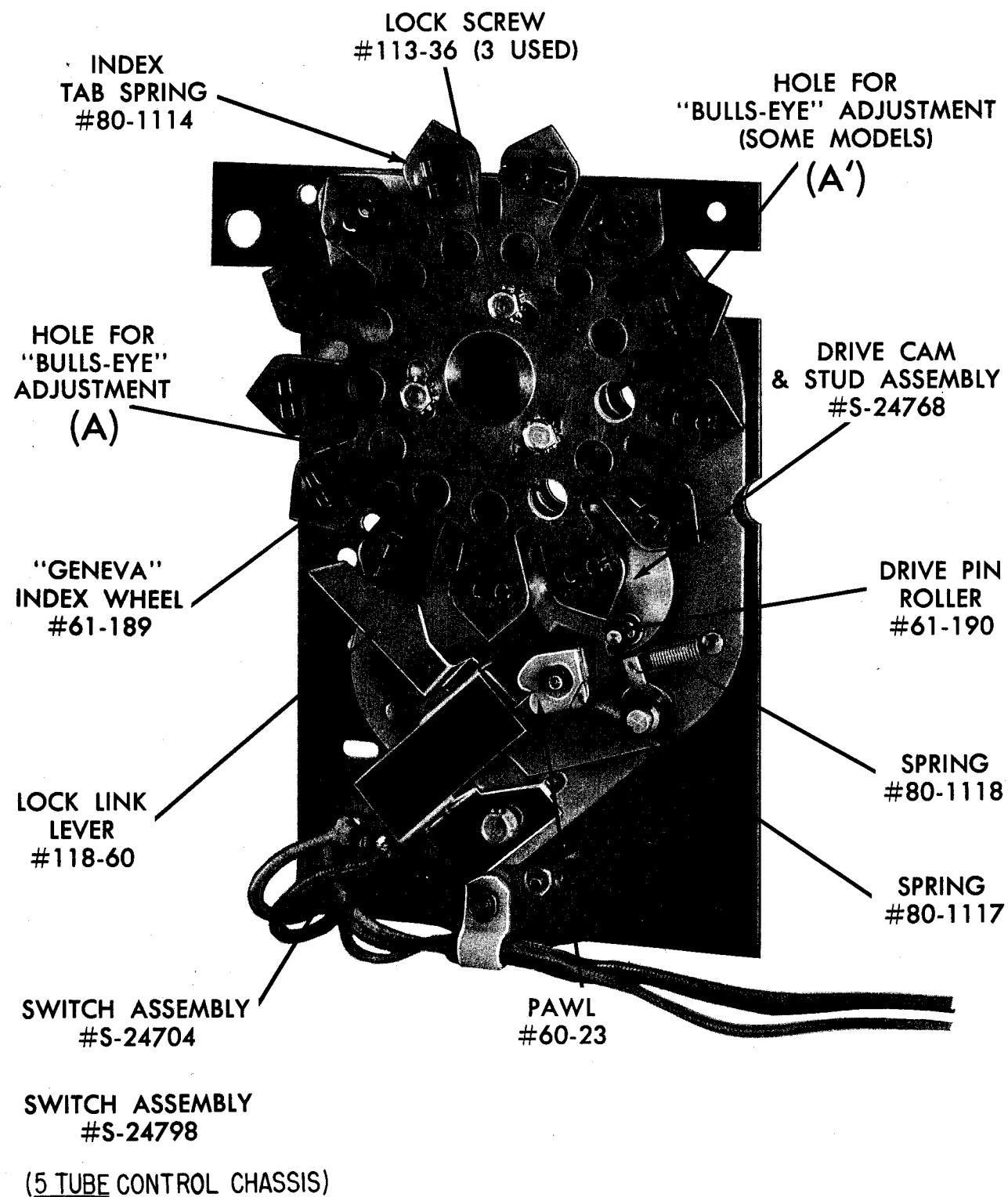


Figure 7—Motor Drive Assembly

## Motor Drive Assembly

(Figure 7).

A 117 volt reversible AC induction type motor is used in the drive assembly. A clutch type brake reduces rotor inertia when the motor is de-energized. This eliminates the possibility of over travel and assures positive channel selector indexing.

The armature shaft of the motor incorporates a wire clutch which engages the drive assembly shaft when power is fed to the motor windings.

The electrical and mechanical operation of the motor drive assembly follows:

The switch contacts of relays K1 and K3, located in the control chassis are in parallel with the contacts of switch #S-24704, located on the motor drive assembly. When the relay is energized, AC power is fed to the motor through the relay contacts. As the motor rotates, it turns the drive cam #S-24768. The drive cam makes one revolution for each channel. The pin on the cam turns the index wheel #61-189 which turns the tuner shaft.

The make and break contact of motor drive assembly switch #S-24704 (which holds or breaks power to the motor) is actuated by the pawl #60-23. The neutral and the make contact position of the pawl is mechanically controlled by the drive cam #S-24768 and the lock link lever #118-60. The lock link lever bracket has a small lug that locks or releases the pawl, depending on the positions of the channel selector metal index tab springs located on the index wheel. When a channel selector tab index spring is in a radial position, it pushes or holds the lock link lever away from the pawl. This allows the drive cam #S-24768 to assume control of the pawl and switch for each channel cycle. When two or more adjacent channel selector metal index tab springs are tangent to the circumference of the index wheel, the lock link lever is held against the pawl and the small lug locks the switch in contact position for more than a single channel selection cycle or until the next radial index tab allows the drive cam to assume control again.

Springs #80-117 and #80-118 return the pawl and the lock link lever to neutral position respectively.

Thus the length of time that power is fed to the motor is controlled for a single channel selection cycle by drive cam #S-24768. For more than a single channel selection cycle the lock link lever and the metal index tab become the control.

The index wheel contains 13 channel selector index tab springs (one for each channel) on its outer rim. The tabs are easily set with a screw-driver for desired tripping. (See Figure 8.)

Motor reversal is achieved by the use of two windings and a series capacitor C26. This capacitor is switched to either motor winding to cause a phase differential resulting in change of motor rotation. A series resistor R32 is placed in series with the capacitor to prevent the motor drive assembly switch contacts from fusing.

The motor also contains a built-in thermostat-protector in series with the motor windings. If the motor is overloaded the thermostat will automatically break the power to the motor and the thermo-contacts will make again within a few minutes.

NOTE: The motor drive assembly of the two function remote control uses a non-reversible motor and an alternate switch assembly.

## Index Tab Adjustments

(Figures 7 and 8).

To set up the channel selector motor drive unit to stop only at the desired TV channels operating in the area, make the following screw-driver adjustments at the back of the cabinet:

1. Turn the channel selector knob on the front of the receiver MANUALLY to an unused channel. With a screw-driver, turn its corresponding metal index tab on the drive assembly at the rear of the cabinet 1/4 turn (either direction) to this position:

INDEX TAB

Follow this same procedure on all remaining unused channels.

2. The index tabs of each desired channel need no adjustment and should remain in the original position.

INDEX TAB

NOTE: The receiver is shipped from the factory with the tabs on each channel positioned as indicated in Step 2.

