SERVICING hi-fi PREAMPS AND AMPLIFIERS

Includes Two Sections . . .

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VOLUME 4

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SERVICE FACTS ABOUT PREAMPS AND AMPLIFIERS

ANALYZING EQUALIZATION NETWORKS

In a hi-fi system, it is generally desirable to have a flat frequency response over the entire audible range. This doesn't mean that every component (speaker, amplifiers, cartridge, etc.) will have a flat response, nor does it mean that corrective measures will be taken with every unit to produce this desired response. It does mean, however, that action should be taken to insure that the output will be as nearly like the original music or sound as possible.

What do we mean by flat? Simply stated, a flat response is realized when, after the volume control is adjusted to reproduce the original volume level at any one frequency, this same volume level will be reproduced at all frequencies on the recording. Now that we have established the need for a frequency response that is flat and covers the entire audible range, let's see how equalization and equalizers fit into the picture.

Those of you who are familiar with the specifications for playback power amplifiers know that a typical listing of these specs might be 30 watts of audio over the range of 20 cps to 50 kc ±1.5 db at less than 3% IM (intermodulation) distortion. You should also be familiar with the fact that a speaker enclosure is designed to load the speaker and, thus, match it to the output amplifier to produce an essentially flat frequency response. It is also readily accepted that voltage amplifier stages can be designed with a flat frequency response over the entire audio range. Why, then, is equalization (frequency compensation) needed?

There are two main reasons — the pickup device used in the playback system, and the recording itself. Let's examine the recording first. Most pickup cartridges utilize the velocity principle, where the output signal voltage is proportional to the excursion rate of the needle. It just so happens that when the record is cut to produce equal velocities for all frequencies of the same voltage amplitude, the excursion distance is inversely proportional to the frequency.

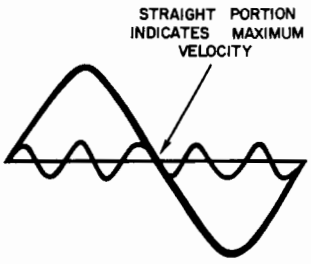


Fig. 1. A constant velocity at all frequencies results in higher amplitudes at low frequencies.

In Fig. 1, two signals are superimposed to illustrate this phenomenon. This would mean (using practical figures) that if an excursion of 1/10,000 of an inch produced maximum output voltage at 20,000 cps, then the excursion required to produce the same output at 20 cps would be 1/10 of an inch. Naturally, grooves 1/10 of an inch wide cannot possibly be packed 100 to the inch on a record. Some LP and extended play 45's even have more than 100 grooves to the inch. For this reason then, the amplitudes of low-frequency signals are attenuated before they are applied to the record.

On modern recordings, this attenuation is not done on a helter-skelter basis. Instead, most recordings are now based on the RIAA (Recording Industry Association of America) curve shown in Fig. 2.

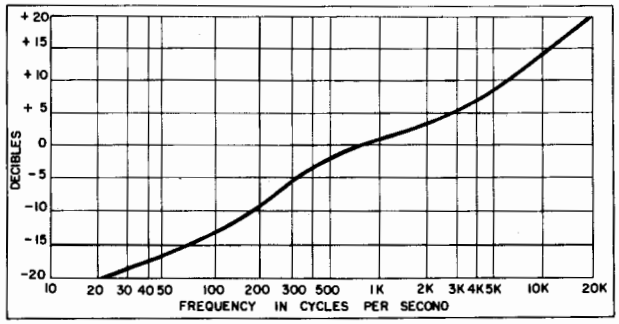


Fig. 2. RIAA recording curve (± 2 db tolerance).

As you can readily see, all signals with a frequency below 1,000 cps will be attenuated, while those above 1,000 cps will be boosted. Applying this information to your knowledge of a playback system, you can see that if we are to hear music as it sounded before being put on the record, some frequency compensation must be employed in the playback system. The RIAA playback curve in Fig. 3 is the reverse of the record curve in Fig. 2, and equalization in the playback must boost the low frequencies and attenuate the high frequencies in accordance with this curve to produce a flat response.

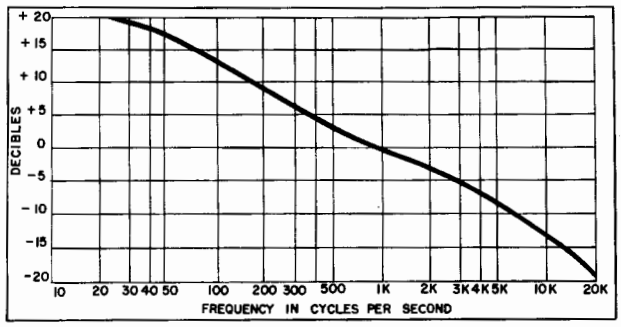


Fig. 3. RIAA playback curve (± 2 db tolerance).

This, of course, assumes a flat response characteristic for the pickup device — a condition not always found. To compensate for the frequency-characteristic differences between the various pickup devices, tone controls that can either boost or attenuate both low and high frequencies are included in playback systems, but the ranges of these controls are generally not sufficient to complement the record curve. Thus, a special circuit that accomplishes the required equalization is incorporated in the playback amplifier and is almost always made up of combinations of resistors and capacitors. Let's examine the basic circuit in Fig. 4 and see how this combination of resistance and capacitance can be used for frequency correction.

First of all, let's eliminate the components not primarily tied in with frequency correction — the plate-load resistor R1 for the first stage, the coupling capacitor and DC blocker C1, and the DC return R4 for the grid of the second stage. Actually, C1 does affect the low-frequency response since its impedance will be fairly high at low audio frequencies, but this is not the reason it is used. As a matter of fact, its effect is the opposite of what we are trying to obtain and must be considered in the design of the compensating network.

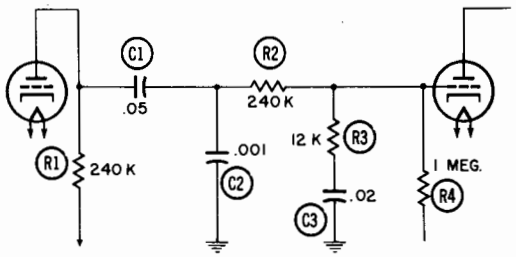


Fig. 4. Basic equalization circuit.

Getting into the network itself, we find that C2 and R2 form a low-pass filter network which attenuates the highs more than the lows. This happens because the higher the frequency, the lower the value of X_C for any given capacitor. In the vernacular of the hi-fi fan, C2 provides high frequency roll-off.

Now we get to the series network of R3 and C3, and again we have a reactance (X_C) that varies with frequency. If you calculate the reactance of a .02-mfd capacitor, you will find that: at 60 cps, X_C equals 191K, at 1,000 cps, X_C equals 7,950 ohms; at 10,000 cps, X_C equals 795 ohms; and at 20,000 cps, X_C equals 397 ohms. Since X_C and R are in series, the net result is an impedance which varies from 12,397 ohms at 20 kc to 203,000 ohms at 60 cps.

If we further analyze this circuit, we see that any signal at the junction of C1, C2 and R2 will divide between R2 and the combination of R3 and C3. Since the total impedance of R3 and C3 is higher at low frequencies, more signal voltage will be applied to the output grid at low frequencies. This is the type of equalization circuitry employed for a common variable-reluctance style of pickup cartridge.

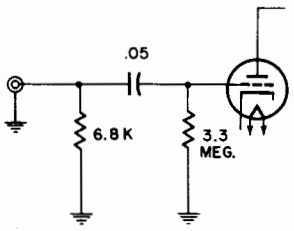


Fig. 5. Equalization in input circuit.

Equalization may not always be accomplished entirely between the halves of a dual triode, as shown in Fig. 4. In many cases, high frequency roll-off is accomplished through the use of a small resistor across the input, as shown in Fig. 5. Its purpose is to provide damping for the variable-reluctance cartridge and, thus, reduce the highs.

Other types of pickup devices usually require different equalization characteristics; furthermore, different circuit designs (such as pentode-to-triode or triode-to-pentode) will require different equalization network configurations. However, these circuits could also be analyzed for an understanding of how they are used to accomplish equalization.

USING THE AUDIO SIGNAL GENERATOR TO TEST AMPLIFIER RESPONSE

Testing a high-quality amplifier without specialized equipment has always been a problem. However, an amplifier can be checked for power output and frequency response with an audio signal generator, AC voltmeter, and scope. If the scope has a wide bandpass response, flat from 0 to 1,000,000 cps or greater, a square-wave audio signal can be used to check both high- and low-frequency responses of the amplifier. If, however, the scope is the general-service type (response to 500 kc), then a sine-wave signal is more suitable. The limited response of a narrow-band scope will distort the square wave slightly and affect the accuracy of the test.

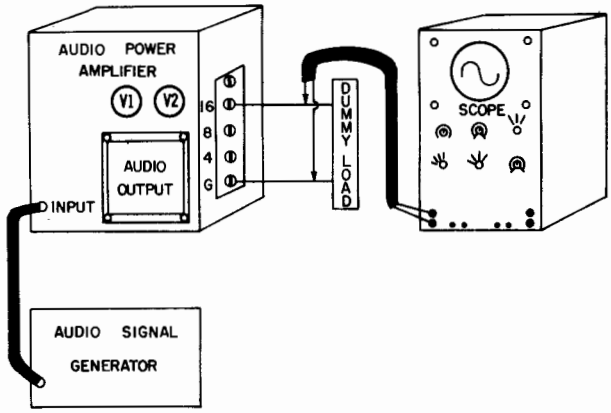
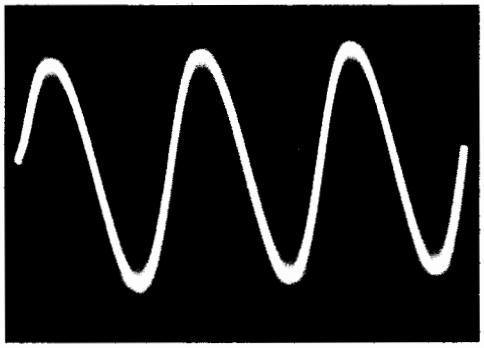
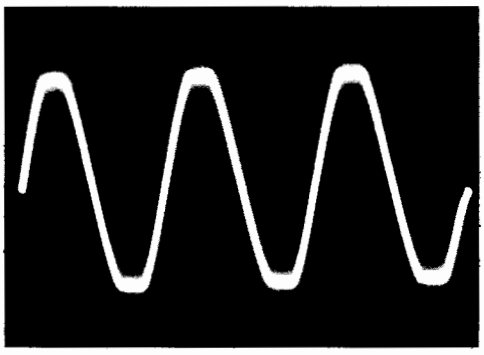


Fig. 6. Test setup for checking amplifier gain over the audio-frequency range.



(A) No clipping.



(B) Mild clipping.

Fig. 7. Comparison of scope patterns observed when setting generator gain level.

In making the test setup, the audio sine-wave signal is applied to the amplifier input, and the speaker output terminals are terminated with a suitable resistor (8 or 16 ohms of a wattage equal to or greater than the power rating of the amplifier). The scope is connected across this resistor, as shown in Fig. 6. A 25-ohm, 100-watt potentiometer makes a good universal dummy load.

After allowing about 15 minutes for warmup, set the signal generator frequency at 1,000 cps and adjust the signal level to the point just below clipping, as illustrated in Fig. 7. The AC output voltage can now be measured across the dummy resistor. A sensitive AC VTVM is best for this measurement; however, a conventional 5,000 ohm-per-volt VOM will give satisfactory performance. Compare your readings with those in Table I to obtain the power output capability of the amplifier under test. If you use a conventional VOM, your amplifier is producing a power output equal to or slightly higher (10 to 15%) than the figure in the table.

DUMMY LOAD– –4 OHMS		DUMMY LOAD– –8 OHMS		DUMMY LOAD– –16 OHMS	
VOLTAGE	WATTS	VOLTAGE	WATTS	VOLTAGE	WATTS
2	1	4	2.0	8	4
2.3	1.3	5	3.125	9	5
2.6	1.71	6	4.5	10	6.25
3	2.25	7	6.125	11	7.5
3.5	3	8	8	12	8
4	4	9	10.1	13	10.6
5	6.25	10	12.5	14	12.25
6	9	11	15	15	14
7	12.5	12	18	16	16
8	16	13	21	17	18
		14	24.5	18	20
		15	28	19	22.5
		16	32	20	25
				21	27.5
				22	30
				23	33
				24	36
				25	39
				30	56
				35	75.6
				40	100

Table I. Power Output in Terms of Voltage Across Fixed Resistor.

To check frequency response, adjust the signal-generator frequency to the lowest frequency the amplifier can pass, and adjust the generator output to produce a signal level above which clipping will take place. Repeat this operation at 500- to 1,000-cps increments across the audio spectrum, noting the voltage reading obtained. Plotting the readings on a graph, as

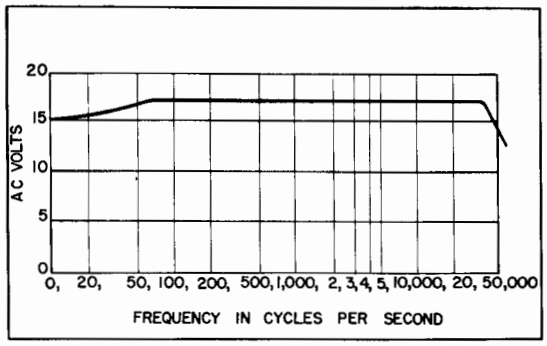


Fig. 8. Amplifier response graph obtained by plotting output voltage readings.

shown in Fig. 8, will provide a gain curve of the amplifier. Harmonic or intermodulation distortion will not be evident; but if the gain curve is fairly flat across the band (similar to Fig. 8), the amplifier is doing a reasonably good job. If you need a more accurate check, use a harmonic distortion analyzer and intermodulation analyzer in the prescribed manner.

