

SECTION VI
TONE KEYER UNIT
CRV-35007
TECHNICAL SUMMARY

ELECTRICAL CHARACTERISTICS—

Keying Speed (maximum)	500 dots second
Input Impedance	10,000 ohms
Input Current (minimum)	0.15 milliamperes
Output Impedance	600 ohms

Output Power (maximum):

With Attenuator Pad In	1.2-12.6 milliwatts
With Attenuator Pad Out	6 db above 1.2-12.6 milliwatts

External Tone Source:

Frequency	Up to 5,000 cycles
Input Voltage (minimum)	0.7 volt r.m.s
Oscillator Frequency Range	400-5,000 cycles

AGC Time Constant:

Fast	0.01 second
Medium	0.1 second
Slow	1 second
Battery Requirement (45 volts)	1 Burgess 2308 or equivalent

TUBE COMPLEMENT—

Limiter	1 RCA-36
Output (Push-Pull) Amplifier	2 RCA-37
Threshold	1 RCA-36
Oscillator	1 RCA-37

MECHANICAL SPECIFICATIONS—

Dimensions:

Panel Size	19 inches (width) x 10 ¹⁷ / ₃₂ inches (height)
Unit Depth (including shield)	10 ³ / ₄ inches
Weight (net)	37 pounds

DESCRIPTION

The tone keyer unit of the diversity receiving equipment serves to key a locally generated tone signal of constant frequency in accordance with the telegraph or facsimile keying of the incoming radio signal. A keyed tone of this sort can be used for transmission over land lines and can also be used to control any type of recording or automatic keying equipment.

Incorporated within the unit are an audio-frequency (tone) oscillator, a push-pull audio-frequency (tone) amplifier, a limiter stage, and a threshold bias control tube.

The audio-frequency (tone) oscillator circuits are such as to permit the control (from the front panel) of the generated frequency. Any desired frequency between the limits of 400 and 5,000

cycles per second may be obtained. The output of the audio-frequency oscillator, or tone from an external source, may be coupled to the input of the audio-frequency (tone) amplifier tubes through operation of the "OSC.-EXT. TONE" Key-switch.

The function of the limiter tube (V401) is to key the audio-frequency amplifier tubes (V403, V404) in exact step with the dots and dashes of the incoming radio-frequency signal. This action is accomplished as follows:

The bias voltage which is applied to the limiter tube is developed by the output of the diode detector tube which flows through potentiometer R406 and is adjustable by means of the "INPUT" control. During the intervals in which no

signal is being received, no bias voltage is developed and as a consequence the plate current drawn by the limiter tube is comparatively high. This plate current flows through resistors R408 and R409 across which bias voltage for the audio-frequency amplifier tubes (V403, V404) is developed.

During the intervals in which no radio-frequency signal is being received, this plate current develops a bias voltage which is sufficient to reduce the output of the audio-frequency amplifier tubes to zero. During the intervals in which a radio-frequency signal is being received, bias voltage is developed across the "INPUT" potentiometer (R406). As a result, the plate current of the limiter tube and the resulting bias applied to the audio-frequency amplifier tubes is reduced. The audio-frequency amplifier tubes then function to amplify the constant frequency output from the tone generator.

The function of the threshold tube (V402) is to provide limiting bias for the tubes in the radio-frequency amplifier unit during the intervals when no radio-frequency signal is being received. This bias voltage is developed by the current which flows through resistor R405 and the "THRESHOLD" potentiometer (R403) from the cathode of the threshold tube. There is no bias voltage on the grid of the threshold tube during the intervals in which no signal is being received. Therefore, the cathode current which flows from this tube during these intervals is comparatively high and, under these conditions, the actual bias that is applied to the grids of the tubes in the radio-frequency amplifier is determined by the position of the arm on the "THRESHOLD" potentiometer (R403).