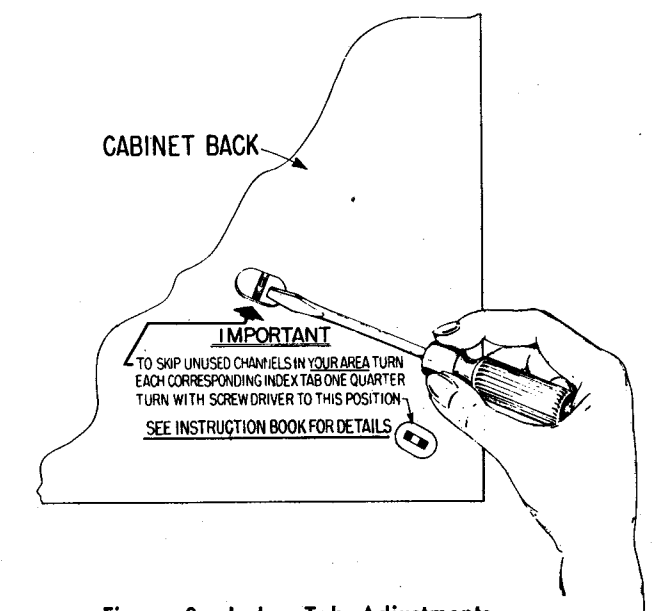


Figure 8—Index Tab Adjustments

## Motor Drive Assembly Adjustments

(Figure 7).

1. IF CHANNEL SELECTOR STOPS OFF INDEX: Loosen the three lock screws #113-36 and carefully re-set index wheel to index properly. Tighten screws.
2. MOTOR RUNS CONTINUOUSLY: Switch contacts not breaking. Remove switch assembly cover and carefully bend switch contact blades for approximately 1/32" clearance when pawl #60-23 is in "neutral" position.

The failure of bias supply voltage or grid control circuitry will also result in loss of control. Check voltages, resistances, tubes, etc. in these circuits.

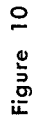
IMPORTANT: CONNECT JUMPER BETWEEN BLACK AND GREY LEADS WHEN REMOVING CONTROL CHASSIS FOR SHOP REPAIR.

POWER CABLE FROM T.V. CHASSIS

(8-TUBE)  
CONTROL CHASSIS  
POWER CABLE

APPLY 117V. A.C. ACROSS PINS 2 AND 4  
TO POWER REMOTE CHASSIS.

(5 TUBE CONTROL CHASSIS REMOVAL)  
IMPORTANT: CONNECT JUMPER BETWEEN PINS 6 AND 7 (POWER CONNECTION)  
1 AND 8 (AUDIO CONNECTION)



**NOTE:** Use #S-40542 power supply when servicing 5 tube control chassis #S-40511.

Set the power supply switch to the "ORANGE DOT" position when servicing 5 tube remote control chassis stamped with an orange cross.

Set switch to other position for all 5 tube remote control chassis not stamped with an orange cross.

**NOTE:** The cable connection between the remote control chassis and the power supply unit must be made to complete the power circuit.

## SERVICE

## Localizing Trouble

(Figures 2, 12 and 18).

The following procedure is recommended to quickly localize trouble:

1. Check to see that the AUTOMATIC-MANUAL switch located at the cabinet rear is in AUTOMATIC position.
2. Check the customer's hand tuning control unit. Loss of control signal can be caused by the rods within the box loosening up from their retaining springs. (See Figure 18.)  
To dis-assemble unit remove the Phillips head screw located behind the control key knobs. (Press down on both keys for access to screw.) Push down on control keys and remove assembly from box.  
Carefully re-set with a twisting motion any rod that has become loose.  
A weak control signal can also be caused by improper air gap between the striking hammer and the rod bottom. If necessary, carefully bend the hammer spring bracket for a .035" clearance.
3. Replace microphone located at left center of the picture tube escutcheon.
4. Set the AUTOMATIC-MANUAL switch to the AUTOMATIC position, remove the relay dust cover and mechanically actuate the relays with an insulated screw-driver. If doing this results in normal operation, the trouble is ahead of these circuits. A defective microphone, tuning control unit, tubes or components in the control chassis may be at fault. However, if the mechanical movement sug-

gested has no effect, it indicates trouble beyond that point, such as in the motor drive assembly, or cable assemblies. Check all cable and plug connections.

## Remote Control Chassis Removal

(Figures 8A and 9).

**NOTE:** When a remote control chassis is removed from the TV receiver for shop repair, it is necessary to connect a jumper to supply 117V AC power to the receiver, also leads for audio connections.

The 5 tube control chassis does not require speaker extension leads. The jumper plug connects power and audio.

1. Connect jumper wire across grey and blue lead of the receiver socket, or use Zenith jumper plug #S-40463. (8 tube control chassis.)
2. Connect jumper wire between pins #6 and #7, also between pins #1 and #8, of the receiver socket or use Zenith jumper plug #S-40537. (5 tube control chassis.)
3. Remove speaker leads from remote control chassis; also disconnect speaker leads at the TV chassis.
4. Connect extension cable between speaker leads and TV chassis.

(Use Zenith extension cable #S-22113.)

On some models the original speaker leads are of sufficient length. Re-route them in the cabinet to reach the TV chassis audio output lugs.

## Service Kit

(Figures 9 and 13).

A service kit #S-40467 is available from your Zenith distributor. This kit consists of jumper plugs #S-40463 and #S-40537, speaker extension leads #S-22113, power cord #11-129 and a special alignment generator #S-40466 for discriminator alignment only. The plugs and cables are used to provide power and audio connections for the TV receiver when a control chassis is removed for shop repair. Cord #11-129 is used for power connection when the 8 tube remote control unit is serviced.

## Service Power Supply

(Figures 10 and 20).

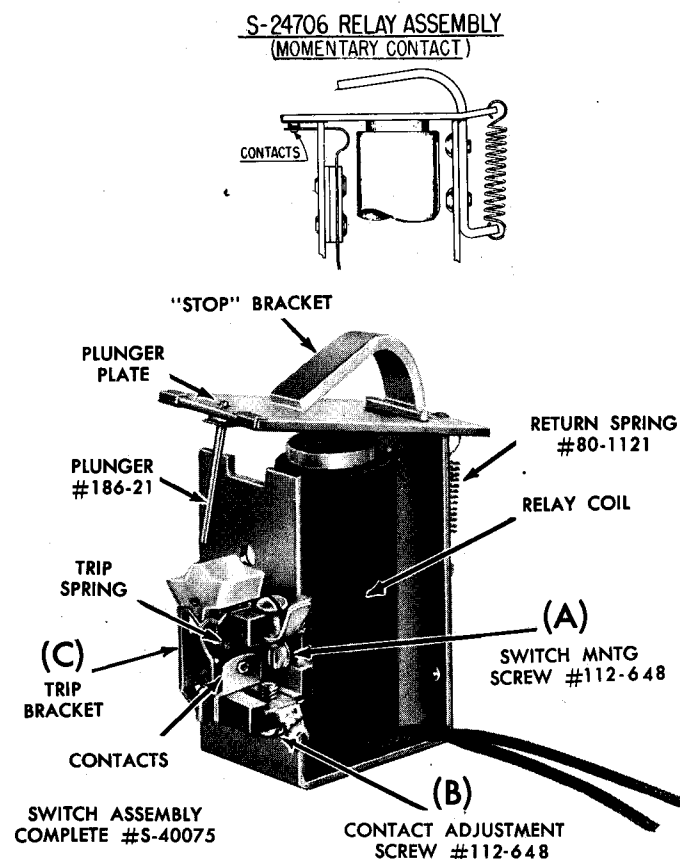
**NOTE:** Use power supply #S-40542, available from your Zenith distributor to power the 5 tube remote control chassis #S-40511 for service repair work.

## Relay Adjustments

(Figure 11).

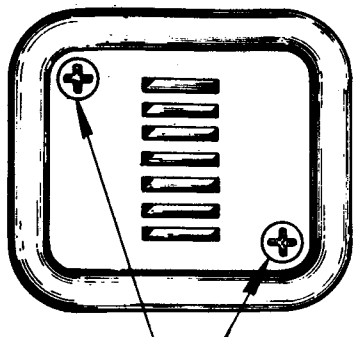
**NOTE:** Remove relay dust cover.