A GLIMPSE INTO STEREO PREAMP DESIGN

To say a preamp is a preamp and a stereo preamp is simply two preamps would be like saying any two babies are twins. Since we know a 6SN7 won't work as the final amplifier in a 100-kw transmitter stage, we can realize that a stereo preamp isn't just two of everything. While two of everything is required, several other considerations are of utmost importance to stereo operation. In the block diagram of Fig. 9,

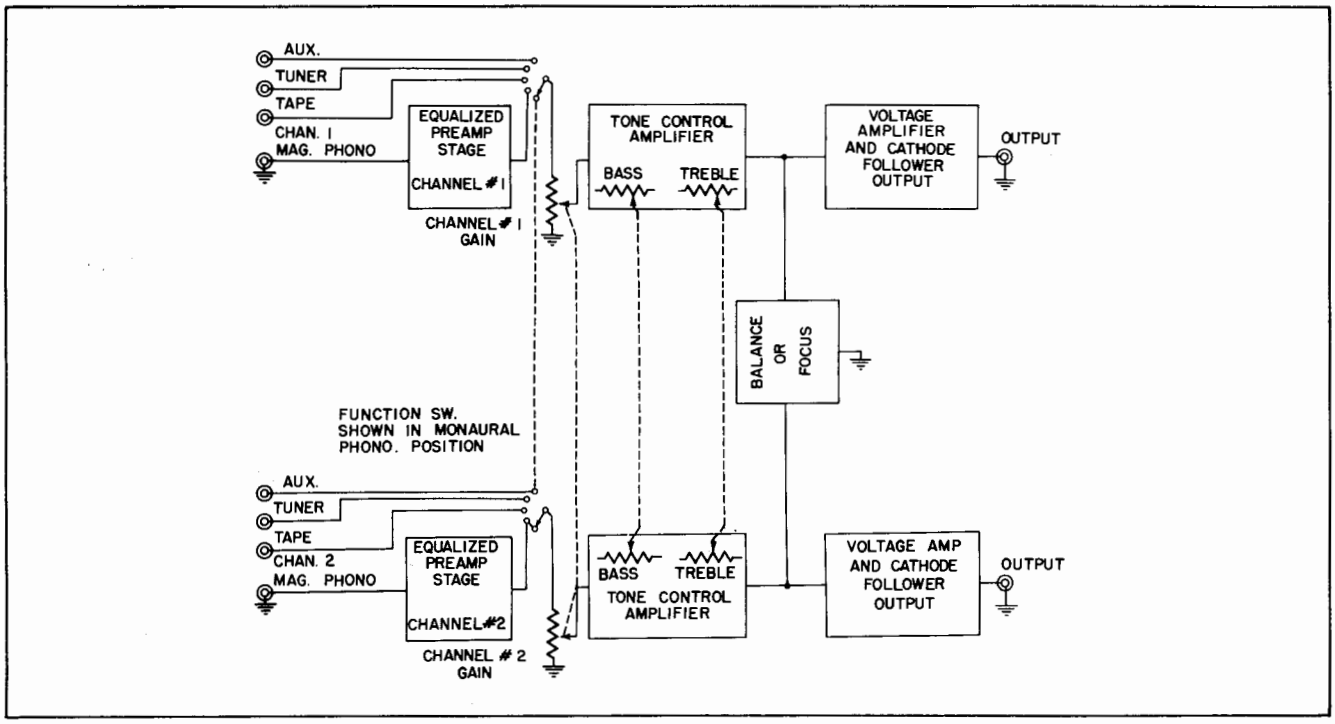


Fig. 9. Block diagram of basic stereo preamplifier, showing pair of identical sound channels, ganged controls, balance network, and function-switch circuit.

for example, you will notice such things as balance control, ganged controls, monaural phono position, and two input jacks for each position on the function selector (except monaural phono). Ganged equalization switches that simultaneously provide the desired equalization to both preamplifier stages may also be provided.

Of particular interest is the fact that the function selector switches, gain, treble, and bass controls of the two channels are ganged — making this portion of the stereo preamplifier no more complicated to operate than a single-channel preamplifier.

The gain controls in Fig. 9 might be labeled volume or loudness in a commercial unit. The function would be the same, however — to vary the output signal of the two channels equally and simultaneously. The ganged bass and treble controls need no explanation other than that they provide simultaneous changes in bass or treble response for the two channels. The design of the circuit in each channel must consider this ganged operation, and the components selected must be of close tolerance to insure a balanced operating condition.

The balance or focus control is peculiar to stereo preamps — monaural units don't have one. This control provides precise balancing of the two output signal amplitudes. If, for any reason (such as unbalanced gain in the preceding stages), the output signals are not identical in amplitude, the balance control can be adjusted to achieve the desired degree of equality. While the balance control is shown connecting the two channels, it does so only from a DC bias standpoint. It does not link the signals in the two channels, nor does it in any way cause the two signals to be mixed.

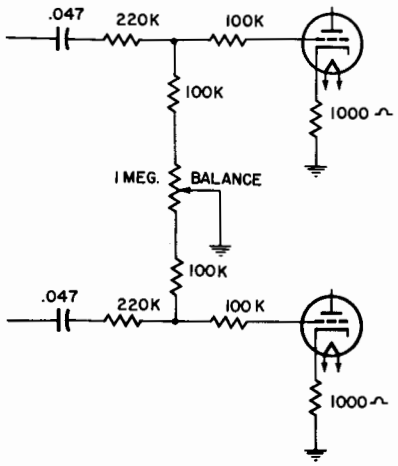


Fig. 10. Schematic of balance control network between stereo preamp channels.

The sample circuit in Fig. 10 shows how the balance control connects into the circuit to do its required job. As you can see, the control is in the common grid return and varies the ratio of DC resistance in each grid circuit. Because of this feature, a stage of gain is provided after the balance control and just ahead of the usual cathode-follower output stage. Thus, where some commercial preamp designs have employed only two dual-triode tubes (one tube as equalized preamp, one-half tube as tone-control amplifier, and one-half tube as a cathode follower), many stereo preamps will employ three dual triodes in each channel. When this is done, one tube will probably be used for equalized preamp stages, one as a tone-control amplifier, and one as a voltage amplifier and cathode-follower output.

The major problem in stereo preamp design is to construct the unit so that it will provide identical performance on both channels without interaction between the two. This is achieved by the use of close-tolerance components, matched tubes, adequate filtering and decoupling between the two channels and the power supply, and careful layout of components so that ground loops will not be created. While the foregoing are most important on the manufacturing level, they also enter the picture whenever service is required. The service technician should replace defective components with replacements having identical ratings and characteristics. Furthermore, replacements should be installed exactly like the originals; ground connections, etc., should not be moved, even though it may be easier to connect a part differently. Also, any tube to be used in a stereo preamp should be aged in the circuit for 24 hours before the unit undergoes a final check prior to its return.

INTERESTING FACTS ABOUT FEEDBACK IN AMPLIFIERS

Feedback is a term often encountered by anyone active in audio work, especially by those who have a particular interest in amplifiers. Persons who work with public-address systems may connect the term with the howls and squeals that occur when sound from a loudspeaker is picked up by the microphone which picked up the original signal. The service technician, on the other hand, may be reminded of the whistles and squeals heard from a radio loudspeaker because unwanted feedback or coupling in some part of the receiver circuit caused the circuit to oscillate.

Feedback occurs when a portion of a signal in one part of an amplifier is reintroduced, or fed back, to a circuit nearer the amplifier input. The feedback is positive when the signal fed back is in phase with the input signal, in which case the gain of the circuit will increase and cause oscillation. The feedback is negative when the signal fed back is out of phase with the input signal. In this case, the gain of the circuit will be reduced.

We will concern ourselves here with the negative (or inverse) feedback applied to amplifiers to obtain certain desirable results. Almost everyone who works with amplifiers is acquainted with the basic principle of how an out-of-phase signal is fed back into an amplifier to reduce distortion, but this is only part of the story and is far from being enough to be of much assistance when an amplifier is being tested or serviced. The service technician should be familiar with the principles involved in negative feedback because some unusual and puzzling conditions can arise when a circuit included in a feedback loop is modified or disturbed. The term "feedback loop" refers to the circuit between the point where the feedback signal is taken from the circuit and the point where it is fed back into the circuit.

Negative feedback is largely responsible for the very low percentages of distortion featured by modern high-quality amplifiers. Only a few years ago, an amplifier with five per cent harmonic distortion was considered very good, but now the situation has changed. With the use of negative feedback, improved circuits, and high-grade output transformers in

present-day amplifiers, one-half per cent harmonic distortion at rated output is common, and much lower percentages are not at all unusual.

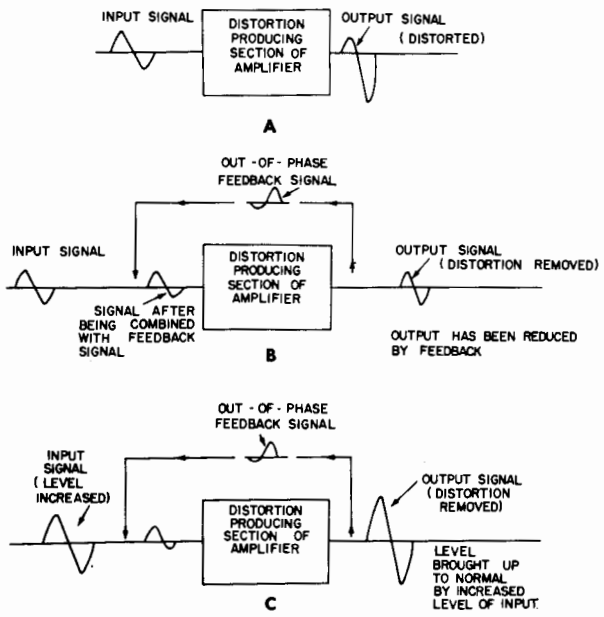


Fig. 11. The effect of negative feedback on a distorted signal.

The basic effect of negative feedback is illustrated in Fig. 11. The undistorted input signal and the distorted output signal are shown in Fig. 11A. The distortion of the output signal is evident because one peak of the signal waveform reaches a greater amplitude than the other. Such distortion, due to the nonlinear operation of tubes and other circuit components, is characteristic of amplifiers. A portion of the distorted output signal is fed back out of phase to the input, where it combines with and modifies the input signal, as shown in Fig. 11B. The input signal is actually distorted by the out-of-phase feedback signal, so that the greater part of the distortion developed in the amplifying circuit is counteracted. Note that in Fig. 11B, the amplitude of the output signal has been reduced because of negative feedback. The output can be brought up to its normal level, as in Fig. 11C, if the level of the input signal is increased. The power-handling capabilities of amplifiers are not reduced by the application of negative feedback.

To be effective, the out-of-phase feedback signal must be taken from the amplifier at a point following the circuit in which the distortion is developed and must be fed into the amplifier at a point ahead of the circuit in which the distortion is developed.

The amount of negative feedback in an amplifier is rated in decibels and is the ratio of the output voltage obtained without feedback to the output voltage developed when feedback is applied. In other words, it is the gain reduction, in decibels, caused by the application of negative feedback.

The amount of negative feedback that can be used is limited, for several reasons. In the first place, we can realize that the full signal could not be fed back because the output would then drop to zero. This is never approached in actual practice because more than 20 decibels of feedback are seldom applied in a single feedback loop.

If 20 decibels of feedback were used in such a manner as to be fully effective, distortion and noise in the circuit would be reduced by a factor of 10. The gain of the circuit would also be reduced by a factor of 10; therefore, 10 times the amount of signal required before the feedback was applied would have to be used to obtain the same power output. For example, if 0.1 volt of input signal were required for a 20-watt output from an amplifier without feedback, then 1.0 volt of input signal would be needed to obtain the normal output of 20 watts after 20 decibels of feedback were applied.

An amplifier must be carefully designed and must use high-quality components if any large amount of negative feedback is to be utilized satisfactorily. Otherwise, the operation of the amplifier can become very unstable, even when only a moderate amount of feedback is applied.

Negative feedback is not a cure-all and must not be relied upon to make an excellent amplifier out of one that was poorly designed with undesirable characteristics. Negative feedback can make a very noticeable improvement in the operation of a mediocre amplifier, but it cannot work miracles.

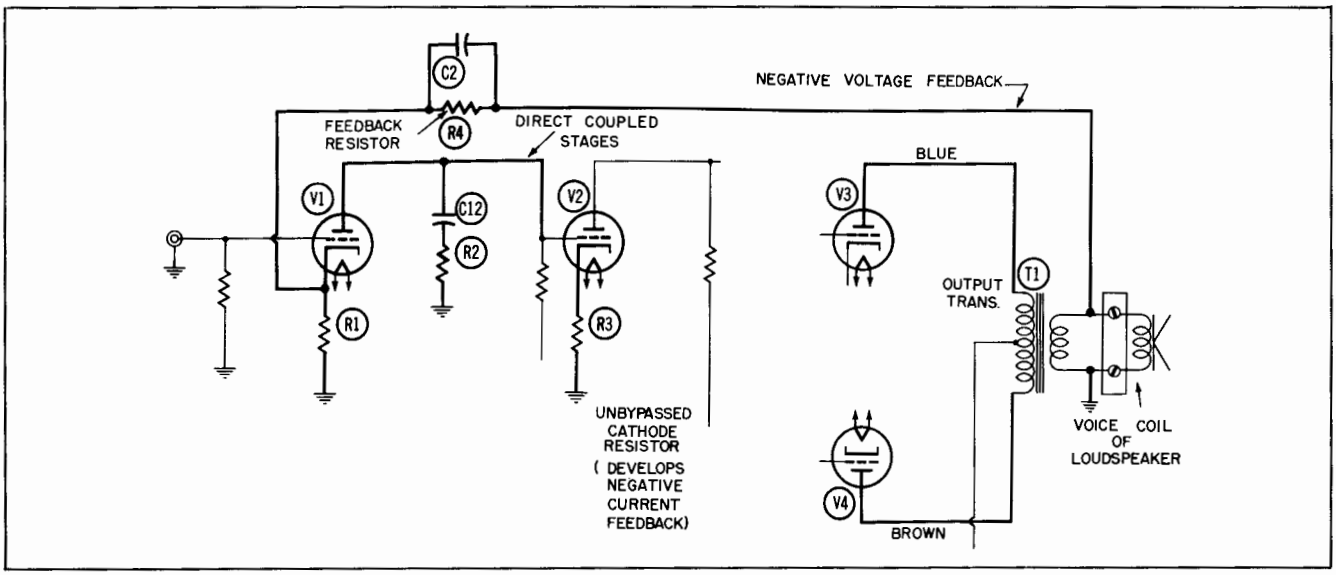


Fig. 12. Partial schematic diagram of a typical amplifier circuit using negative feedback.