Automatic gain control (AGC) potential for the radio-frequency amplifier tubes is developed across the "INPUT" potentiometer (R406) by the rectified signal current which flows through it to the diode output terminal on the intermediate-frequency amplifier unit. During the intervals when no signal is being received and for all signals below the adjustable threshold level, the voltage developed across the "THRESHOLD" potentiometer (R403) will be more negative than the voltage developed by the signal current

which flows through the "INPUT" potentiometer (R406). Under these conditions the voltage developed by the cathode current from the threshold tube will be the bias voltage applied to the radio-frequency amplifier tubes. For all signals, which are above the adjustable threshold value, the potential developed by the rectified signal current flowing through R406 will be greater (more negative) than the potential developed across R403. Under these conditions the potential developed across R406 will be the bias voltage applied to the radio-frequency amplifier tubes.

Automatic shifting back and forth from AGC bias supplied by the signal itself to a manually adjustable threshold bias is the chief feature of the circuit. This permits the use of AGC at practically all times, even when the signal-to-noise ratio is poor. It gives the desired AGC action on strong signals and prevents noise from breaking through during spaces or during pauses in traffic. The time constant of this AGC and threshold system can be adjusted to slow, medium or fast at the signal control panel.

The internal tone oscillator has a frequency range of from 400 to 5,000 cycles (approximately) and its calibration is satisfactory for ordinary requirements. This unit is designed for maximum stability and minimum of harmonic content throughout the entire frequency range in order to operate in installations where several tones are to be transmitted over a single land line. Frequency drift is not greater than 0.1 of 1 per cent over long periods of time, and total harmonic content with the associated amplifier is not greater than 6 per cent when measured at the output terminals of the tone keyer.

A differential milliammeter is provided on the front panel to indicate the balance of the push-pull amplifier stage. The frequency characteristic of this stage is such that tone frequencies up to 5,000 cycles or higher may be used. The fidelity of the overall circuit is such that keying speeds up to 500 dots (50-50) per second can be handled. In operation, therefore, keying is limited not by the keying stages but by the band width employed in the i-f system of the receiver.

OPERATION

To prepare the tone keyer unit for operation, power should be applied by throwing the "POWER SWITCH" upward. Adjustments should be made with the "NORMAL-TEST" switch in the "TEST" position, which provides a steady tone output. The "INPUT" and "THRESHOLD" controls afford the adjustments required in normal operation as described in Section I. Additional output control is obtainable with the attenuator switch marked "PAD IN—PAD OUT," this switch controlling a 6 db pad.

The "Ip BALANCE" meter indicates the difference between the plate currents of the two tubes in the push-pull output stage. Normally, this difference is approximately 0.2 ma, and in no case should exceed 0.5 ma. To obtain this condition, the output tubes must be closely matched.

Selection of either the internal oscillator or an external tone source is afforded by the "OSC.-EXT. TONE" key switch at the right-hand side

of the panel. When using the internal oscillator, the tone frequency may be set by referring to the calibration card mounted inside the small door on the panel. The wide frequency range of 400 to 5,000 cycles is obtained by variation of induct-

ance as well as capacitance. Inductance adjustment is provided by the "HIGH-LOW" key switch adjacent to the oscillator switch, while the dial and switches directly above afford the capacitance adjustment.

SERVICE

Failure of the tone keyer unit to operate will necessitate a systematic trouble check. It is advisable first to determine that the plate and filament voltages are correct at the power control panel. The absence of one or more of these supply voltages is usually an indication that the associated fuse or fuses on the latter panel have blown. Replacement fuses should be equivalent in current rating to those originally employed—never higher. Immediate failure of a replacement fuse indicates trouble within the keyer unit proper, and power should be removed from the unit by throwing the power switch off (downward). Such faults are usually traceable to a short circuit, perhaps, between the elements of a tube or due to breakdown of a capacitor, and are therefore comparatively easy to locate.

In cases where the supply voltages are normal but the unit fails to function properly, the condition is more difficult to diagnose. The tubes

should be tested initially and replacements made where the mutual conductance has decreased to less than 70 per cent. of the nominal value. Replacement tubes, except in the case of the tone oscillator, can only be judged on the basis of actual performance in the unit. A spare pair of matched (type 37) tubes for the push-pull output stage should be kept on hand for replacement purposes.

If the tubes are satisfactory, the tube-socket voltages should be checked (see Section 1). Next, an ohmmeter should be used to check resistance values and circuit continuity. Referring to the schematic diagram, Figure 5, resistors deviating more than 10 per cent. from the nominal value should be replaced. The 45-volt "B" battery contained in the unit for plate supply to the threshold tube should be replaced when the potential is reduced to less than 40 volts.