1. **SWITCH ADJUSTMENTS**  
If the switch contacts are not making or breaking properly, reset them by loosening contact adjustment screw (B). Reset contact assembly and tighten screw.  
Mechanical lagging or sticking can be caused by improper setting of trip bracket (C). Carefully bend bracket for positive action.
2. **SWITCH REPLACEMENT**  
If necessary, the switch assembly is easily removed for replacement by taking out switch mounting screw (A).
3. **RELAY CONTACTS**  
To assure positive electrical action, clean relay contact points with carbon tetra-chloride.



### Figure 11—Relay Adjustments





### Microphone Removal

(Figure 12).

The microphone located at left center of the picture tube escutcheon can be easily replaced by taking out the two holding screws accessible from the front.

### Bias Adjustment (5 Tube Control Chassis)

(Some Models.)

Improper relay action can be caused by mis-adjustment of the bias control. Connect negative lead of vacuum tube voltmeter to bias test point N and positive lead to control chassis frame. Adjust for a minus 18 V.D.C. reading.

**IMPORTANT:** When a control chassis is re-installed after having been serviced or repaired, check to see that the bias control is set to a minus 18 V.D.C. reading.

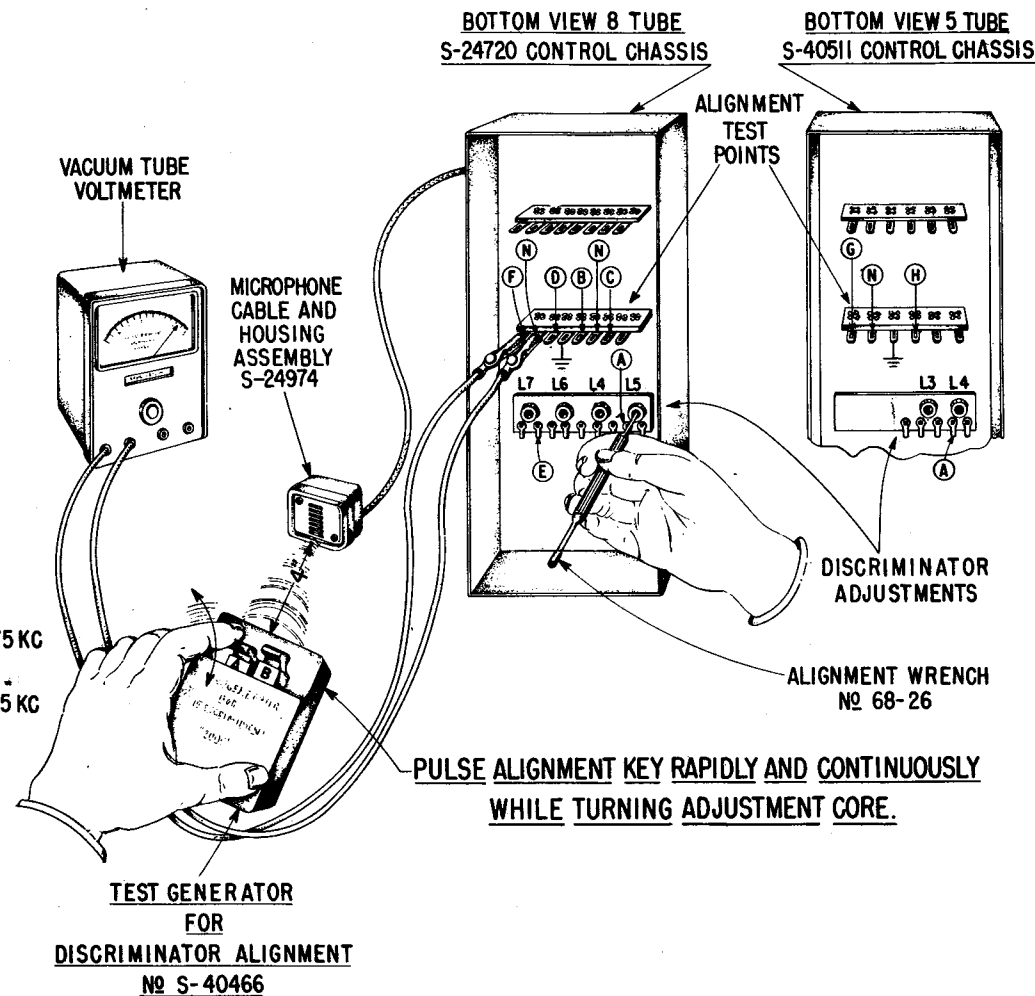


Figure 13—Discriminator Alignment

### Discriminator Alignment

(Figures 13, 14, 15, 16 and 17).

**IMPORTANT:** Do not disturb the alignment settings of the front end coil cores. Very stable broad band circuits are used in the Zenith SPACE-COMMAND control chassis. If voltage and resistance checks indicate trouble at these points, replace the complete coil assembly, available from your Zenith distributor.

Should it be determined that the discriminator circuit requires re-alignment, the following procedure is recommended:

### Equipment

- Special 2 key alignment generator #S-40466 (Part of Service Kit #S-40467).
- Remote tuning control supplied with TV receiver.
- Microphone and cable assembly #S-24974.
- Alignment wrench #68-26.
- Vacuum tube voltmeter.
- Power Supply #S-40542 (Used to power 5 tube control chassis).

A zero center meter is recommended for null adjustments. However, observing closely when the meter pointer starts to go to the left or right of zero will give the same results when using a non-zero center meter.

### Procedure

- Insert a 1 Megohm resistor in test lead of meter.
  - Plug microphone cable into socket on control chassis.
  - Connect power to control chassis.
  - Remove control tube or tubes 6CM7 (V5 and V8).
- NOTE:** The test alignment generator has two keys, one marked **A**, the other **B**. Key **A** vibrates at 38.25 KC and Key **B** at 40.75 KC. This frequency is tripled in the control chassis to produce the discriminator center frequency.

- Pulse Key **B** to align discriminator circuit of remote control chassis #S-40511 (5 tube).

- Pulse Keys **A** or **B** to align the corresponding discriminator circuits of remote control chassis #S-24720 or #S-40217 (8 tube).

Before proceeding with alignment, turn the cores of the discriminator primary and secondary coils 5 turns out toward the top of the coils.

### 5 Tube Control Chassis #S-40511

- Connect power supply #S-40542 to control chassis (Figure 10).

**NOTE:** Set switch to "orange dot" position for control chassis stamped with an orange cross. Set switch to other position for control chassis not stamped with an orange cross. If control chassis contains a bias control, set it to a minus 18 V.D.C. reading at bias bus test point **(N)**.

- Remove 6CM7 (V5). Set the meter to the —300V DC scale and connect it from the center tap of the discriminator coil secondary (test point **(A)**) and connect the common meter lead to bias bus test point **(N)**.

- Set test alignment generator approximately 4" away from the microphone and rapidly pulse Key **B** while tuning the discriminator primary L3 for maximum DC reading. (Figure 4.)

- Again pulse Key **B** and adjust the discriminator secondary coil L4 for minimum output.

- Connect the + meter lead to diode load test point **(G)** and set the meter to + 100V DC scale.

Again rapidly pulse the test alignment generator Key **B** while tuning the core of the discriminator coil secondary L4 for zero voltage. (The use of a zero center meter will be helpful in this adjustment.)

- The discriminator circuit is now correctly aligned. Check alignment as follows:

- Set the customer's tuning control unit approximately 4" away from the microphone.
- Alternately connect the meter positive lead across each of the diode load test points **(G)** and **(H)** while rapidly pulsing the corresponding key. See chart below. Compare the voltages.

| <u>Tuning</u><br><u>Control Key</u> | <u>Meter Test Points</u><br>(Negative Lead to<br>Bias Bus Test Point <b>(N)</b> ) |
|-------------------------------------|---|
| MUTE                                | <b>(G)</b>  |
| TUNE                                | <b>(H)</b>  |

The measured DC voltages should exceed 20V DC and should not differ from each other by more than 25%. Should the voltages at the diode load test points differ by more than 25%, carefully re-touch the secondary coil tuning L4 for a more nearly equal output. If the voltages still differ greatly, try another tuning control unit known to be good, check diode load resistors and the 6AL5 (V4) tube.