Fig. 12 shows a partial schematic of a typical amplifier circuit in which the output transformer is included in the negative-feedback loop. A portion of the signal voltage developed across the load (the voice coil of the loudspeaker) is fed back to the cathode of tube V1 in the input stage. The amount of signal fed back depends upon the resistance value of feedback resistor R4. A large value of resistance reduces the amount of feedback, while a low value increases the feedback.

The feedback signal must be 180° out of phase with the input signal to produce the desired effects on the output signal. While the 180° out-of-phase relationship can be maintained readily at midfrequencies, the extreme low and high ends of the frequency range present some difficulties.

Circuit components, particularly the output transformer and the coupling capacitors, tend to shift the signal phase at the extreme high and low frequencies. The phase can be shifted so far that the feedback becomes positive at high and low frequencies. This situation can cause the amplifier to become very unstable at the frequency extremes because positive feedback produces oscillations. The feedback may become positive only on signal peaks, and therefore, the oscillations may occur in bursts and at certain frequencies only. This condition can give rise to many peculiar and disturbing forms of distortion. Loudspeakers have been blamed for a rattling or buzzing sound, when the amplifier was actually at fault.

Various precautions are taken to prevent or at least reduce the phase shift and thereby stabilize the operation of the amplifier. Output transformers with sufficiently low leakage reactances are a necessity. Very large coupling capacitors are employed where required, or capacitors are eliminated altogether by direct coupling. Phase- and frequency-correction networks, such as resistor R2 and capacitor C1 in the plate circuit of V1 or capacitor C2 across feedback resistor R4, aid in stabilizing the amplifier.

Since the feedback signal must be 180° out of phase, the output transformer must be correctly phased in the circuit. For instance, if the plate leads of the transformer were reversed so that the blue lead went to the plate of V4 and the brown lead went to the plate of V3, the phase of the feedback signal would be reversed and would become positive. The amplifier would oscillate and produce a terrific roar or howl.

The feedback in the circuit we have been discussing is voltage feedback because the feedback signal is a portion of the signal voltage developed across the voice coil of the loudspeaker. The results from the use of negative feedback in this circuit are typical of the desirable effects of voltage feedback when it is applied properly. We can list them as follows:

Distortion is reduced.

Certain types of hum and noise are reduced.

Output impedance is decreased.

Loudspeaker damping is increased.

The effects of the varying load presented to the amplifier by the loudspeaker are decreased.

Frequency response is increased.

Tone controls should not be located inside a feedback loop because much of their effectiveness will be nullified by negative feedback. This is one reason tone controls and other compensating circuits are usually located in another section of the audio system.

An unbypassed cathode resistor is another method of obtaining negative feedback. As an example, R3 in Fig. 2 produces current feedback. Some of the effects of current feedback are the same as those obtained with voltage feedback, while others are the opposite. Some of the characteristic effects of current feedback are:

Distortion is reduced.

Gain is reduced.

Plate resistance of the stage in which the feedback is located is increased.

Effect of load impedance on the output voltage is increased.

Loudspeaker damping is decreased when current feedback is applied.

The damping applied to the loudspeaker can be controlled by varying the amount of feedback. The damping control circuit in Fig. 13 is a good example of this application of negative feedback. Two negative-feedback loops are used. One is voltage feedback, and the other is current feedback. The damping factor can be changed by varying the ratio of voltage feedback to current feedback.

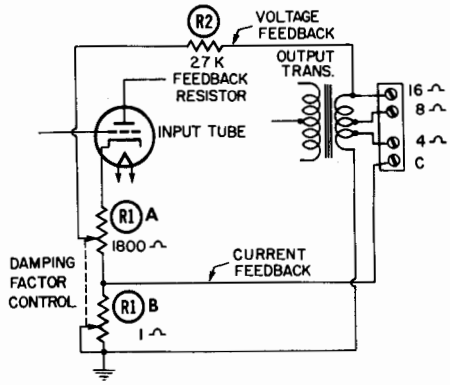


Fig. 13. Circuit using damping factor control.

Negative feedback is developed by the voltage-feedback loop connected from the top (or 16-ohm tap) of the output transformer through feedback resistor R2 to the moving contact of R1A in the cathode circuit of the input tube. When the moving contact is moved to the top or cathode end of R1A, negative voltage feedback will increase to maximum, and maximum damping action will be produced.

Negative feedback is developed in the current feedback circuit connected from the common (C) tap through R1B to ground. When the moving contact of R1B is moved toward the top or cathode end, current feedback will decrease because the resistance is reduced toward zero as R1B is progressively shorted to ground.

When R1B is moved in the opposite direction, current feedback is increased. Here we should recall that loudspeaker damping decreases as negative current feedback increases and that the damping increases when negative voltage feedback increases.

R1A and R1B are ganged and must turn together; therefore, when the damping-factor control tap is

moved to maximum (upward on the schematic), the negative voltage feedback produces the desired maximum damping factor, and no current feedback is produced because R1B is shorted.

When the damping control is set to the minimum position, minimum negative voltage feedback is developed, and the damping factor is reduced. But, in this minimum position, maximum negative current feedback is produced; and this, in turn, also reduces the damping factor. Thus, a large range of damping can be obtained; however, since negative feedback is always applied, distortion will be held to a minimum at any setting of the damping-factor control.

Negative feedback can be utilized by tone controls, compensation circuits for magnetic cartridges, and record-playback compensation circuits in phono preamplifiers to modify the frequency response of an amplifier. This action is possible because the negative-feedback loop can be frequency selective. The feedback network is so modified that certain frequencies are fed back while other frequencies are not. The frequencies that are fed back are attenuated because negative feedback reduces gain, but those that are not fed back are not attenuated and are effectively boosted.

Fig. 14 shows a typical phono-preamplifier circuit in which compensation (bass boost) is obtained with a frequency-selective feedback circuit. C1 (shunted across feedback resistor R1) and C2 (shunted by R2) offer very little opposition to the feedback of high frequencies; consequently, these frequencies are fed back and attenuated. The reactances of C1 and C2 become progressively greater as frequency is lowered, and therefore, the low frequencies are not subjected to as much loss and are effectively boosted. The

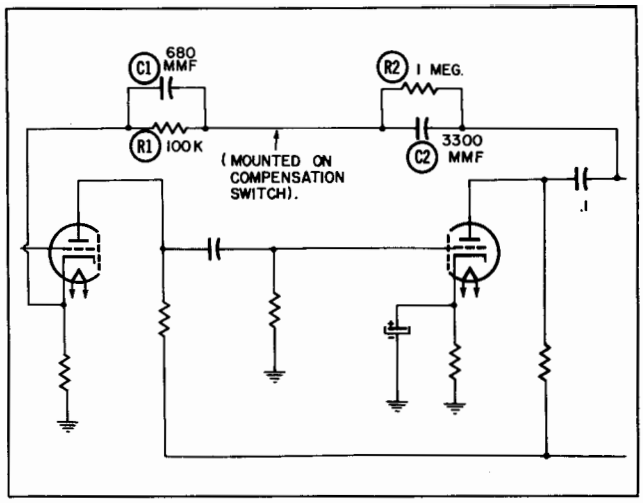


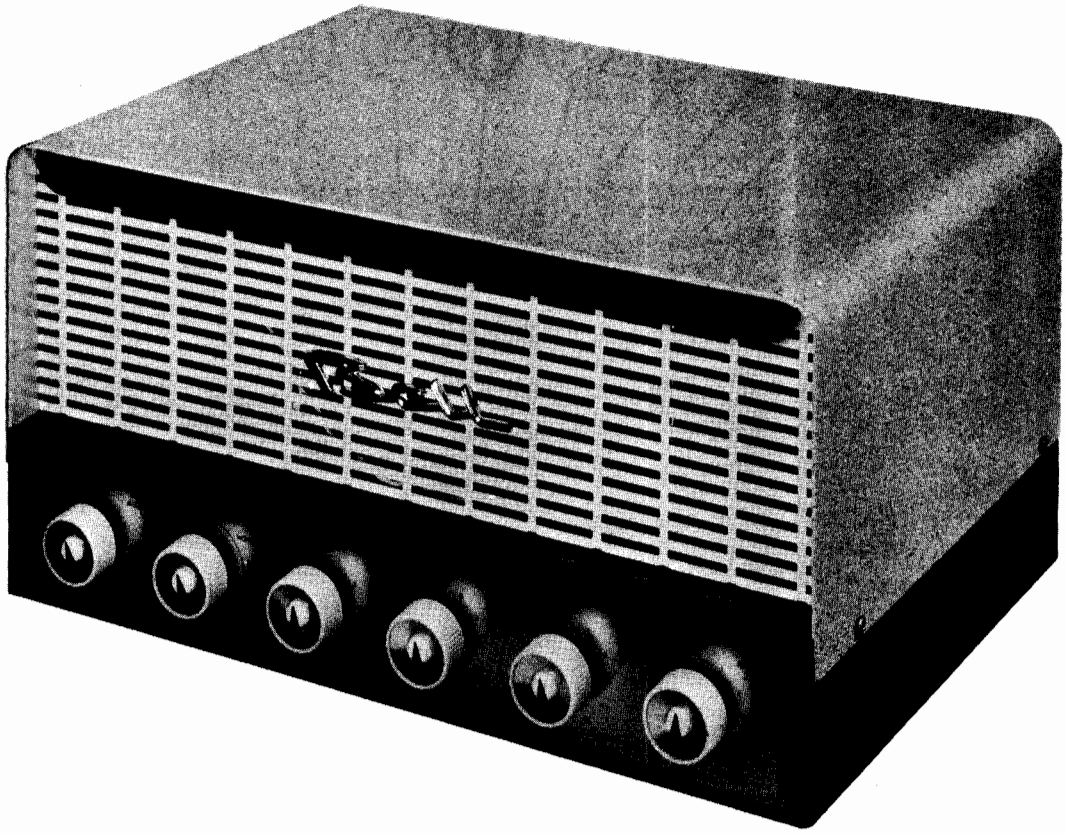
Fig. 14. Circuit using negative feedback for compensation.

compensation can be made to follow almost any desired curve if the appropriate network of resistors and capacitors is inserted in the feedback circuit. The values shown in Fig. 14 have been used for RIAA record compensation.

The same basic action is used with tone controls that employ negative feedback to control frequency response. A variety of such tone-control circuits are used, and some of them can appear to be very elaborate, but they all use the frequency-selective feedback action.

The definite advantage of negative feedback in equalizing circuits is that, in addition to the compensation obtained, distortion and noise are reduced by the action of the feedback.

BELL SOUND MODEL 3DT (G)



TRADE NAME	Bell Sound Model 3DT (G)
MANUFACTURER	Bell Sound Systems, Inc., 555 Marion Road, Columbus 7, Ohio.
TYPE SET	AC Operated 8 Channel Binaural Amplifier
TUBES	Eleven
POWER SUPPLY	110-120 Volts AC-60 Cycles RATING 1.1 Amp@117 Volts AC (120 Watts)

BELL SOUND
MODEL 3DT (G)

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co., Inc., as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co., Inc., by the manufacturers of the particular type of replacement part listed. Reproduction or use, without express permission, of editorial or pictorial content, in any manner, is prohibited. No patent liability is assumed with respect to the use of the information contained herein. © 1958 Howard W. Sams & Co., Inc., Indianapolis 5, Indiana . Printed in U.S. of America