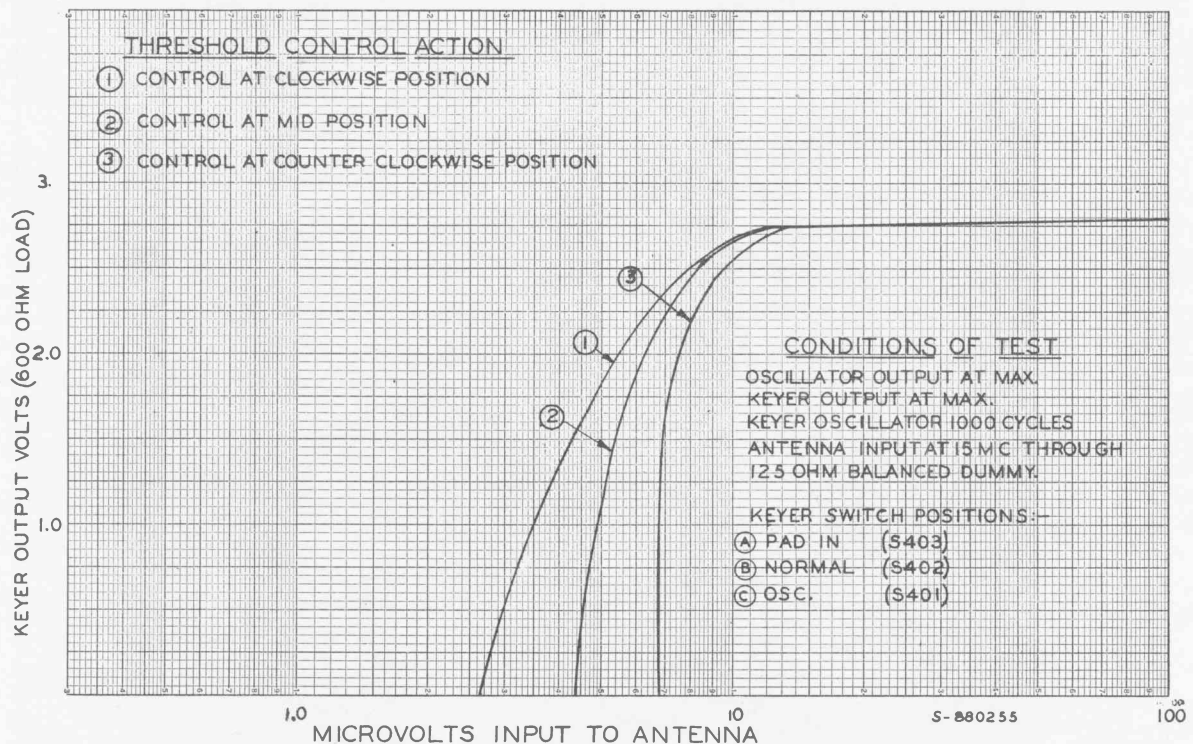


Figure 1—Threshold Control Action
(S-880255—Sub. 0)