### 8 Tube Control Chassis, #S-24720, #S-40214

- Remove both 6CM7 control tubes and set the meter to the —300V DC scale. Connect it from the center tap of discriminator coil secondary (test point **(A)**) and common meter lead to bias bus test point **(N)**.

- Set test alignment generator approximately 4" away from the microphone and rapidly pulse Key **B** while tuning the discriminator primary L4 for maximum DC reading.

- Again pulse Key **B** and adjust the discriminator secondary coil L5 for minimum output.

- Connect + meter lead to center tap of discriminator coil secondary (test point **(E)**).

- Rapidly pulse Key **A** of the test alignment generator while tuning the discriminator primary L6 for maximum DC reading.

- Again pulse Key **A** and adjust the discriminator secondary coil L7 for minimum output.

- Connect the + meter lead to diode load test point **(B)** and set the meter to + 100V DC scale.

Again rapidly pulse the test alignment generator Key **B** while tuning the core of the discriminator coil secondary L5 for zero voltage. (The use of a zero center meter will be helpful in this adjustment.)

- Connect the + meter lead to diode load test point **(D)** and set the meter to + 100V DC scale.

Rapidly pulse the test alignment generator Key **A** while tuning the core of discriminator coil secondary L7 for zero voltage.

- The discriminator circuit is now correctly aligned. Check alignment as follows:

- Set the customer's tuning control unit approximately 4" away from the microphone.
- Alternately connect the meter positive lead across each of the diode load test points **(D)** and **(C)** while rapidly pulsing the corresponding test alignment generator key. See chart below. Compare the voltages.
- Repeat step #2 but use test points **(F)** and **(D)** and their corresponding keys as shown in chart. Compare the voltages.

| <u>Tuning</u><br><u>Control Key</u> | <u>Meter Test Points</u><br>(Negative Lead to Bias<br>Bus Test Point <b>(N)</b> ) |
|-------------------------------------|---|
| RIGHT                               | <b>(B)</b>  |
| LEFT                                | <b>(C)</b>  |
| ON-OFF                              | <b>(F)</b>  |
| MUTE                                | <b>(D)</b>  |
|                                     | L-5 (Sec.)  |
|                                     | L-7 (Sec.)  |

The measured voltages of both diode sections of an individual discriminator circuit should exceed 25V DC and should not differ from each other by more than 25%. Should the compared voltages exceed this difference, carefully retouch the respective secondary coil L5 or L7 tuning for a more nearly equal output. If the measured voltages still do not compare favorably with each other, try another tuning control unit known to be good, check diode load resistors and the 6AL5 (V4, V7) tubes.

### Voltage Measurements

**IMPORTANT:** When making voltage measurements insert a shielded 100 MMF dummy input load into the microphone input socket of the control chassis. Microphone, cable and housing assembly #S-24974 will also provide a proper load for correct measurements.



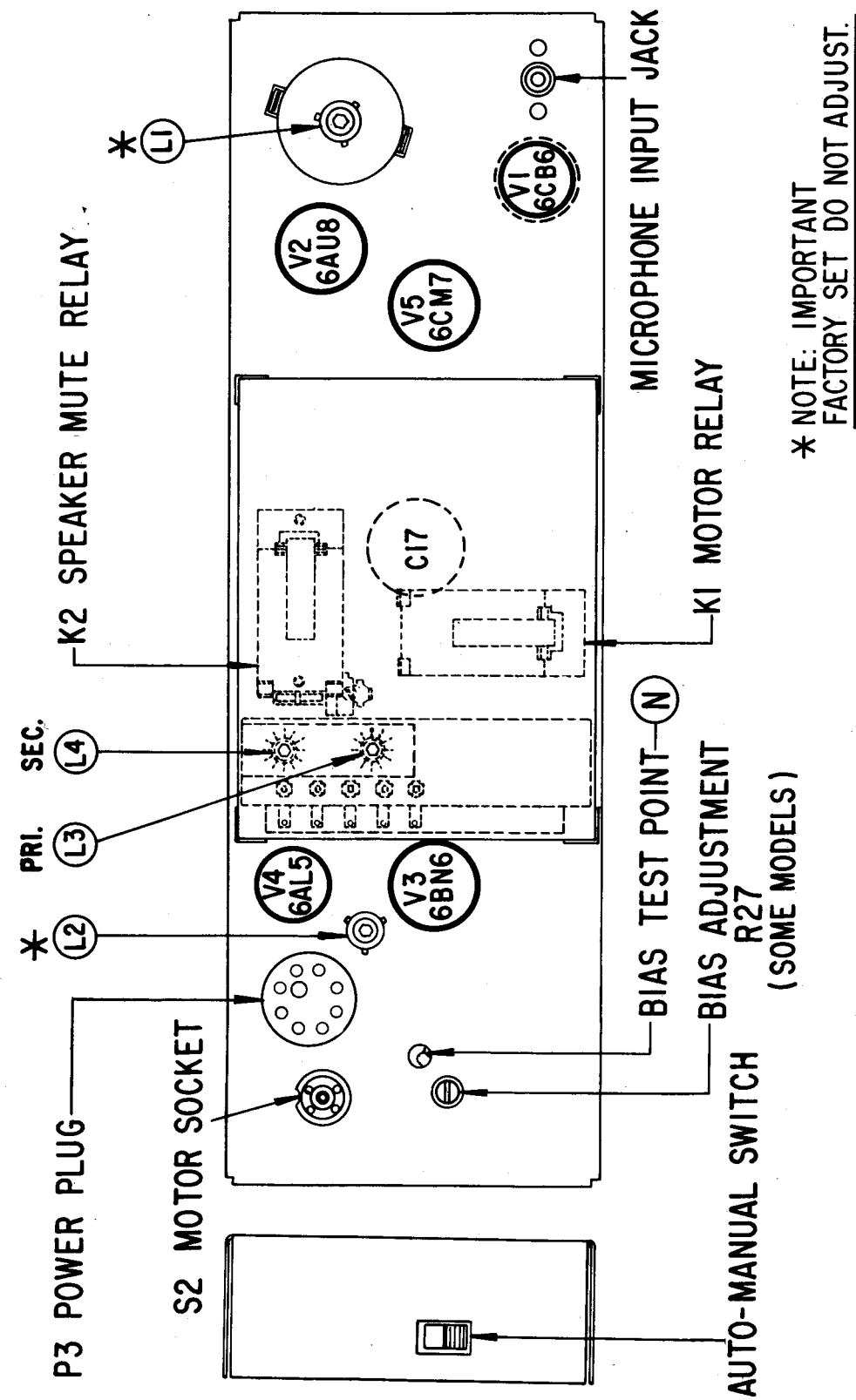


Figure 14—Control Chassis, Top View (5 tube unit #S-40511)