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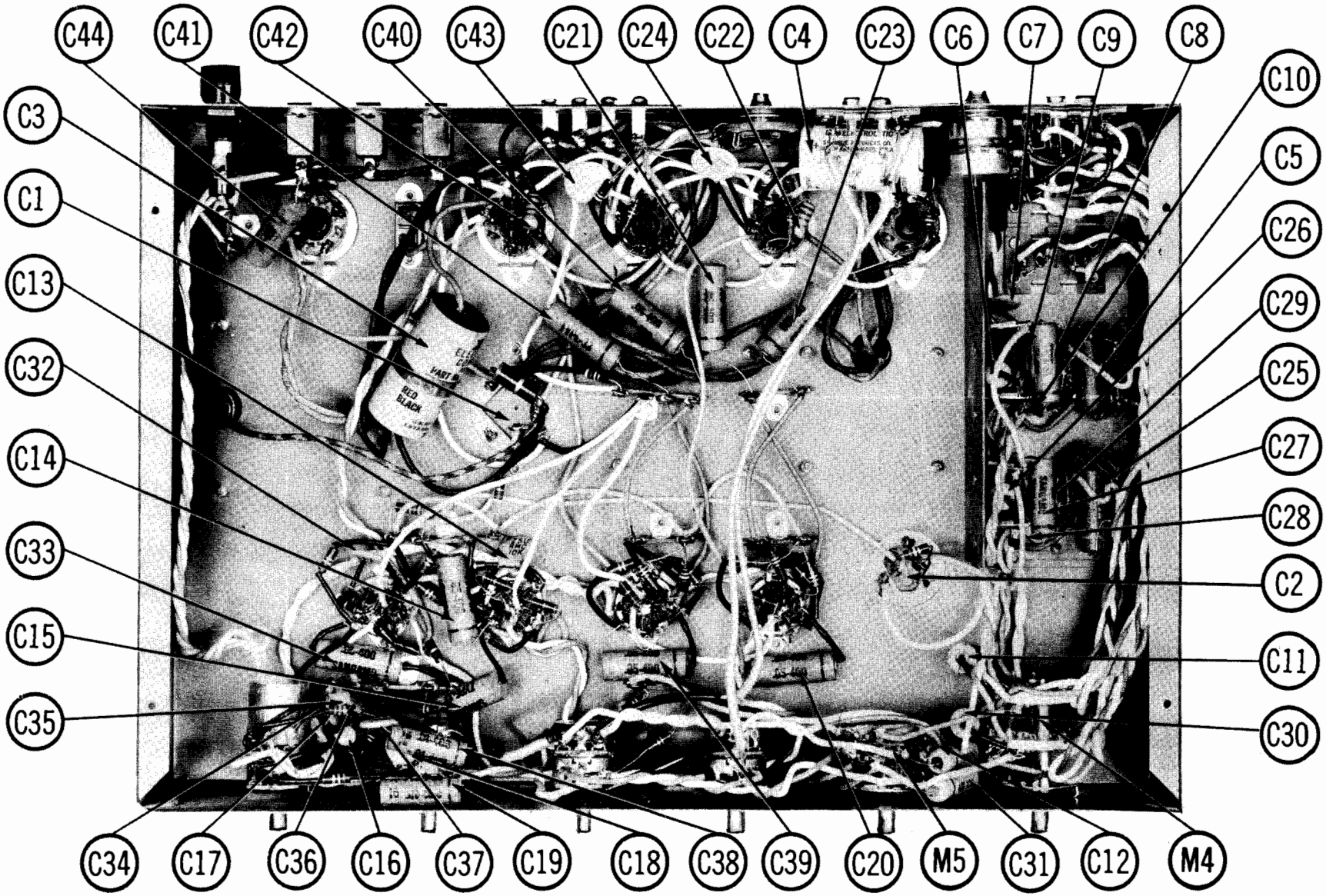
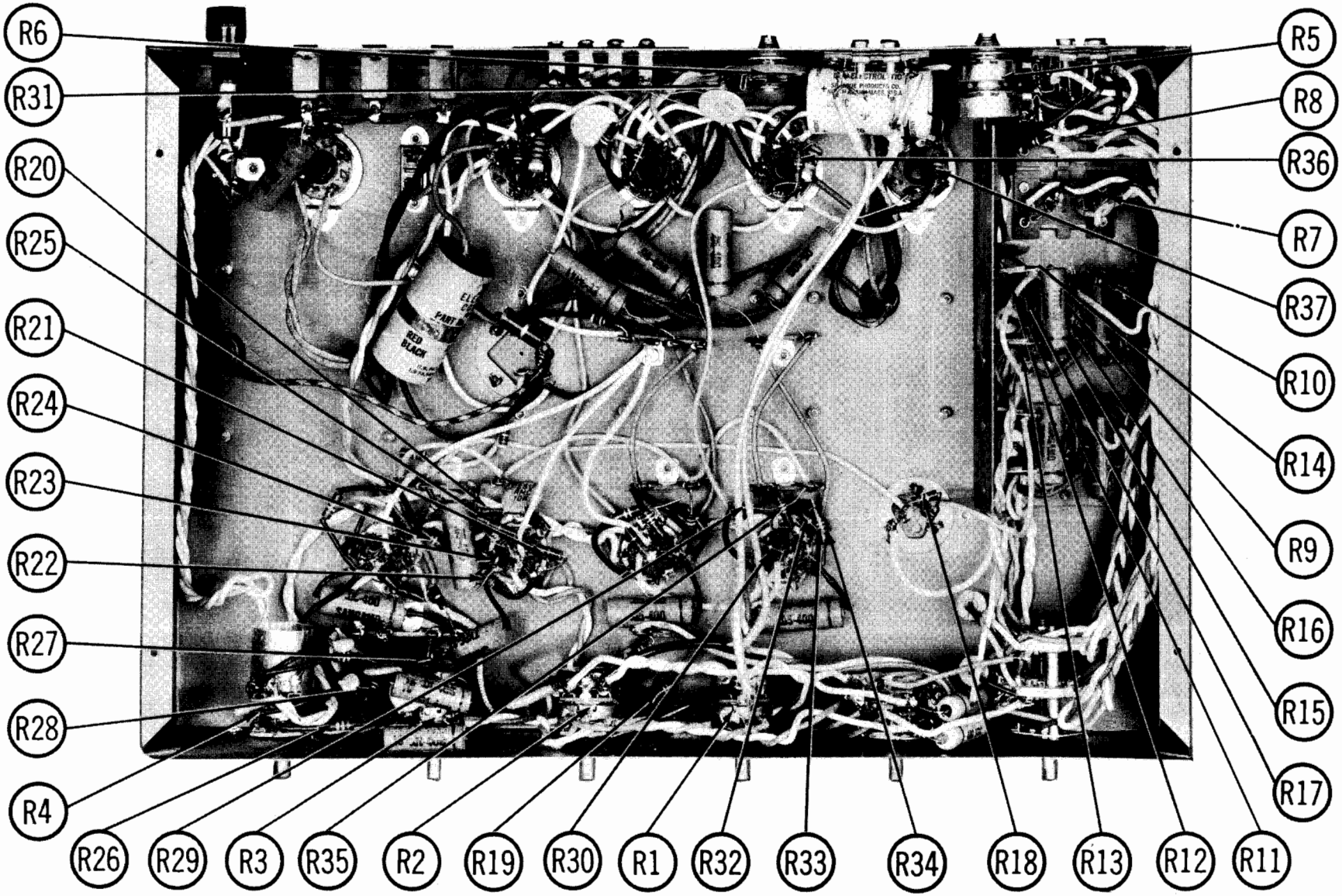
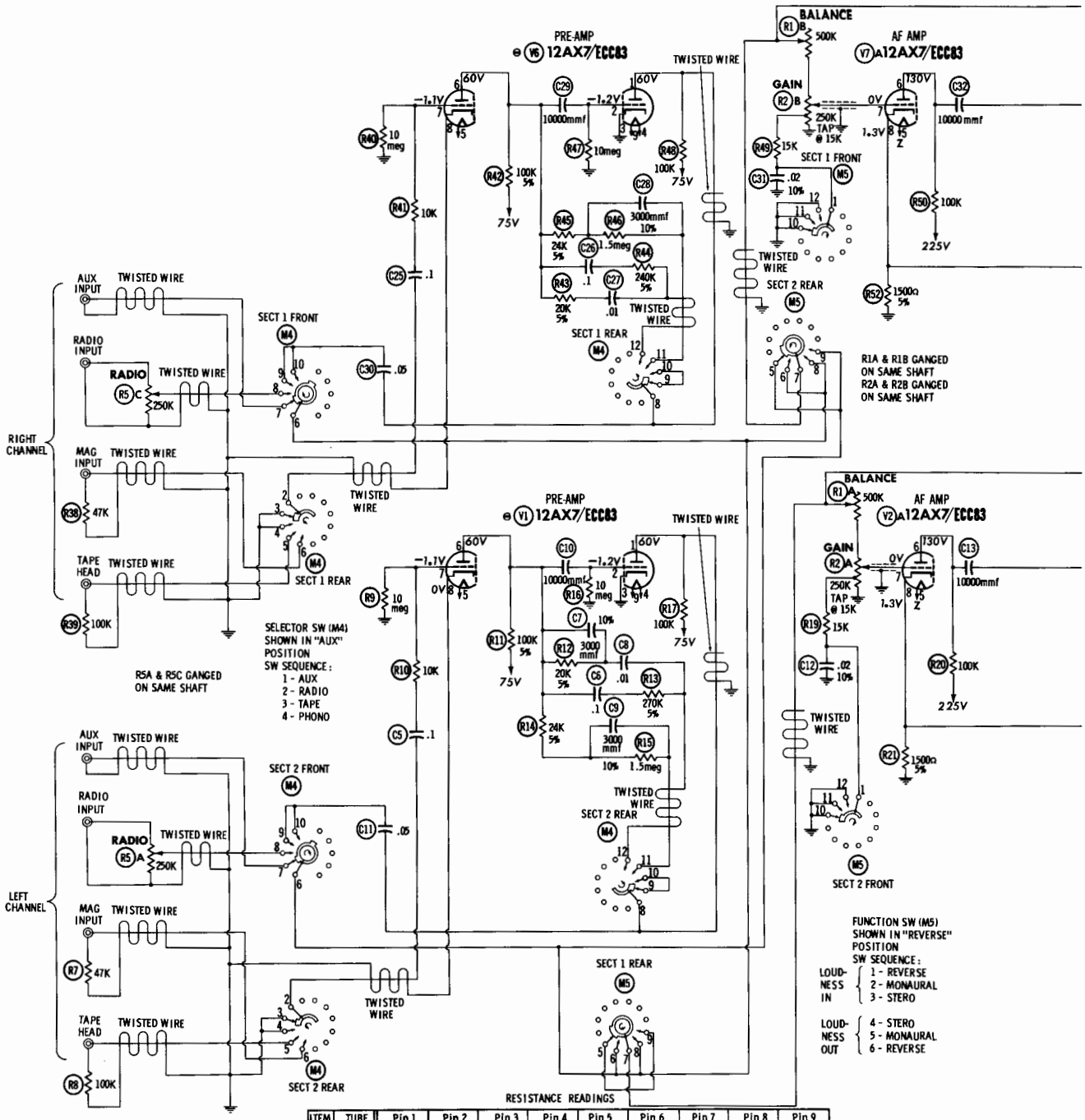


CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION



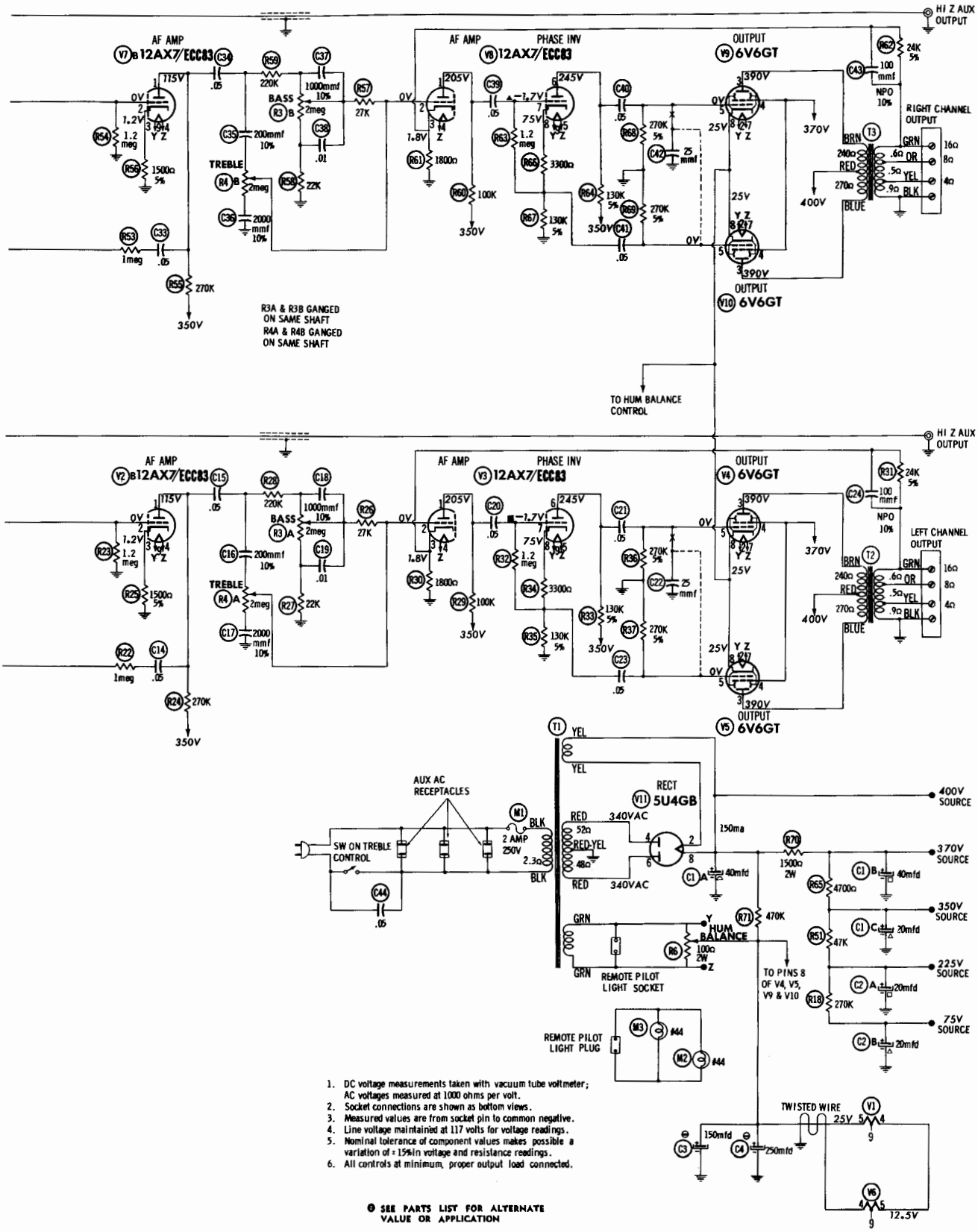
CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