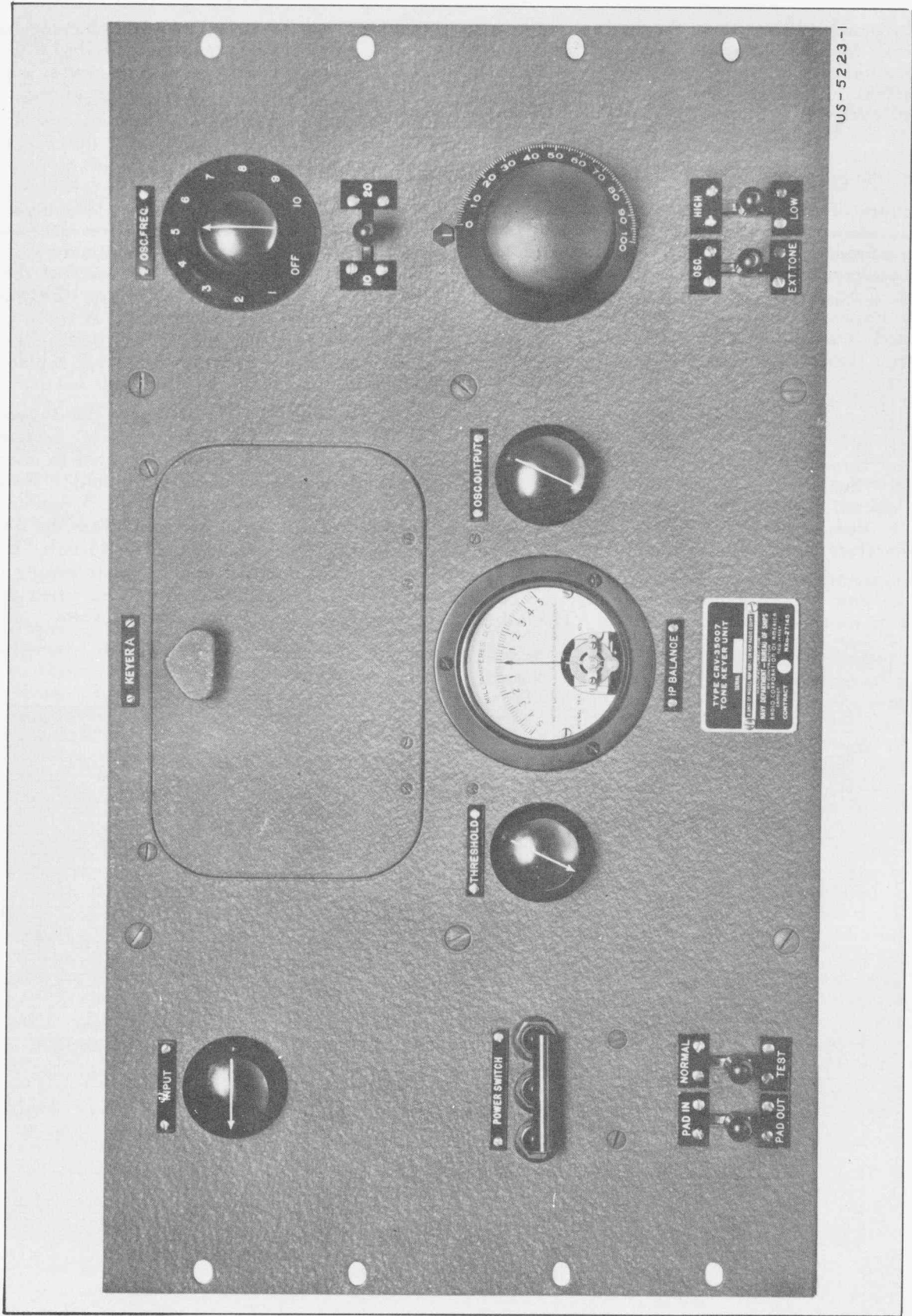


Figure 2—Type CRV-35007 Tone Keyer Unit
(Front View)