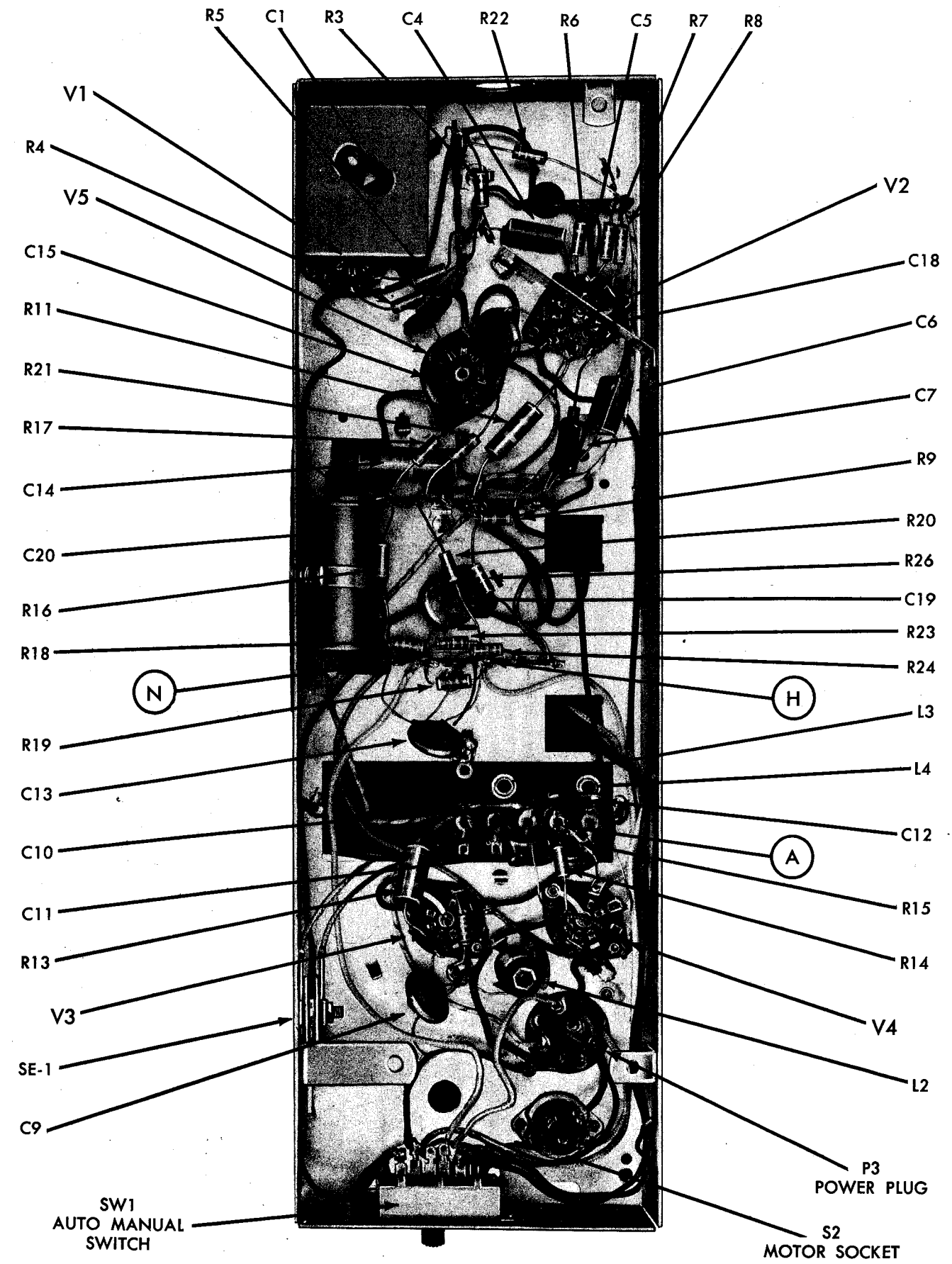
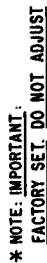


Figure 14A—Control Chassis, Bottom View (5 tube unit #S-40511)





17

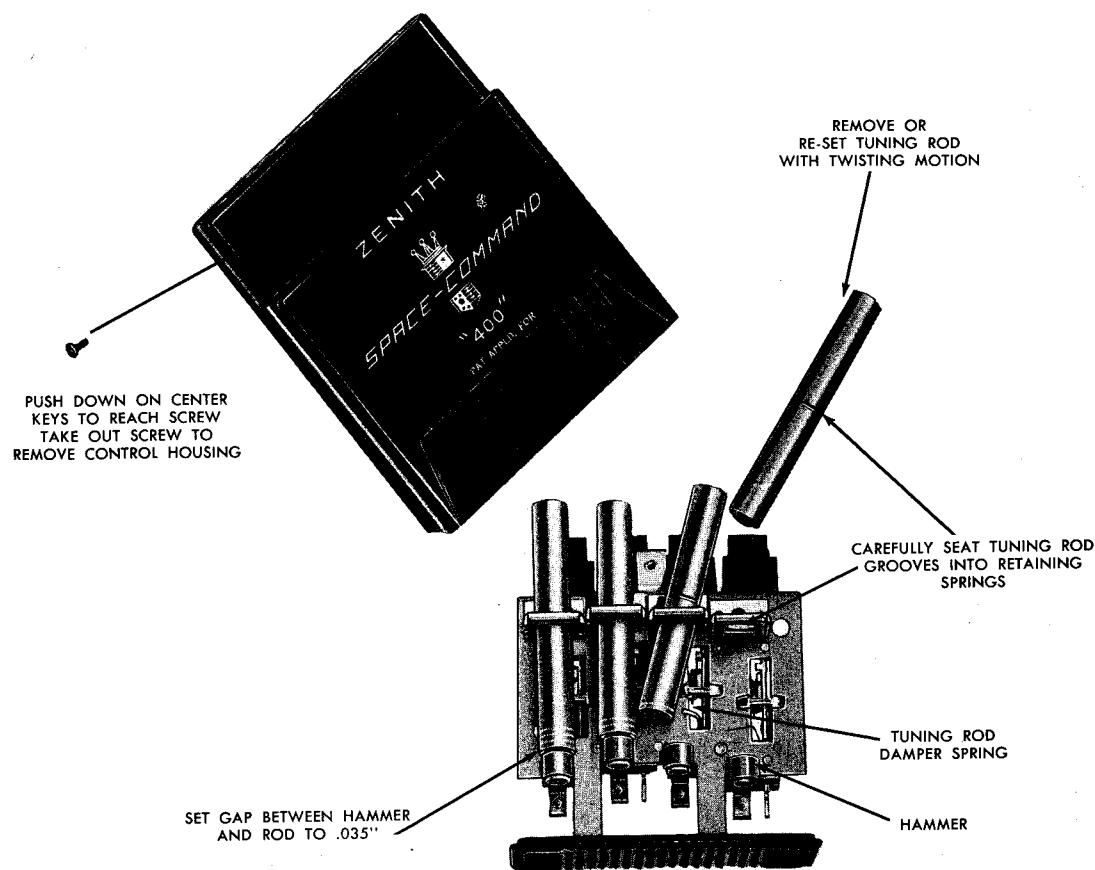


Figure 18—Dis-assembled View of Control Unit (4 Function)

## SERVICE NOTES

### Channel Over-ride

A possible cause for the channel selector mechanism to select more than one channel is improper damping action to the rods in the hand control unit.

Place a small piece of spaghetti over the damping springs of the motor control rod/or rods. (Fig. 18.)

### Poor Sensitivity

- Check that 6CB6 (V1) tube shield is secure and grounding.
- Replace 6CB6 (V1) and/or 6AU8 (V2) in the control chassis.
- Check the ground connection of the microphone cable plug and jack at the control chassis. Resolder or repair any poor connection at this point.
- A regenerative or parasitic oscillation condition may be present in the control chassis. Insert a 120 ohm  $\frac{1}{2}$  watt carbon resistor in series to input grid (pin #2) of the 6BN6 (V3) limiter tube of control chassis.

### Microphonics

If control chassis relays trigger when TV cabinet is jarred, a microphonic input capacitor is indicated.

Dress C1 (220 mmf) pig tail leads or replace with new Durez coated type #22-2926.

### Channel Selector Trips During Warm-Up

(Control Chassis not Stamped with Orange Cross)

Replace 6CG7 (V12) horizontal sweep discharge tube in TV chassis. Check bias adjustment. Set to minus 18 V.D.C.

(All Control Chassis)

Replace 6CM7 relay control tube.