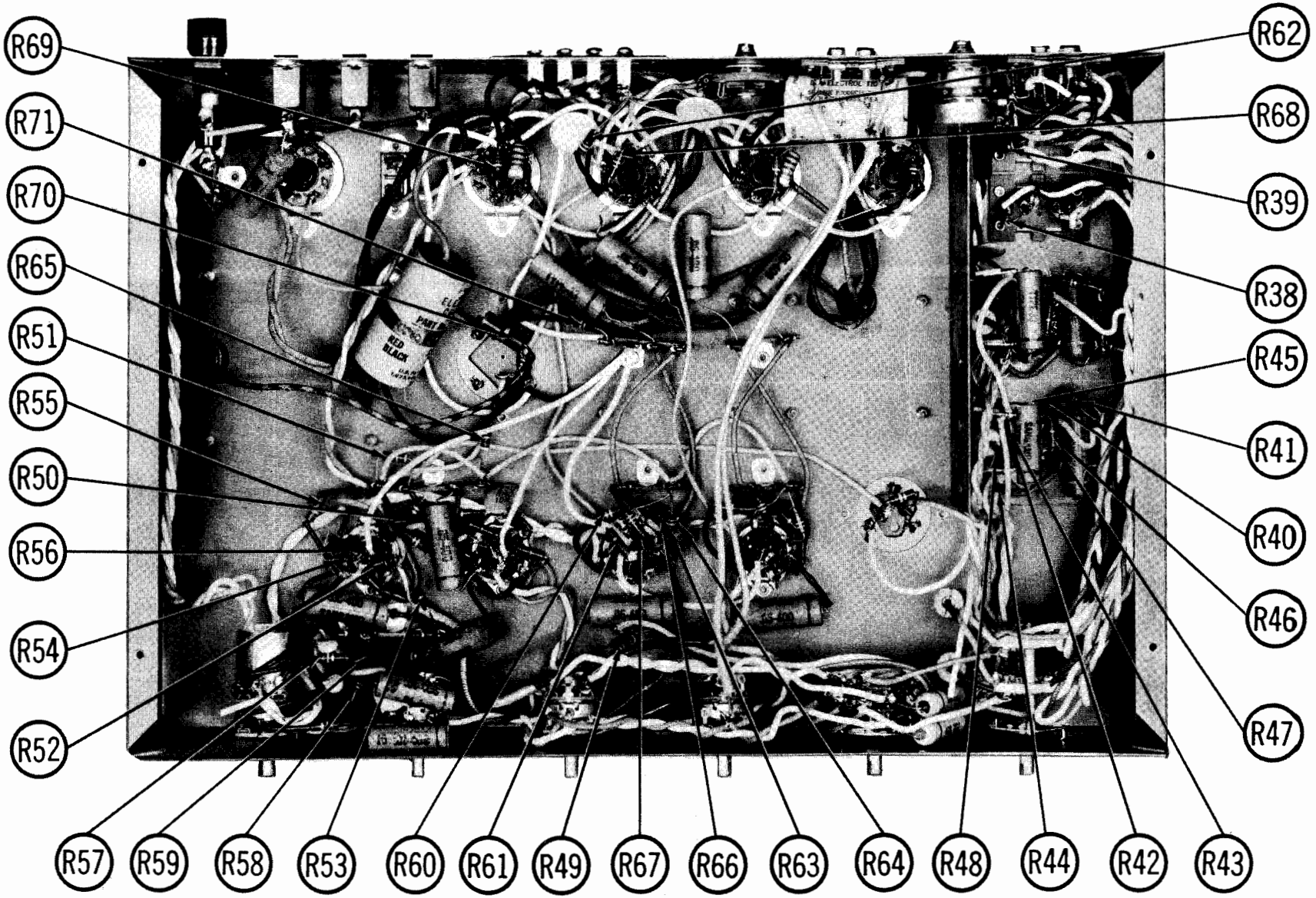


ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7 ECC83	†420K	10meg	0Ω	15Ω	30Ω	†420K	10meg	0Ω	NC
V2	12AX7 ECC83	†270K	1.2meg	1500Ω	50Ω	50Ω	†150K	0Ω	1500Ω	50Ω
V3	12AX7 ECC83	†100K	8500Ω	1800Ω	50Ω	50Ω	†130K	1.3meg	130K	50Ω
V4	6V6GT	0Ω	50Ω	†240Ω	†1500Ω	270K	TP	50Ω	30Ω	
V5	6V6GT	0Ω	50Ω	†270Ω	†1500Ω	270K	NC	50Ω	30Ω	
V6	12AX7 ECC83	†420K	10meg	0Ω	0Ω	15Ω	†420K	10meg	0Ω	NC
V7	12AX7 ECC83	†270K	1.2meg	1500Ω	50Ω	50Ω	†150K	0Ω	1500Ω	50Ω
V8	12AX7 ECC83	†100K	49K	1600Ω	50Ω	50Ω	†130K	1.3meg	130K	50Ω
V9	6V6GT	0Ω	50Ω	†240Ω	†1500Ω	270K	TP	50Ω	30Ω	
V10	6V6GT	0Ω	50Ω	†270Ω	†1500Ω	270K	NC	50Ω	30Ω	
V11	5U4GB	NC	20K(MIN)	NC	52Ω	NC	48Ω	NC	20K(MIN)	

† MEASURED FROM PIN 8 OF V11
▪ MEASURED FROM PIN 8 OF V3
▲ MEASURED FROM PIN 8 OF V8
NC NO CONNECTION
TP TIE POINT

A PHOTOFACT STANDARD NOTATION SCHEMATIC
Howard W. Sams & Co., Inc. 1958


HI Z AUX OUTPUT
AF AMP
V7 B 12AX7/ECC83
PHASE INV
V8 12AX7/ECC83
OUTPUT
V9 6V6GT
V10 6V6GT
RIGHT CHANNEL OUTPUT
R3A & R3B GANGED ON SAME SHAFT
R4A & R4B GANGED ON SAME SHAFT
TO HUM BALANCE CONTROL
AF AMP
V2 B 12AX7/ECC83
PHASE INV
V3 12AX7/ECC83
OUTPUT
V4 6V6GT
V5 6V6GT
LEFT CHANNEL OUTPUT
T1
T2
T3
AUX AC RECEPTACLES
SW ON TREBLE CONTROL
2 AMP 250V
RECT
V11 5U4GB
340VAC
150ma
400V SOURCE
370V SOURCE
350V SOURCE
225V SOURCE
75V SOURCE
HUM BALANCE
REMOTE PILOT LIGHT SOCKET
REMOTE PILOT LIGHT PLUG
#44
TO PINS 8 OF V4, V5, V9 & V10
TWISTED WIRE
12.5V
1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ± 15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.
⊖ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION



CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE
V1	Left Channel Preamp.	12AX7/ ECC83 ①
V2	AF Amplifier	12AX7/ ECC83
V3	AF Amp. -Phase Inv.	12AX7/ ECC83
V4	Output	6V6GT
V5	Output	6V6GT

ITEM No.	USE	TYPE
V6	Right Channel Preamp.	12AX7/ECC83 ①
V7	AF Amplifier	12AX7/ ECC83
V8	AF Amp. -Phase Inv.	12AX7/ ECC83
V9	Output	6V6GT
V10	Output	6V6GT
V11	Rectifier	5U4GB

①Some versions may use 12AY7 in this application

ELECTROLYTIC CAPACITORS

ITEM No.	RATING CAP.	RATING VOLT.	REPLACEMENT DATA Bell Sound PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▲40	450		AFH3-43-50	C0344	FP376.9	TMT-39	T-165 MT-4510	TVL-3786
B	■40	450							
C	▲20	450							
C2A	■20	450		AFH2-51	B0400	FP234	TMD-50	D-215	TVL-2755
B	▲20	450							
C3	150	50	①	PRS50V150	BR1505	TC495	TD-150-50	MT-15150	TVA-1311
C4	250	50	①	PRS50V250	BR2505	TC50025	TD-250-50	S-057	TVA-1312

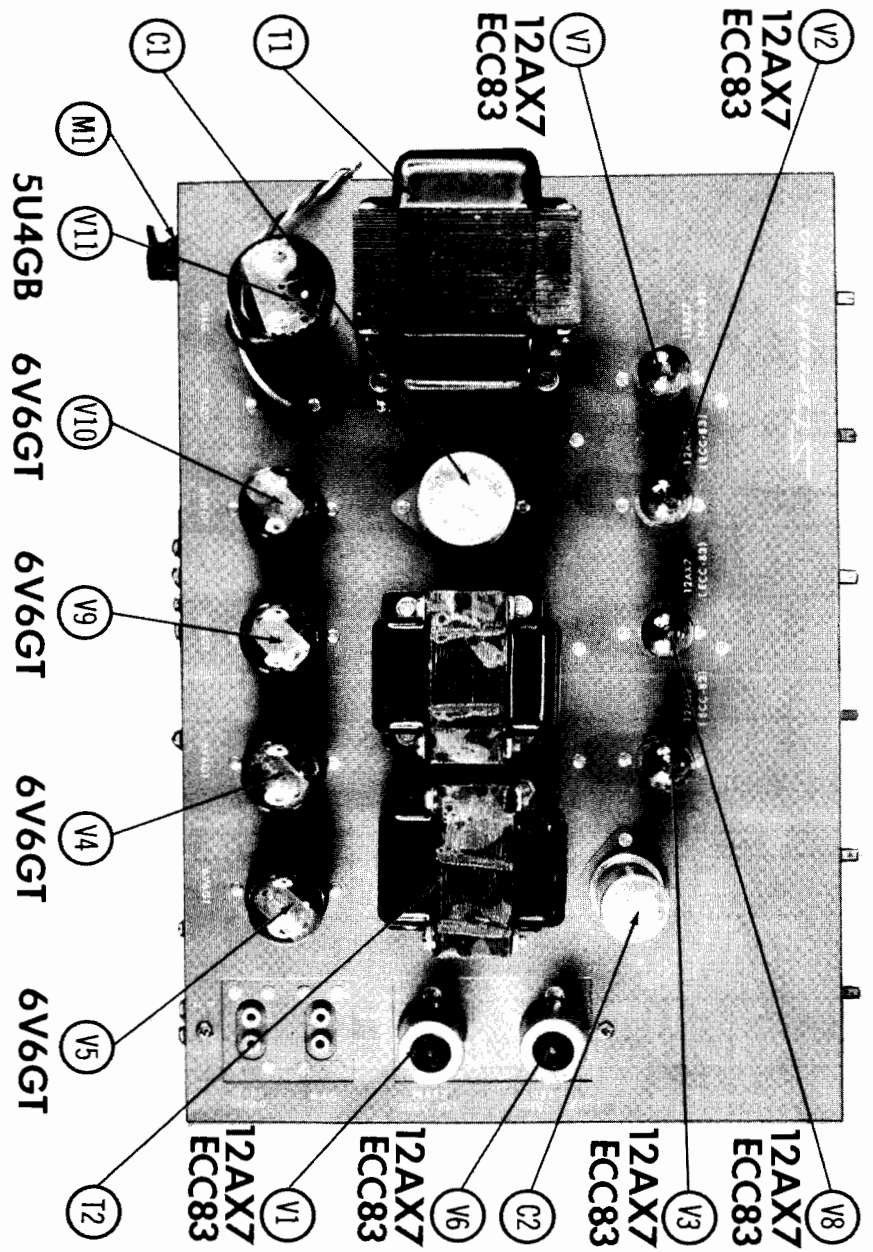
① When C3 is 500mfd, C4 is not used

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING CAP.	RATING VOLT	REPLACEMENT DATA Bell Sound PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C5	.1	200		P288N-1	DF-104	CUB2P1	GEM-201	2TM-P1	
C6	.1	200		P288N-1	DF-104	CUB2P1	GEM-201	2TM-P1	
C7	3000					1R5D3	MCB461	MS-23	10%
C8	.01	400		P488N-01	D6-103	CUB4S1	GEM-411	4TM-S1	
C9	3000					1R5D3	MCB461	MS-23	10%
C10	10000			BPD-01	DD-103	BYA6S1	DC511	5HK-S1	
C11	.05	400		P488N-05	DF-503	CUB4S5	GEM-415	4TM-S5	
C12	.02	400					GEM-1612		10%
C13	10000			BPD-01	DD-103	BYA6S1	DC511	5HK-S1	
C14	.05	400		P488N-05	DF-503	CUB4S5	GEM-415	4TM-S5	
C15	.05	400		P488N-05	DF-503	CUB4S5	GEM-415	4TM-S5	
C16	200				TCZ-200	L10T2	MCB237	MS-32	10%
C17	2000					1R5D2	MCB457	MS-22	10%
C18	1000					1R5D1	MCB255	MS-21	10%
C19	.01	400		P488N-01	D6-103	CUB4S1	GEM-411	4TM-S1	
C20	.05	400		P488N-05	DF-503	CUB4S5	GEM-415	4TM-S5	
C21	.05	400		P488N-05	DF-503	CUB4S5	GEM-415	4TM-S5	
C22	25			SI25	D6-250	LT6Q25	UC-5425	5GA-Q25	
C23	.05	400		P488N-05	DF-503	CUB4S5	GEM-415	4TM-S5	
C24	100			NP0-DI100	TCZ-100	C10T1C	ZT-531	5TCC-T1	NP0 10%
C25	.1	200		P288N-1	DF-104	CUB2P1	GEM-201	2TM-P1	
C26	.1	200		P288N-1	DF-104	CUB2P1	GEM-201	2TM-P1	
C27	.01	400		P488N-01	D6-103	CUB4S1	GEM-411	4TM-S1	
C28	3000					1R5D3	MCB461	MS-23	10%
C29	10000			BPD-01	DD-103	BYA6S1	DC511	5HK-S1	
C30	.05	400		P488N-05	DF-503	CUB4S5	GEM-415	4TM-S5	
C31	.02	400					GEM-1612		10%
C32	10000			BPD-01	DD-103	BYA6S1	DC511	5HK-S1	
C33	.05	400		P488N-05	DF-503	CUB4S5	GEM-415	4TM-S5	
C34	.05	400		P488N-05	DF-503	CUB4S5	GEM-415	4TM-S5	
C35	200				D6-201	L10T2	MCB237	MS-32	10%
C36	2000					1R5D2	MCB457	MS-22	10%
C37	1000					1R5D1	MCB255	MS-21	10%
C38	.01	400		P488N-01	D6-103	CUB4S1	GEM-411	4TM-S1	
C39	.05	400		P488N-05	DF-503	CUB4S5	GEM-415	4TM-S5	
C40	.05	400		P488N-05	DF-503	CUB4S5	GEM-415	4TM-S5	
C41	.05	400		P488N-05	DF-503	CUB4S5	GEM-415	4TM-S5	
C42	25			SI25	D6-250	LT6Q25	UC-5425	5GA-Q25	
C43	100			NP0-DI100	TCZ-100	C10T1C	ZT-531	5TCC-T1	NP0 10%
C44	.05	400		P488N-05	DF-503	CUB4S5	GEM-415	4TM-S5	

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	Bell Sound PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	
R1A	500K	½	20066P121	B-1041		Q13-133	UE1295	Balance
B	500K	½				M13-133		Balance
R2A	250K	½	20066P122				UE1299	Gain, Tap ⓐ 15K
B	250K	½						Gain, Tap ⓐ 15K
R3A	2meg	½	20066P120			Q13-139	UE1874	Bass
B	2meg	½				M13-139		Bass
R4A	2meg	½	20066P119			Q13-139	UE18738	Treble
B	2meg	½				M13-139		Treble
C	Switch					76-1		
R5A	250K	½	B20066P123	BB-103	AD47-250K-2	Q13-130		Radio input adjust.
B	250K	½		Not Req.	Not Req.	M13-130		Radio input adjust.
C	Shaft			Not Req.	FKS-1/4	RQ		
R6A	100Ω	2(WW)	B-20066P141	WN101	A43-100	WPK100	R100L	Hum Balance
B	Shaft			Not Req.	FKS-1/4	Not Req.	Not Req.	