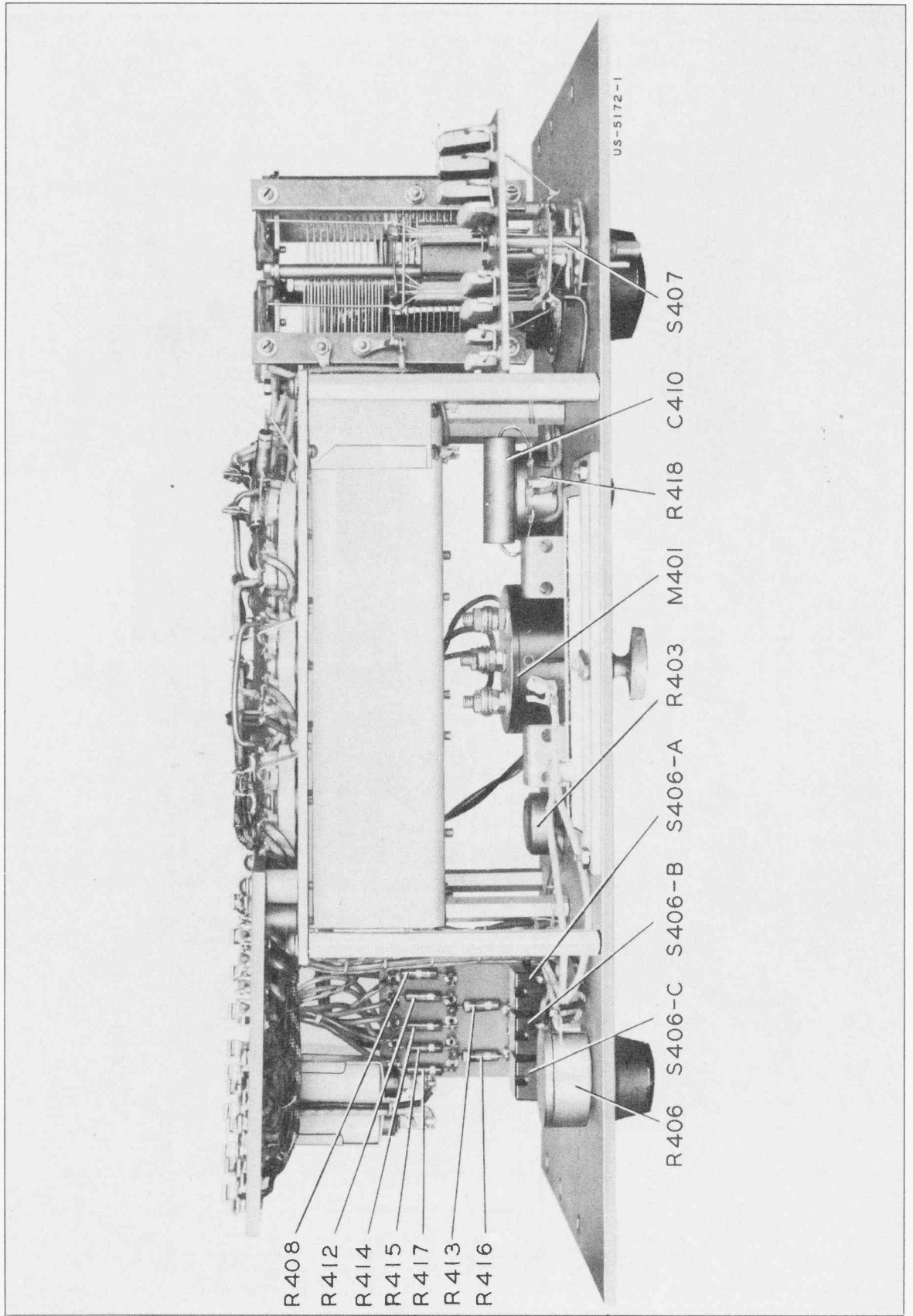


Figure 3—Type CRV-35007 Tone Keyer Unit
(Top View)