**NOTE:** Premature relay tripping can also be caused by parasitic oscillation occurring only during warm-up. Replace 6CB6 (V1), insert 120 ohm  $\frac{1}{2}$  watt carbon resistor in series to input grid (pin #2) of the 6BN6 (V3) limiter tube.

## PARTS LIST

### #S-40511 Control Chassis Parts (5 TUBE UNIT)

| Part No. | Description           |
|----------|-----------------------|
| 19-238   | Coil mtg. clip        |
| 19-307   | Coil mtg. clip        |
| 22-3     | .01 Mfd. ceramic disc |

| Part No.   | Description              |
|------------|--------------------------|
| 22-21      | 2x.001 Mfd. ceramic disc |
| 22-12      | .0015 Mfd. ceramic disc  |
| 22-1442    | 100 Mmf. mica            |
| C1 22-2926 | 220 Mmf. mica            |
| 22-1645    | 330 Mmf. mica            |
| 22-1781    | .022 Mfd. molded—200 V   |

| Part No.     | Description  |
|--------------|--|
| 22-2524      | 470 Mmf. mica  |
| 22-2740      | Electrolytic   |
| 22-2901      | 680 Mmf. mica  |
| 54-271       | 6-32x $\frac{1}{4}$ hex palnut                                   |
| 57-2261      | Relay mtg. plate   |
| 58-135       | 9 prong plug   |
| 63-947       | 27K ohm 2W Ins. 10%  |
| 63-1188      | 39K ohm 1W Ins. 10%  |
| 63-1747      | 120 ohm $\frac{1}{2}$ W Ins. 10%                                 |
| 63-1757      | 220 ohm $\frac{1}{2}$ W Ins. 10%                                 |
| 63-1803      | 2700 ohm $\frac{1}{2}$ W Ins. 10%                                |
| 63-1841      | 22K ohm $\frac{1}{2}$ W Ins. 10%                                 |
| 63-1869      | 100K ohm $\frac{1}{2}$ W Ins. 10%                                |
| 63-1894      | 390K ohm $\frac{1}{2}$ W Ins. 10%                                |
| 63-1897      | 470K ohm $\frac{1}{2}$ W Ins. 10%                                |
| 63-1912      | 1 megohm $\frac{1}{2}$ W Ins. 20%                                |
| 63-1922      | 1.8 megohm $\frac{1}{2}$ W Ins. 10%                              |
| 63-1925      | 2.2 megohm $\frac{1}{2}$ W Ins. 10%                              |
| 63-1933      | 3.3 megohm $\frac{1}{2}$ W Ins. 20%                              |
| 63-1961      | 15 megohm $\frac{1}{2}$ W Ins. 20%                               |
| 78-644       | Connector socket   |
| 78-846       | 9 contact wafer tube socket                                      |
| 78-906       | 9 contact wafer tube socket                                      |
| 78-916       | 7 contact wafer tube socket                                      |
| 78-1036      | 5 contact molded connector socket                                |
| 83-300       | 3 lug terminal strip   |
| 83-1405      | 5 lug terminal strip   |
| 84-1652      | 6 lug terminal strip   |
| 83-2584      | Coil form. mtg. strip  |
| W1 85-580    | Auto-manual switch   |
| 93-1106      | .144x $\frac{1}{2}$ x.031 washer                                 |
| 113-25       | 6-32x $\frac{1}{4}$ hex hd. mach screw—lockwasher att.           |
| 113-67       | 4-40x $\frac{1}{4}$ x $\frac{1}{4}$ hex hd. mach. screw (2 used) |
| 126-554      | Tube shield  |
| 126-741      | Input shield   |
| 126-822      | Interstage shield  |
| 149-153      | Iron core  |
| 149-172      | Iron core  |
| 149-173      | Iron core  |
| K1 195-4     | Relay (used when S-24706 is not used)                            |
| SE1 212-9    | Selenium rectifier   |
| K2 S-24705   | Relay (Bi-Stable) complete                                       |
| K1 S-24706   | Relay S.P.D.T. (used when 195-4 is not used)                     |
| S-24781      | Coil shield assembly   |
| L1 S-24785   | Amplifier plate coil assem.                                      |
| L2 S-24786   | Limiter grid coil assem.   |
| L3 S-24788   | Discriminator coil assem.  |
| L4 S-24789   | Discriminator coil assem.  |
| S-24795      | Relay cover assembly   |
| S-24858      | Terminal strip assem.  |
| <b>TUBES</b> |  |
| 6AL5         | 6CB6   |
| 6AU8         | 6CM7   |
| 6BN6         |  |

### #S-24703 Drive Mechanism Parts (5 TUBE REMOTE CONTROL)

|         |  |
|---------|--|
| 17-141  | Nylon Clamp (Rets. sw. & mtr. wires)       |
| 23-23   | Wire Connector                             |
| 34-261  | Pinion gear (drives S-24765)               |
| 34-264  | Gear (used with S-24777)                   |
| 54-34   | 6-32x $\frac{1}{4}$ x3/32 hex nut (2 used) |
| 58-226  | 5 prong plug                               |
| 61-190  | Drive roller (used on S-24768)             |
| 80-1034 | Spring clip (part of S-24777)              |

| Part No.    | Description   |
|-------------|---|
| 80-1108     | Snubber spring (checks 34-261; part of S-24767)                               |
| 80-1109     | Pinion spring (used on 34-261)  |
| 80-1110     | Mtr. coupling spring (part of 141-144)  |
| 80-1117     | Panel spring (for S-24766)  |
| 80-1118     | Lock link spring  |
| 93-179      | .140x5/16x1/32 washer   |
| 93-502      | Lockwasher (2 used)   |
| 93-1231     | .171x $\frac{3}{8}$ x.020 washer  |
| 93-1244     | Neoprene washer (used with 34-261)  |
| 94-938      | Drive wheel bushing   |
| 113-34      | 6-32x $\frac{3}{8}$ x $\frac{1}{4}$ hex. mach. screw—lockwasher att. (3 used) |
| 114-39      | 8-32x $\frac{1}{4}$ x $\frac{1}{4}$ hex hd. self-tap. screw                   |
| 118-60      | Sw. lock link   |
| M1 141-144  | Remote control dr. mtr.   |
| 188-148     | Retaining ring  |
| 188-168     | Retaining ring (2 used)   |
| S-24762     | Mtg. plate assembly   |
| S-24765     | Gear & pinion assem.  |
| S-24766     | Pawl & bushing assem.   |
| S-24767     | Cover plate assembly  |
| S-24768     | Dr. whl. & stud assem.  |
| S-24777     | Index whl. hub & spring clip assem.   |
| SW2 S-24798 | Switch assembly   |

### #S-24717 Two Key Tuning Control Complete

|         |                                    |
|---------|------------------------------------|
| 24-827  | Housing Back                       |
| 46-1579 | Tuner Knob                         |
| 46-1580 | Mute Knob                          |
| 54-426  | Speed Nut—Rd—Push-On (2)           |
| 71-114  | 2-56x3/16 Flat Hd. Mach. Screw (4) |
| 138-132 | Grille                             |
| S-24820 | Housing Assembly                   |

### Microphone

|         |                                     |
|---------|-------------------------------------|
| S-24916 | Microphone                          |
| S-24974 | Microphone, housing, & cable assem. |