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		Bell Sound PART No.	NOTES
	OHMS	WATT		
R7	47K			
R8	100K			
R9	10meg			
R10	10K			
R11	100K 5%			
R12	20K 5%			
R13	270K 5%			
R14	24K 5%			
R15	1.5meg			
R16	10meg			
R17	100K			
R18	270K			
R19	15K			
R20	100K			
R21	1500Ω 5%			
R22	1meg			
R23	1.2meg			
R24	270K			
R25	1500Ω 5%			
R26	27K			
R27	22K			
R28	220K			
R29	100K			
R30	1800Ω			
R31	24K 5%			
R32	1.2meg			
R33	130K 5%			
R34	3300Ω			
R35	130K 5%			
R36	270K 5%			
R37	270K 5%			
R38	47K			
R39	100K			

ITEM No.	RATING		Bell Sound PART No.	NOTES
	OHMS	WATT		
R40	10meg			
R41	10K			
R42	100K 5%			
R43	20K 5%			
R44	240K 5%			
R45	24K 5%			
R46	1.5meg			
R47	10meg			
R48	100K			
R49	15K			
R50	100K			
R51	47K			
R52	1500Ω 5%			
R53	1meg			
R54	1.2meg			
R55	270K			
R56	1500Ω 5%			
R57	27K			
R58	22K			
R59	220K			
R60	100K			
R61	1800Ω			
R62	24K 5%			
R63	1.2meg			
R64	130K 5%			
R65	4700Ω			
R66	3300Ω			
R67	130K 5%			
R68	270K 5%			
R69	270K 5%			
R70	1500Ω	2		
R71	470K			

TRANSFORMER (POWER)

ITEM No.	RATING			REPLACEMENT DATA						
	PRI.	SEC. 1	SEC. 2	Bell Sound PART No.	Halldorson PART No.	Merit PART No.	Rom PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117V ⓐ 1.1A	680VCT ⓐ .150A	5V ⓐ 3A	B-20373		P-3173		PC8422	22R33	R-16A
	SEC. 3	SEC. 4	SEC. 5							
	6.3V ⓐ 3.5A									

PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA							NOTES
	PRI.	SEC.	Bell Sound PART No.	Halldorson PART No.	Merit PART No.	Ram PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	
T2	6500Ω CT	16Ω Tap ⓐ 8Ω & 4Ω	B-20374				A-3304	22S68 ①		① Tape 250Ω & 500Ω taps
T3	6500Ω CT	16Ω Tap ⓐ 8Ω & 4Ω	B20374				A-3304	22S68 ①		

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			Bell Sound PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M1	3AG	2A 250V			312002. (3AG 2A 250V)	342001	AGC2	HKP

MISCELLANEOUS

ITEM No.	PART NAME	Bell Sound PART No.	NOTES
M2	Pilot Lamp		#44
M3	Pilot Lamp		#44
M4	Switch		Selector (input) (Rotary wafer type)
M5	Switch		Function (Rotary wafer type)

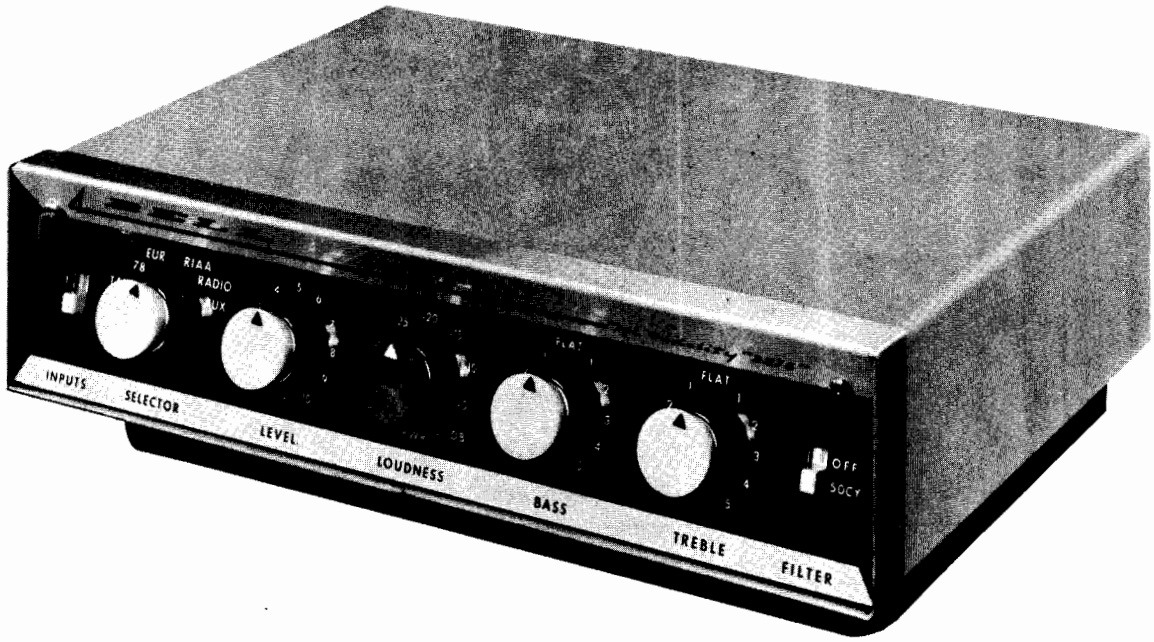
WIRING DATA

General-use Unshielded Hook-up Wire ..... Use BELDEN No. 8530 (Solid) Available in Ten Colors
8524 (Stranded) Available in Ten Colors

Power Cord ..... Use BELDEN No. 1765-B (6 Ft. Length)
1725-K (7½ Ft. Length)

Low-Loss Shielded Lead (Interconnecting) .....Use BELDEN No. 8401

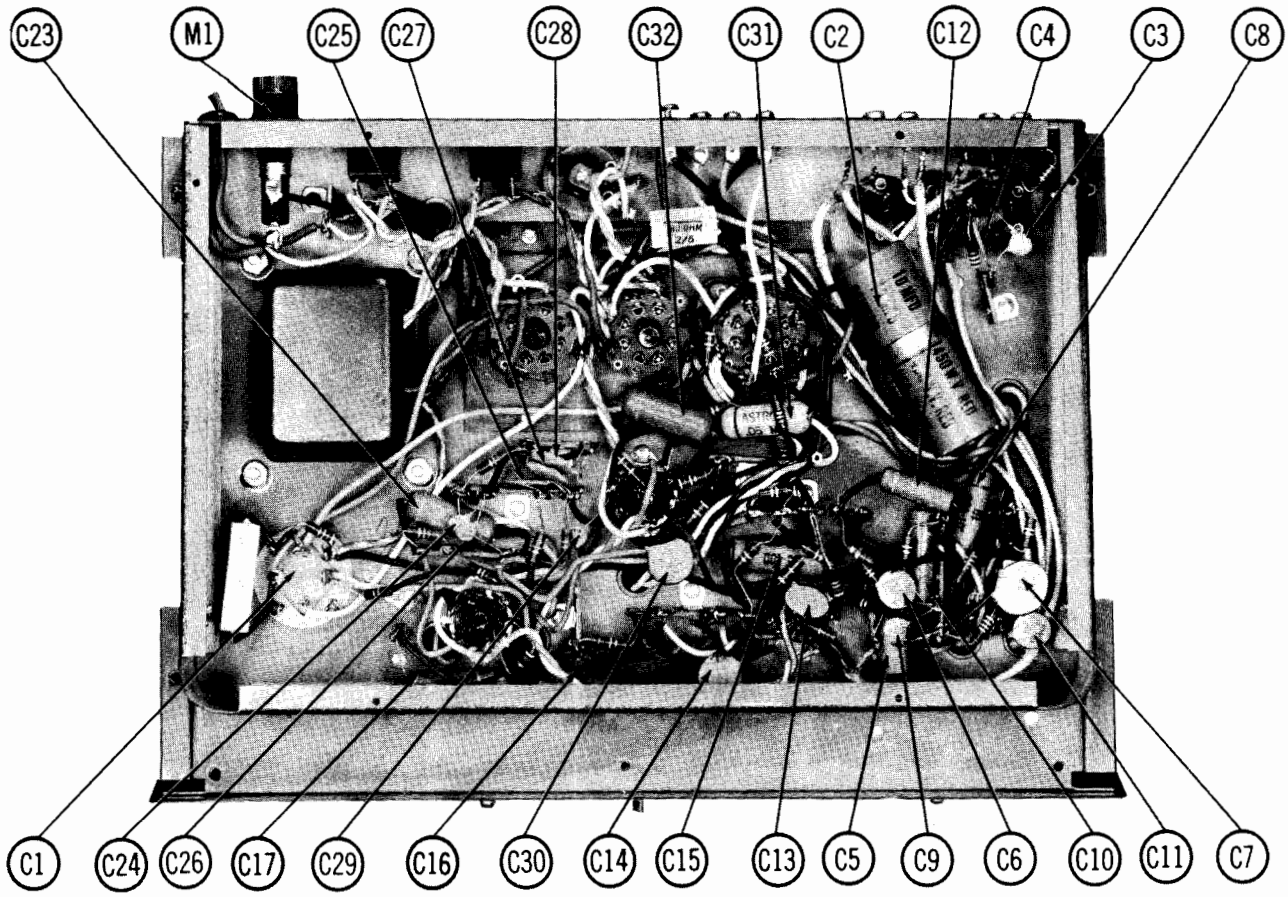
Phono Pick-up Arm Cable ..... Use BELDEN No. 8430 (Two Conductor - Twisted)



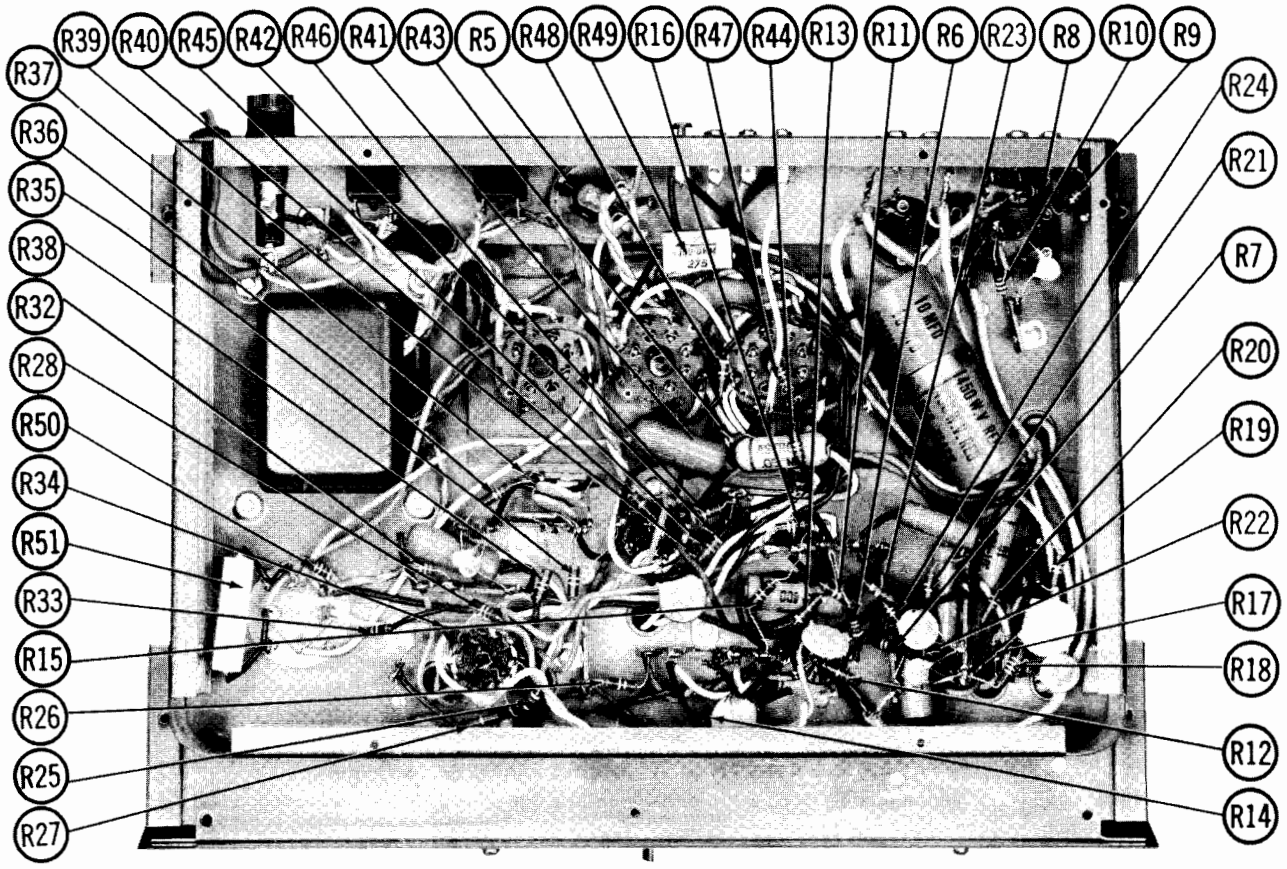
TRADE NAME	Bell Sound Model 2315
MANUFACTURER	Bell Sound Systems, Inc., 555 Marion Road, Columbus 7, Ohio
TYPE SET	AC Operated 6 Channel 12 Watt Audio Amplifier
TUBES (Six)	Types 12AX7/ECC83 Phono Preamplifier, 12AX7/ECC83 AF Amplifier, 12AX7/ECC83 AF Amp.-Phase Inv., (2) 6V6GT Output, 5Y3GT Rectifier
POWER SUPPLY	110-120 Volts AC -60 Cycles RATING .74 Amp. @ 117 Volts AC (75 Watts)