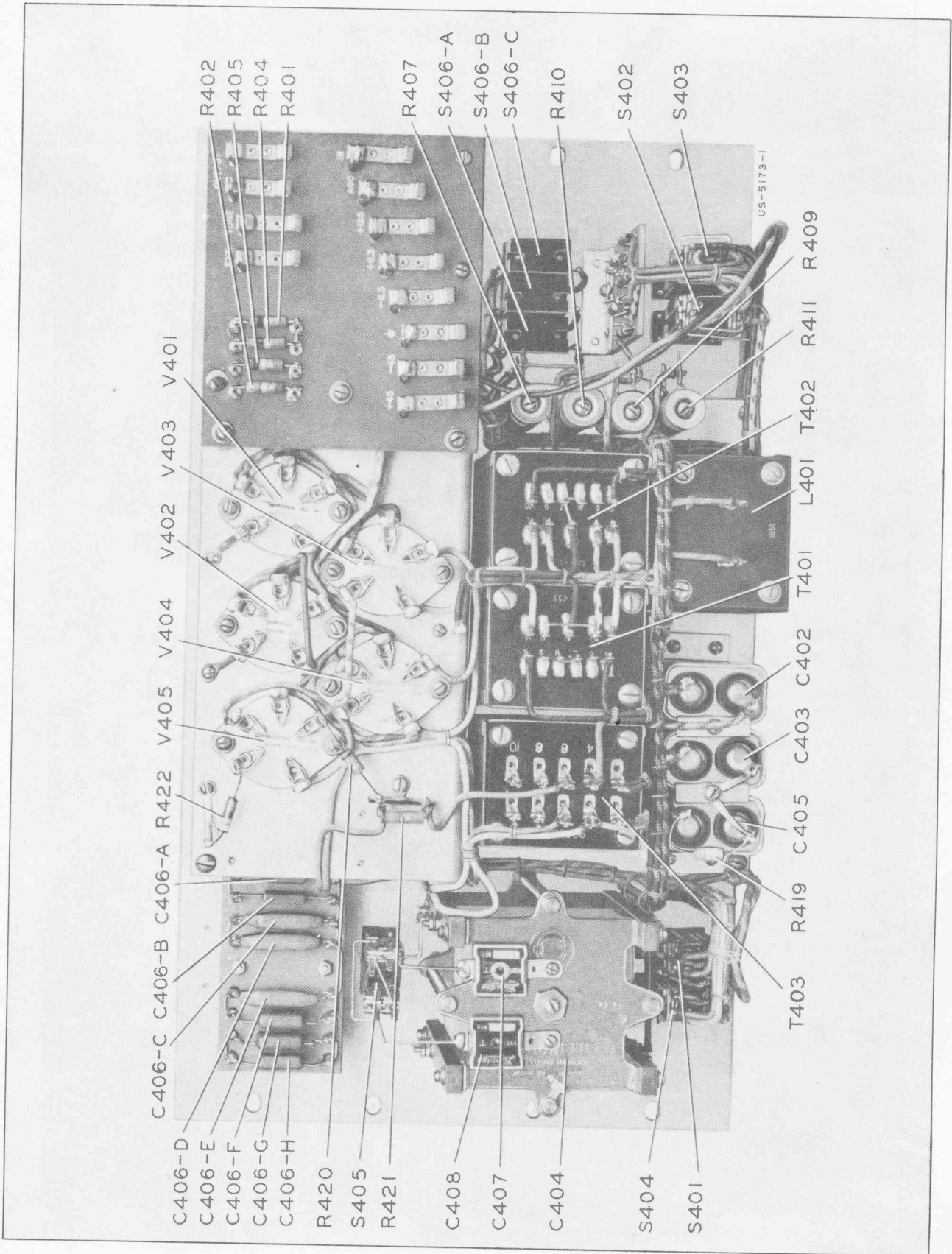


Figure 4—Type CRV-35007 Tone Keyer Unit
(Rear View)