### #S-24720 or #S-40217 Control Chassis Parts (8 TUBE UNIT)

|             |  |
|-------------|--|
| 19-238      | Coil mtg. clip (1 part of ea. S-24785 & S-24906)               |
| 19-278      | Brass clip   |
| 19-307      | Coil mtg. clip (1 mt. ea. S-24788 & S-24789)                   |
| 22-3        | .01 Mfd. ceramic disc (2 used)                                 |
| 22-17       | .001 Mfd. ceramic disc—1KV                                     |
| 22-21       | 2x.001 Mfd. ceramic disc (2 used)                              |
| 22-1442     | 100 Mmf. mica (4 used)   |
| C1 22-2926  | 220 Mmf. mica (2 used)   |
| 22-1781     | .022 Mfd. molded—200 V (2 used)                                |
| 22-2376     | 2x.01 Mfd. ceramic disc (2 used)                               |
| 22-2276     | 47 Mmf. ceramic disc   |
| 22-2668     | 680 Mmf. mica (5 used)   |
| 22-2681     | 8.2 Mmf. ceramic disc  |
| C18 22-2696 | 5 Mfd. electrolytic—100 V                                      |
| 22-2820     | .0068 Mfd. paper—400 V   |
| 22-2892     | 10 Mfd. electrolytic—300 V                                     |
| C19 22-2893 | Electrolytic   |
| 54-271      | 6-32x $\frac{1}{4}$ hex yalnut—Inverted type (2 mt. ea. 195-4) |
| 57-2261     | Relay mtg. plate   |
| 58-229      | 4 prong plate  |
| 63-942      | 15K ohm 2W Ins. 10%  |
| 63-965      | 1000 ohm 1W Ins. 10%   |
| 63-1747     | 120 ohm $\frac{1}{2}$ W Ins. 10% (2 used)                      |
| 63-1194     | 47K ohm 1W Ins. 10%  |

| Part No.       | Description  |
|----------------|--|
| 63-1757        | 220 ohm 1/2 W Ins. 10%                                 |
| 63-1772        | 470 ohm 1/2 W Ins. 20%                                 |
| 63-1803        | 2700 ohm 1/2 W Ins. 10%                                |
| 63-1813        | 4700 ohm 1/2 W Ins. 10%                                |
| 63-1855        | 47K ohm 1/2 W Ins. 10%                                 |
| 63-1862        | 68K ohm 1/2 W Ins. 10%                                 |
| 63-1887        | 270K ohm 1/2 W Ins. 10%                                |
| 63-1897        | 470K ohm 1/2 W Ins. 10% (8 used)                       |
| 63-1922        | 1.8 meg. 1/2 W Ins. 10%                                |
| 63-1925        | 2.2 meg. 1/2 W Ins. 10% (8 used)                       |
| 63-1933        | 3.3 meg. 1/2 W Ins. 20%                                |
| 63-1936        | 3.9 meg. 1/2 W Ins. 10%                                |
| 63-1961        | 15 meg. 1/2 W Ins. 20%                                 |
| 63-3667        | 100 ohm 10W WW 10%                                     |
| 78-644         | Connector socket                                       |
| 78-755         | Octal tube socket                                      |
| 78-846         | 9 contact wafer tube socket (2 used)                   |
| 78-906         | 8 contact wafer tube socket                            |
| 78-916         | 7 contact wafer tube socket (4 used)                   |
| 78-1036        | 5 contact molded connector socket                      |
| 83-300         | 3 lug terminal strip                                   |
| 83-341         | 1 lug terminal strip                                   |
| 83-1405        | 5 lug terminal strip                                   |
| 83-1759        | 8 lug terminal strip (2 used)                          |
| 83-2470        | Ins. strip   |
| 83-1990        | Trans. ins. strip                                      |
| SW1 85-580     | Auto-manual switch                                     |
| 86-254         | Connector terminal (2 used)                            |
| 93-1106        | .144x1/2x.031 masher (4 used on 57-2261)               |
| 94-706         | Coil form (insert) (part of S-24906)                   |
| T1 95-1500     | Power Transformer                                      |
| 113-25         | 6-32x3/8x1/4 hex hd. mach. screw (4 used with 57-2261) |
| 113-67         | 4-40x1/4x1/4 hex hd. mach. screw (2 mt. 85-580)        |
| 126-554        | Tube shield  |
| 126-741        | Input shield   |
| 126-822        | Interstage shield                                      |
| 149-153        | Iron Core (part of S-24906)                            |
| 149-172        | Iron Core (1 part of ea. S-24788 & S-24789)            |
| 149-173        | Iron Core (1 part of ea. S-24785)                      |
| K1, K3 195-4   | Relay—C.W. & C.C.W.                                    |
| or             |  |
| S-24706        | Relay—C.W. & C.C.W.                                    |
| K2, K4 S-24705 | Relay (Bi-Stable) On-Off or Mute                       |
| S-24781        | Coil shield assembly                                   |
| L1, L2 S-24785 | Amplifier Plate coil assem. (2 used)                   |
| S-24787        | Terminal strip assembly                                |
| L6, L4 S-24788 | Discriminator coil assem. (2 used)                     |
| L7, L5 S-24789 | Discriminator coil assem. (2 used)                     |
| S-24795        | Relay cover assembly                                   |
| L3 S-24906     | Limiter grid tripler coil assem.                       |
| S-26657        | Terminal strip assem.                                  |

#### TUBES

|        |        |
|--------|--------|
| 2-6AL5 | 6CB6   |
| 6AU8   | 2-6CM7 |
| 6BN6   | 25Z6GT |

NOTE: When ordering complete control chassis see model parts list for correct number.

#### #S-24718 Drive Mechanism Parts (8 TUBE REMOTE CONTROL)

|        |                                      |
|--------|--------------------------------------|
| 17-141 | Nylon Clamp (Rets. Sw. & Mtr. wires) |
| 23-23  | Wire connector                       |
| 34-261 | Pinion gear (drives S-24765)         |
| 34-264 | Gear (used with S-24777)             |

| Part No.    | Description   |
|-------------|---|
| 54-34       | 6-32x1/4x3/32 hex nut (3 used)                        |
| 58-226      | 5 prong plug  |
| 61-190      | Drive roller (used on S-24768)                        |
| 80-1034     | Spring clip (part of S-24777)                         |
| 80-1108     | Snubber spring (checks 34-261; part of S-24767)       |
| 80-1109     | Pinion spring (mts. on 34-261)                        |
| 80-1110     | Mtr. coupling spring (part of 141-143)                |
| 80-1117     | Pawl spring (for S-24766)                             |
| 80-1118     | Lock link spring                                      |
| 93-179      | .140x5/16x1/32 washer                                 |
| 93-502      | Lockwasher (3 used)                                   |
| 93-1231     | .171x3/4x.020 washer                                  |
| 93-1244     | Neoprene washer (used with 34-261)                    |
| 94-938      | Drive wheel bushing                                   |
| 113-34      | 6-32x3/8x1/4 hex mach. screw lockwasher att. (3 used) |
| 114-39      | 8-32x1/4x1/4 hex hd. self tap screw                   |
| 118-60      | Sw. lock link   |
| M1 141-143  | Remote control drive mtr. (reversible)                |
| 188-148     | Retaining ring  |
| 188-168     | Retaining ring (2 used)                               |
| SW2 S-24704 | Switch assembly                                       |
| S-24762     | Mtg. plate assem.                                     |
| S-24765     | Gear & pinion assem.                                  |
| S-24766     | Pawl & bushing assem.                                 |
| S-24767     | Cover plate assem.                                    |
| S-24768     | Dr. wheel & stud assem.                               |
| S-24777     | Index whl. hub & spring clip assem.                   |

#### #S-24702 Four Key Tuning Control Complete

|         |                                    |
|---------|------------------------------------|
| 24-827  | Housing Back                       |
| 46-1575 | Knob—On-Off                        |
| 46-1576 | Knob—Left                          |
| 46-1577 | Knob—Right                         |
| 46-1578 | Mute Knob                          |
| 54-426  | Speed Nut—Rd—Push-On (2)           |
| 71-114  | 2-56x3/16 Flat Hd. Mach. Screw (4) |
| 138-132 | Grille                             |
| S-24881 | Housing Assembly                   |