BELL SOUND
MODEL 2315

The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co., Inc., as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co., Inc., by the manufacturers of the particular type of replacement part listed. Reproduction or use, without express permission, of editorial or pictorial content, in any manner, is prohibited. No patent liability is assumed with respect to the use of the information contained herein. © 1958 Howard W. Sams & Co., Inc., Indianapolis 5, Indiana. Printed in U.S. of America



CHASSIS BOTTOM VIEW CAPACITOR AND MISCELLANEOUS IDENTIFICATION



CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE
V1	Phono Preamplifier	12AX7/ECC83
V2	AF Amplifier	12AX7/ECC83
V3	AF Amp. - Phase Inv.	12AX7/ECC83

ITEM No.	USE	TYPE
V4	Output	6V6GT
V5	Output	6V6GT
V6	Rectifier	5Y3GT

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA						
	CAP.	VOLT.	BELL SOUND PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▬40	450							R2555 *
B	■15	450							
C	▲10	450							
D	100	50							
C2A	10	450		PRS450V1010	BBRT11145	TCD72	TDLD-26	MTD-4510	TVA-2722
B	10	450							

* Non Catalog Item

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

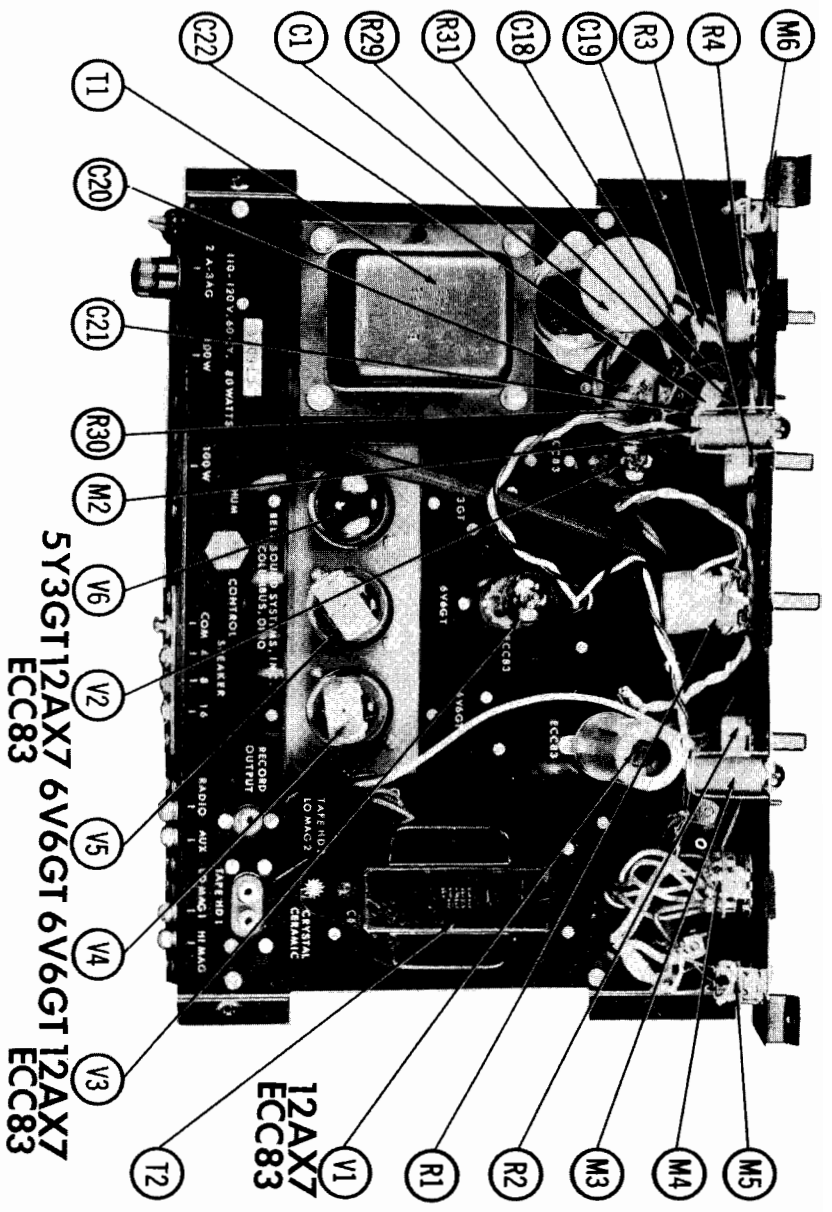
ITEM No.	RATING		REPLACEMENT DATA							NOTES
	CAP.	VOLT	BELL SOUND PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C3	200				TCZ-200	L10T2	ED-200	MCB237	MS-32	10%
C4	68			NPO-D1 68	TCZ-68	C10Q68C	TCO-68		5TCC-Q68	10% NPO
C5	.05	400		P488N-05	DF-503	CUB4S5		GEM-415	4TM-S5	
C6	2400					1R5D24	CY20C242J		MS-224	10%
C7	5000					1R5D5		MCB465	MS-25	10%
C8	.01	400						GEM-1611		10%
C9	470				D6-471	5R5T47	ED-470		MS-324	10%
C10	.025	400								10%
C11	2400					1R5D24	CY20C242J		MS-224	10%
C12	.01	400						GEM-1611		10%
C13	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C14	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C15	.05	400		P488N-05	D -503	CUB4S5		GEM-415	4TM-S5	
C16	.1	200		P288N-1	Dr-104	CUB2P1		GEM-201	2TM-P1	①
C17	.05	400		P488N-05	DF-503	CUB4S5		GEM-415	4TM-S5	
C18	240				D6-241	L10T24	ED-240		MS-324	10%
C19	2400					1R5D24	CY20C242J		MS-224	10%
C20	.01	400						GEM-1611		10%
C21	1000					1R5D1	ED-1000	MCB255	MS-21	10%
C22	68			NPO-D1 68	TCZ-68	C10Q68C	TCO-68		5TCC-Q68	10% NPO
C23	.1	200		P288N-1	DF-104	CUB2P1		GEM-201	2TM-P1	
C24	470				D6-471	5R5T47	ED-470		MS-347	10%
C25	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C26	470				D6-471	5R5T47	ED-470		MS-347	10%
C27	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C28	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C29	270				D6-271	L10T27	ED-270		MS-327	10%
C30	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C31	.05	400		P488N-05	DF-503	CUB4S5		GEM-415	4TM-S5	
C32	.05	400		P488N-05	DF-503	CUB4S5		GEM-415	4TM-S5	

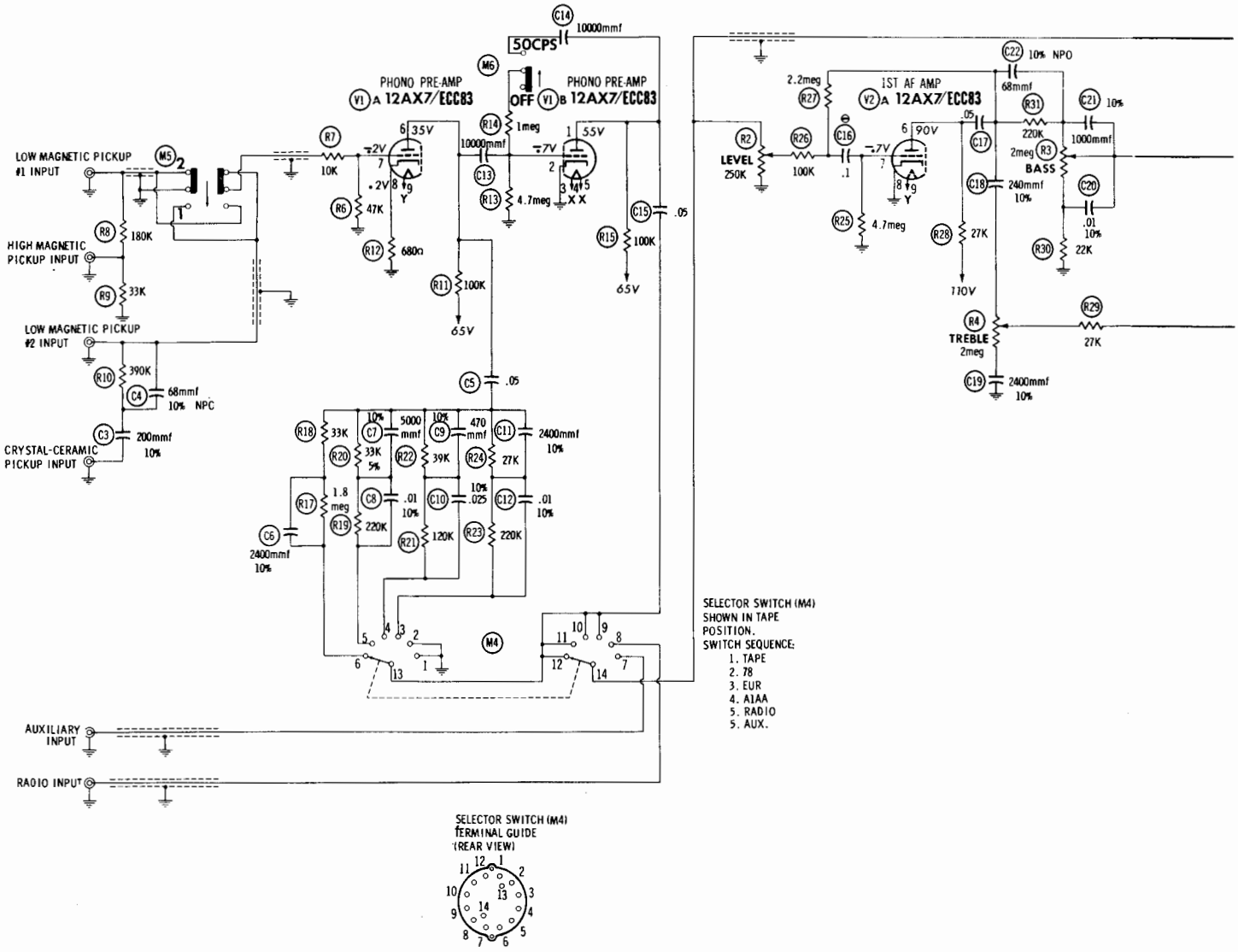
Note 1. Some versions may use .01mfd in this application.

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	BELL SOUND PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	
R1A	250K	½	B-20066164					Loudness, Tap @ 100K & 150K
B	Switch							
R2A	250K	½	B-20066P162	B-50	A47-250K-S	Q11-130	U46	Level
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
R3A	2meg	½	B-20066P159	B-76	A47-2meg-Z	Q13-139	U55	Bass
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	

CHASSIS—TOP VIEW





SELECTOR SWITCH (M4) TERMINAL GUIDE (REAR VIEW)

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

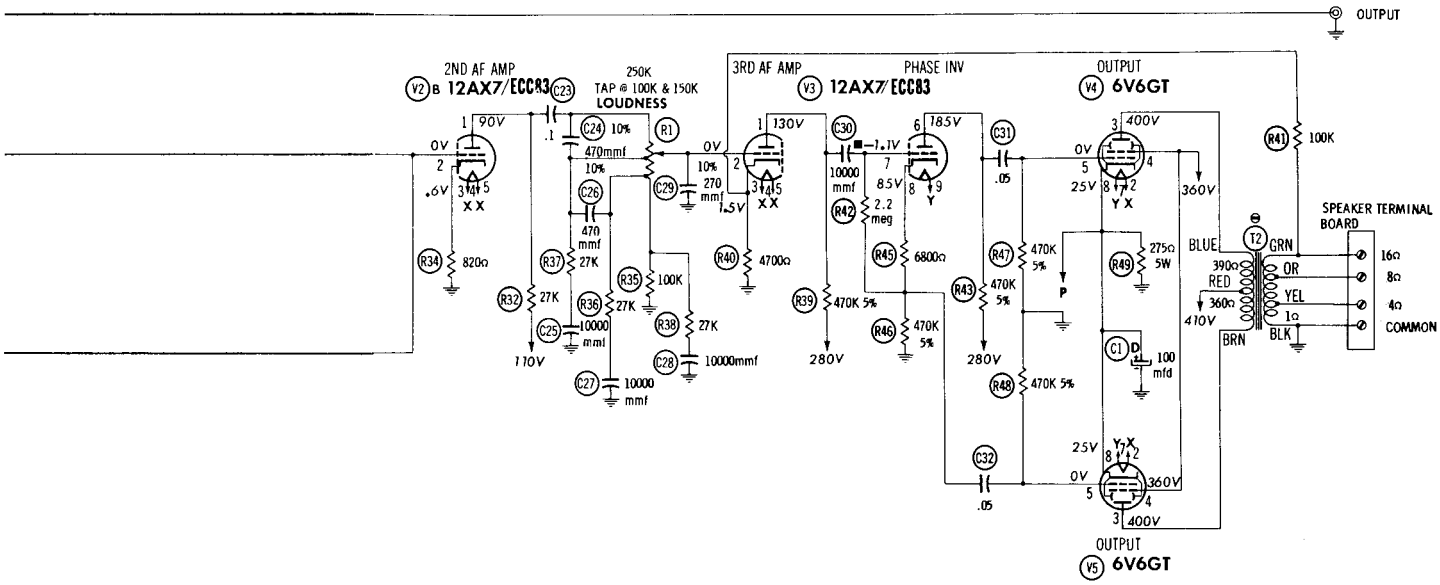
⊖ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