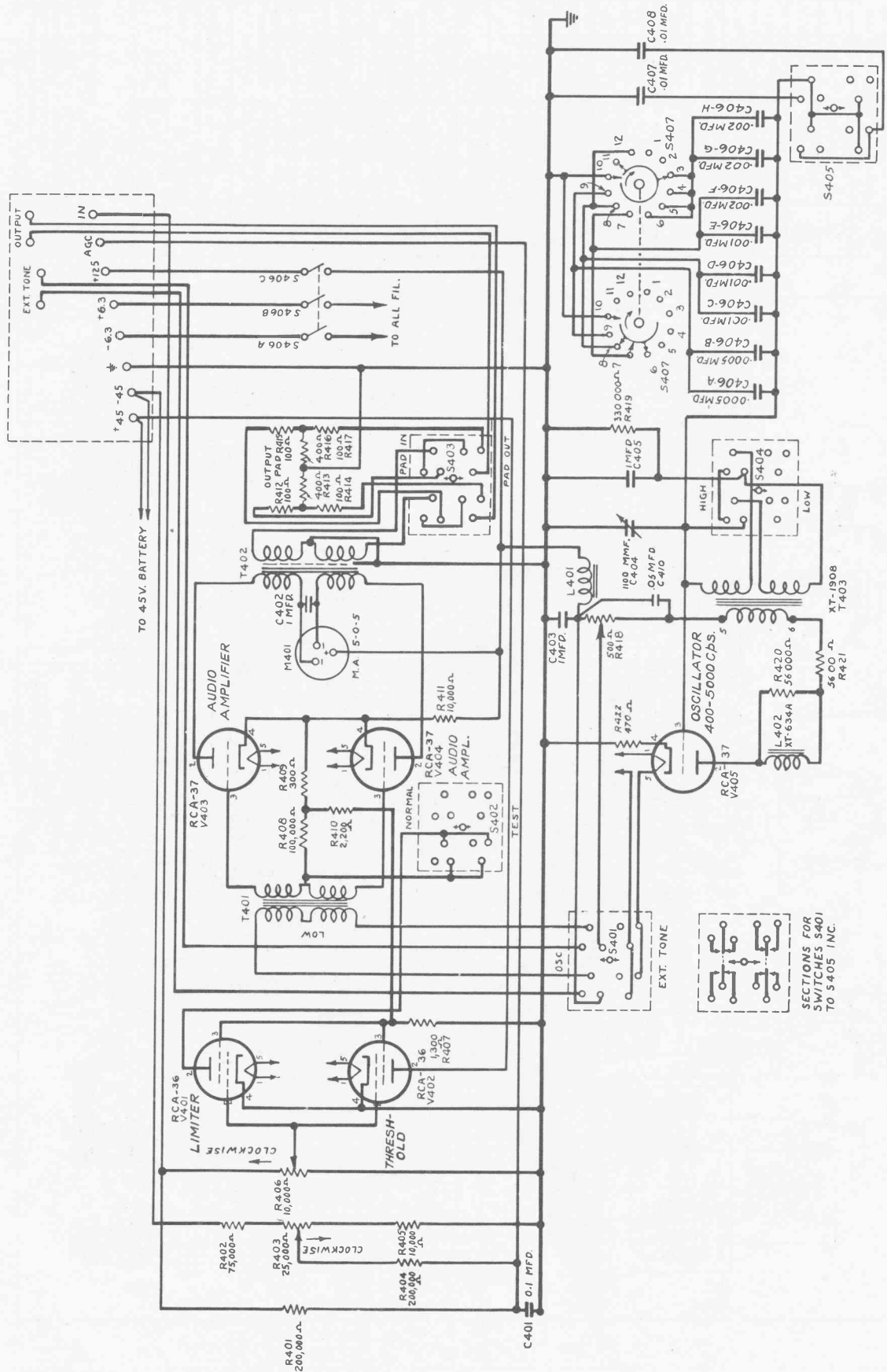


Figure 5—Type CRV-35007 Tone Keyer Unit Schematic (P-721914—Sub. 1)

PART NO. SEC.	DESCRIPTION	WIRE NUMBER
K 802514		
2	K-815877-5 RED-GREEN TR.	1
3	K-815877-4 RED-YELLOW TR.	10 TO 14 INCL.
4	K-815877-6 RED-BLUE TR.	20 TO 22 INCL.
5	K-815877-3 RED	30 TO 37 INCL.
6	K-815877-5 YELLOW	40 TO 47 INCL.
7	K-815877-23 BROWN	50 TO 52 INCL.
8	K-815877-21 ORANGE	60 TO 62 INCL.
9	K-815877-20 BLACK	70 TO 80 INCL.
10	K-815877-1 BLACK-YEL. TR.	90 TO 93 INCL.
11	K-815877-9 VEL.-RED TR.	100 TO 102 INCL.
12	K-815877-16 GRN.-BLU. TR.	110
13	K-815877-15 GRN.-YEL. TR.	115
14	K-815877-13 GREEN	120 & 121
15	K-815877-12 VEL.-BLK. TR.	125 TO 127 INCL.
16	K-815877-24 BLK.-GRN. TR.	130 TO 133 INCL.
17	K-815877-13 BLU.-YEL. TR.	140 TO 147 INCL.
18	K-815877-25 WHI.-RED TR.	150 & 151
19	K-815877-7 RED.-BLK. TR.	155 TO 158 INCL.
20	K-815877-2 BLK.-RED TR.	160 & 161
21	K-815877-18 BLUE	165 TO 169 INCL.
22	0505 THREADED COPPER WIRE	175 TO 197 INCL.
23	PS-50 0661 D.F. LEX. VARN. TUBING BLACK	200

NOTE: CODING INSERTED IN WIRES INDICATES WIRE NO. AND DESTINATION OF WIRE RESP. THUS 1-1403-5 WHERE A NO. ONLY IS GIVEN WIRE NO. IS INTENDED. A NUMBER PRECEDED BY A LETTER INDICATES AN ELECTRICAL ITEM THUS L-401-1 NUMBERS IN CIRCLES REFER TO PT. NUMBERS ON WIRING M/L.