#### Microphone

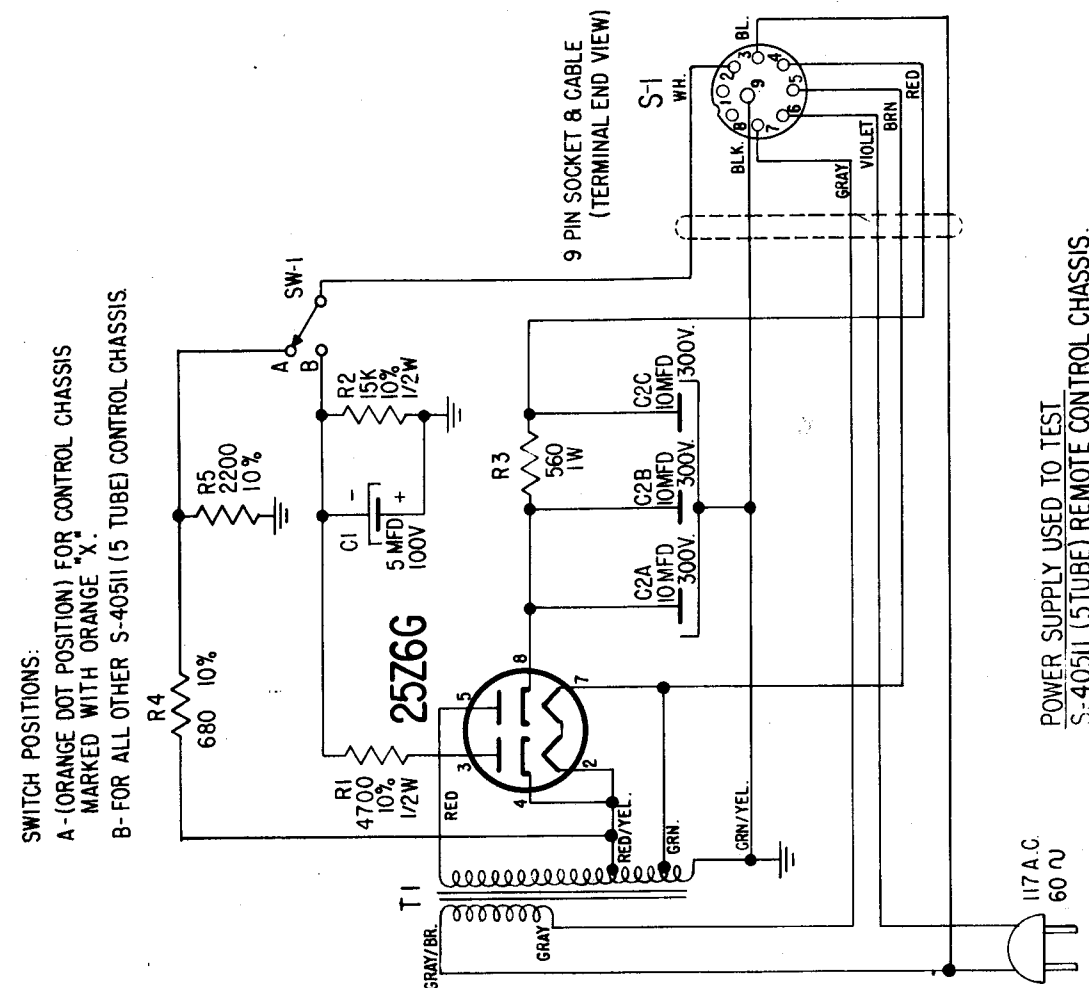
|         |                                     |
|---------|-------------------------------------|
| S-24916 | Microphone                          |
| S-24974 | Microphone, housing, & cable assem. |

#### MISCELLANEOUS

|         |                               |
|---------|-------------------------------|
| S-40467 | Service Kit                   |
| 1—      | Test Generator S-40466        |
| 1—      | Power Cord 11-129             |
| 1—      | Jumper Plug S-40463           |
| 1—      | Jumper Plug S-40537           |
| 1—      | Audio Extension Leads S-22113 |

#### S-40542 Power Supply for 5 tube control chassis (not part of S-40467 kit)

|            |                                      |
|------------|--------------------------------------|
| S-40540    | Socket, cap & wire assembly          |
| 11-85      | Line cord & plug                     |
| 22-2696    | Electrolytic capacitor               |
| C1 22-2892 | Electrolytic capacitor               |
| 63-1778    | 2,200 ohm carbon resistor 1/2 W 10%  |
| 63-1799    | 680 ohm carbon resistor 1/2 W 10%    |
| 63-1813    | 4,700 ohm carbon resistor 1/2 W 10%  |
| 63-1834    | 15,000 ohm carbon resistor 1/2 W 10% |
| 63-2348    | 560 ohm carbon resistor 1 W 10%      |
| 78-582     | Nine contact socket                  |
| 78-755     | Octal tube socket                    |
| SW1 85-495 | D.P.D.T. slide switch                |
| T1 95-1500 | Power transformer                    |
|            | Vacuum tube—type 25Z6GT              |



#### S-24702 FOUR KEY CONTROL BOX RODS

| PART NO. | FUNCTION |
|----------|----------|
| 76-834   | ON-OFF   |
| 76-836   | LEFT     |
| 76-837   | RIGHT    |
| 76-835   | MUTE     |

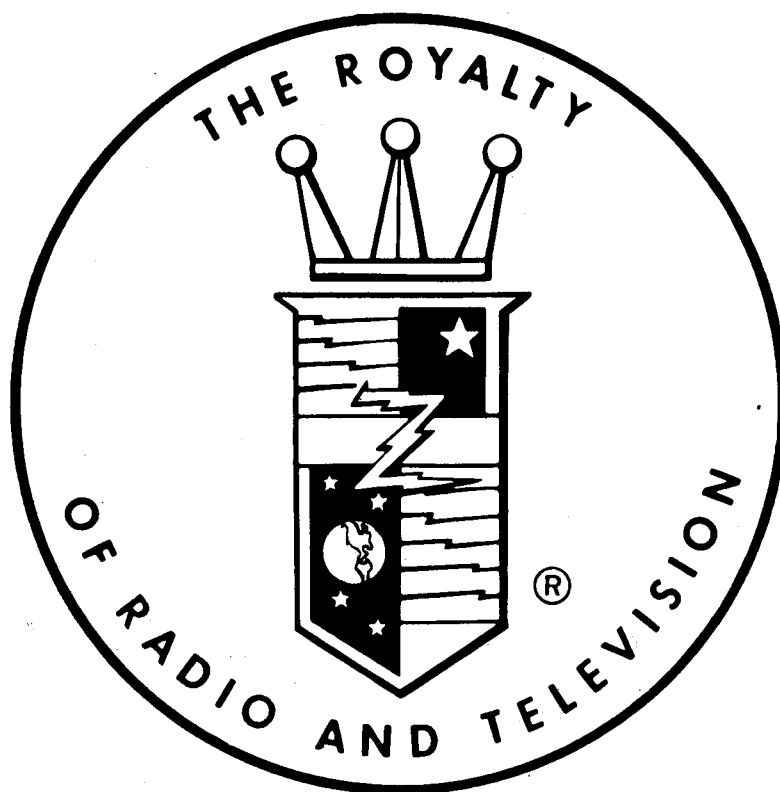
#### S-24717 TWO KEY CONTROL BOX RODS

| PART NO. | FUNCTION |
|----------|----------|
| 76-837   | MUTE     |
| 76-836   | TUNE     |

NOTE: KEY RODS ARE CODED WITH 1, 2, OR 3, KNURLED RINGS OR NO RING

Figure 19—Tuning Control Rods

Figure 20—Schematic Diagram #S-40542 Power Supply



## **ZENITH RADIO CORPORATION**

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