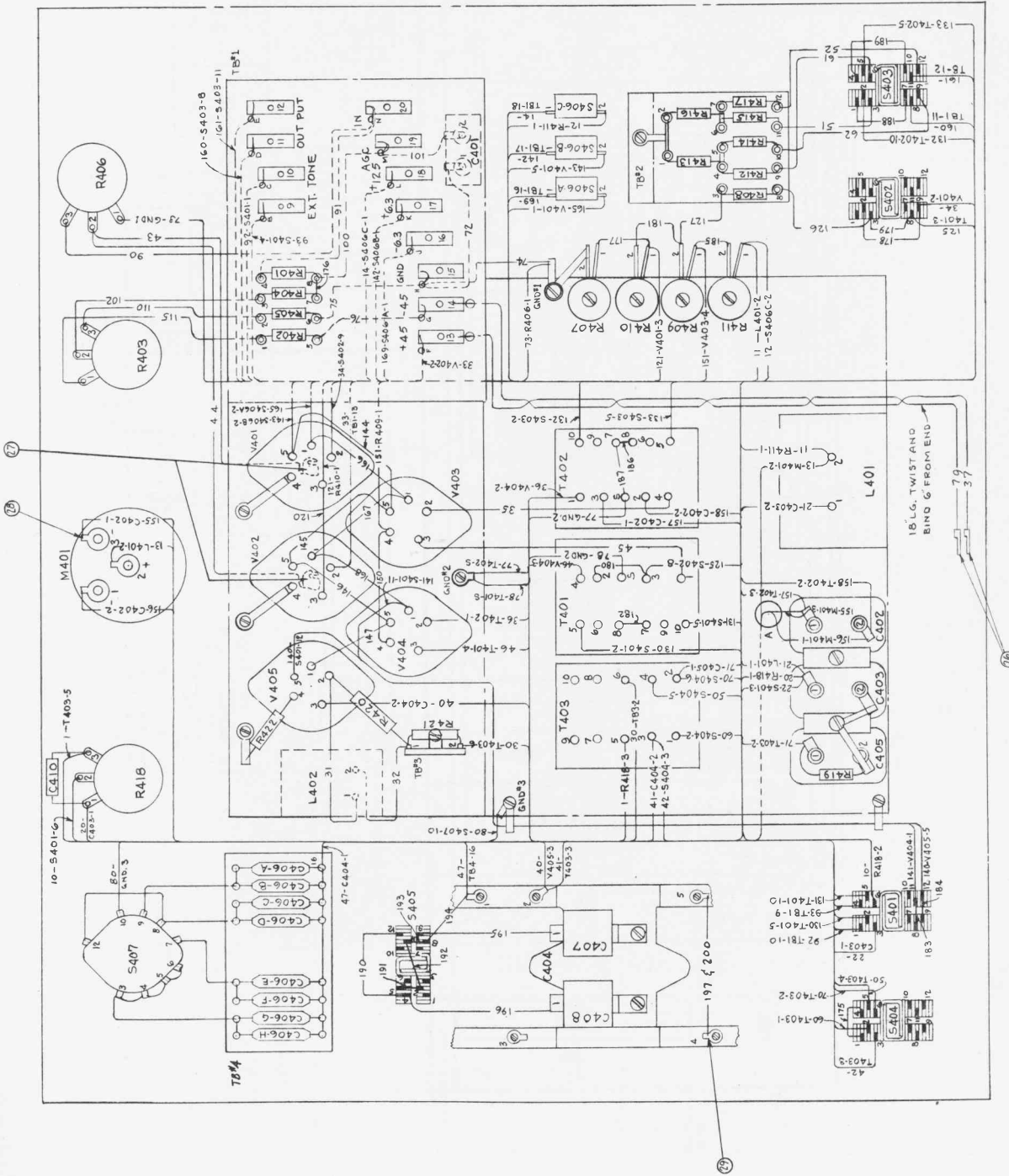


Figure 6—Type CRV-35007 Tone Keyer Unit Connections (T-621147—Sub. 1)