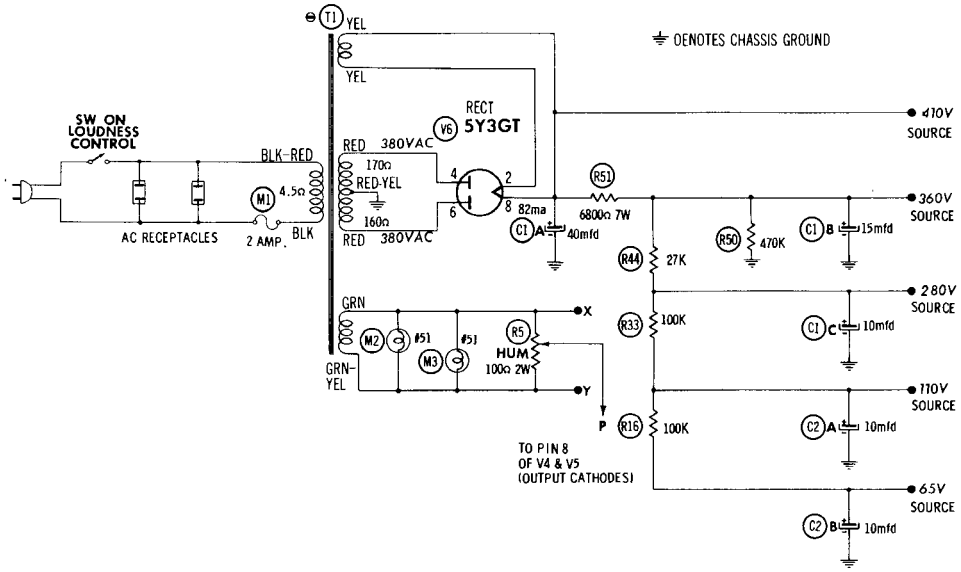
RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7 ECC83	†330K	4.7meg	0Ω	300Ω	300Ω	†330K	47K	680Ω	300Ω
V2	12AX7 ECC83	†160K	22K	820Ω	300Ω	300Ω	†160K	4.7meg	0Ω	300Ω
V3	12AX7 ECC83	†500K	100K	4200Ω	300Ω	300Ω	†500K	2.7meg	470K	300Ω
V4	6V6GT	TP	300Ω	†390Ω	†6800Ω	470K	TP	300Ω	275Ω	
V5	6V6GT	TP	300Ω	†360Ω	†6800Ω	470K	NC	300Ω	275Ω	
V6	5Y3GT	NC	20K(Min)	NC	170Ω	NC	160Ω	NC	20K(Min)	

† MEASURED FROM PIN 8 OF V6
▪ MEASURED FROM PIN 8 OF V3
NC NO CONNECTION
TP TIE POINT

A PHOTOFACT STANDARD NOTATION SCHEMATIC
Howard W. Sams & Co., Inc. 1958


OUTPUT
2ND AF AMP
V2 B 12AX7/ECC83
250K
TAP @ 100K & 150K
LOUDNESS
3RD AF AMP
V3 12AX7/ECC83
PHASE INV
OUTPUT
V4 6V6GT
SPEAKER TERMINAL BOARD
OUTPUT
V5 6V6GT
16Ω
8Ω
4Ω
COMMON


T1
YEL
YEL
RECT
V6 5Y3GT
RED 380VAC
170Ω
RED-YEL
160Ω
RED 380VAC
SW ON LOUDNESS CONTROL
BLK-RED
AC RECEPTACLES
2 AMP.
BLK
GRN
GRN-YEL
HUM
100Ω 2W
TO PIN 8
OF V4 & V5
(OUTPUT CATHODES)
⏚ DENOTES CHASSIS GROUND
410V SOURCE
360V SOURCE
280V SOURCE
170V SOURCE
65V SOURCE

PARTS LIST AND DESCRIPTIONS (Continued)

CONTROLS (cont)

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	BELL SOUND PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	
R4A	2meg	½	B-20066P159	B-76	A47-2meg-Z	Q13-139	U55	Treble
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
R5A	100Ω	2	B-20066P141	WN-101	A43-100		C100P *	Hum (Wire Wound)
B	Shaft			Not Req.	FKS-1/4		Not Req.	

* Use #203 & #212 Fiber Insulating Washers.

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		BELL SOUND PART No.	NOTES
	OHMS	WATT		
R6	47K			
R7	10K			
R8	180K			
R9	33K			
R10	390K			
R11	100K			
R12	680Ω			
R13	4.7meg			
R14	1meg			
R15	100K			
R16	100K			
R17	1.8meg			
R18	33K			
R19	220K			
R20	33K 5%			
R21	120K			
R22	39K			
R23	220K			
R24	27K			
R25	4.7meg			
R26	100K			
R27	2.2meg			
R28	27K			

ITEM No.	RATING		BELL SOUND PART No.	NOTES
	OHMS	WATT		
R29	27K			
R30	22K			
R31	220K			
R32	27K			
R33	100K			
R34	820Ω			
R35	100K			
R36	27K			
R37	27K			
R38	27K			
R39	470K 5%			
R40	4700Ω			
R41	100K			
R42	2.2meg			
R43	470K 5%			
R44	27K			
R45	6800Ω			
R46	470K 5%			
R47	470K 5%			
R48	470K 5%			
R49	275Ω	5		
R50	470K			
R51	6800Ω	7		

TRANSFORMER (POWER)

ITEM No.	RATING			REPLACEMENT DATA						
	PRI.	SEC. 1	SEC. 2	BELL SOUND PART No.	Halldorson PART No.	Merit PART No.	Ram PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117V @ .74A	740VCT @ .082A	5V @ 2A	B20368 ①	P9311 ②			PM8409 ②	24R04 ②	R-11B ②
	SEC. 3	SEC. 4	SEC. 5							
	6.3V @ 2.2A									

① Part #B20369 used for 50~ operation.

② Tape center tap on 6.3V winding.

PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA							NOTES
	PRI.	SEC.	BELL SOUND PART No.	Halldorson PART No.	Merit PART No.	Ram PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	
T2	7600Ω CT	16Ω Tap @ 8Ω, 4Ω	32B8 ①							① Alternate Part #B20370

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			BELL SOUND PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M1	3AG	2A 250V			312002. (3AG 2A 250V)	342001	AGC2	HKP

MISCELLANEOUS

ITEM No.	PART NAME	BELL SOUND PART No.	NOTES
M2	Pilot Lamp		#51
M3	Pilot Lamp		#51
M4	Switch		Selector (Rotary Wafer Type)
M5	Switch		Input (Slide Type DPDT)
M6	Switch		Filter (Slide Type DPDT)

WIRING DATA

General-use Unshielded Hook-up Wire	Use BELDEN No. 8530 (Solid) Available in Ten Colors 8524 (Stranded) Available in Ten Colors
Power Cord	Use BELDEN No. 1765-B (6 Ft. Length) 1725-K (7½ Ft. Length)
Low-Loss Shielded Lead (Interconnecting)	Use BELDEN No. 8401
Phono Pick-up Arm Cable	Use BELDEN No. 8430 (Two Conductor - Twisted)

CHALLENGER
MODELS CHA33, CHA33Y

CHALLENGER
MODELS CHA33, CHA33Y

TRADE NAME	Challenger Models CHA33, CHA33Y
MANUFACTURER	Challenger Amplifier Co., P.O. Box 500, Paramus, N.J.
TYPE SET	AC Operated 3 Channel 33 Watt Audio Amplifier (Model CHA33Y has 3 Speed Manual Record Player)
TUBES (Seven)	Types 12AX7/ECC83 Mic 1-Mic 2 Preamplifier, 6AV6 Mixer, 12AX7/ECC83 AF Amp.-Phase Inv., (2) 6L6GB Output, (2) 5Y3GT Rectifier
POWER SUPPLY	110-120 Volt AC-60 Cycle RATING 1.1 Amp. @117 Volt AC (120Watts)

The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co., Inc., as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co., Inc., by the manufacturers of the particular type of replacement part listed. Reproduction or use, without express permission, of editorial or pictorial content, in any manner, is prohibited. No patent liability is assumed with respect to the use of the information contained herein. © 1958 Howard W. Sams & Co., Inc., Indianapolis 5, Indiana. Printed in U.S. of America

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE
V1	Mic 1-Mic 2 Preamplifier	12AX7/ ECC83
V2	Mixer	6AV6
V3	AF Amp. -Phase Inv.	12AX7/ ECC83
V4	Output	6L6GB

ITEM No.	USE	TYPE
V5	Output	6L6GB
V6	Rectifier	5Y3GT
V7	Rectifier	5Y3GT

ELECTROLYTIC CAPACITORS

ITEM No.	RATING CAP.	RATING VOLT.	REPLACEMENT DATA CHALLENGER PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1	16	500		AFH1-59	BR1650		TMD-61	D-270	TVL-1980
C2A	5	450		AFH4-09	D0080	WP433.6	TMQ-9	Q-027	TVL-4759.7
B	▲5	450							
C	■5	450							
D	▲5	450							
C3	50	50		PR850V50	BR505	TC39	TD-50-50	MT-0550	TVA-1308

FIXED CAPACITORS

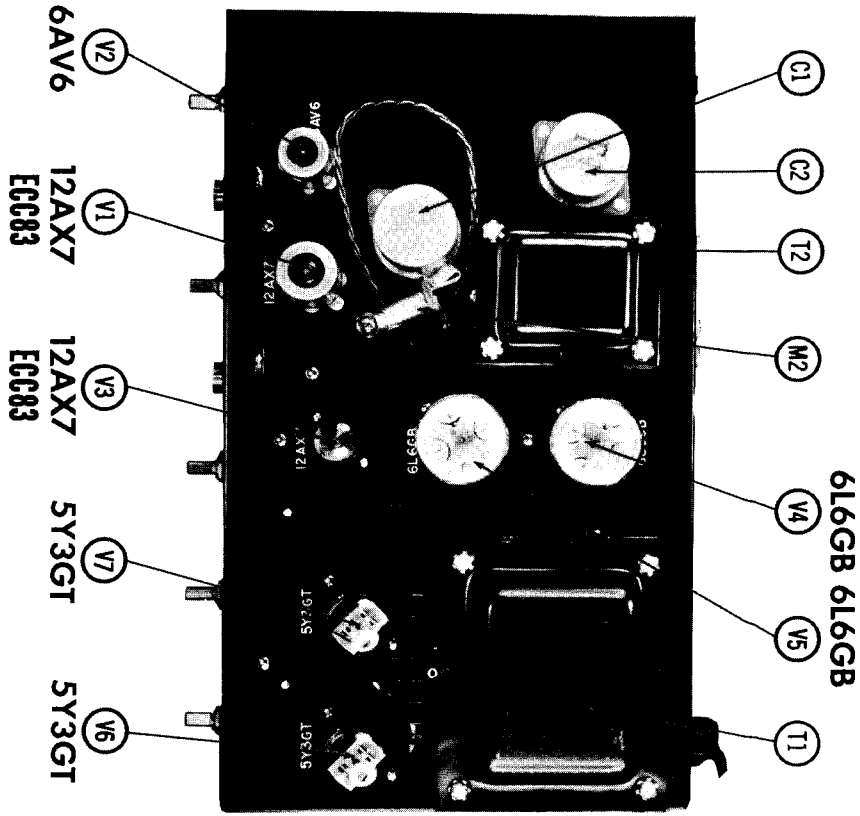
Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING CAP.	RATING VOLT	REPLACEMENT DATA CHALLENGER PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C4	.033	200		P288N-033	DF-303	CUB6S33		GEM-4133	6TM-S33	
C5	.033	400		P488N-033	DF-303	CUB6S33		GEM-4133	6TM-S33	
C6	.033	200		P288N-033	DF-303	CUB6S33		GEM-4133	6TM-S33	
C7	.033	400		P488N-033	DF-303	CUB6S33		GEM-4133	6TM-S33	
C8	.1	400		P488N-1	DF-104	CUB4P1		GEM-401	4TM-P1	
C9	270				D6-271	5R5T27	ED-270		MS-327	10%
C10	2200					1R5D22	CY20C222K		MS-222	10%
C11	1000					1R5D1	ED-1000	MCB255	MS-21	10%
C12	.0056	200			D6-562		GP-5600			
C13	.033	200		P288N-033	DF-303	CUB6S33		GEM-4133	6TM-S33	
C14	15000			BPD-015	DD16-153	BYA10S15	ED-015		5HK-S15	
C15	.033	400		P488N-033	DF-303	CUB6S33		GEM-4133	6TM-S33	
C16	.033	400		P488N-033	DF-303	CUB6S33		GEM-4133	6TM-S33	
C17	2200					1R5D22	CY20C222K		MS-222	10%

CONTROLS

ITEM No.	RATING RESISTANCE	RATING WATTS	REPLACEMENT DATA CHALLENGER PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	2meg	½	V417	B-76	A47-2meg-Z	Q13-139	U55	Treble
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
C	Switch			KB-1	SWE-12	76-1	US-26	
R2A	2meg	½	V413	B-76	A47-2meg-Z	Q13-139	U55	Bass
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
R3A	500K	½	V367	B-60	A47-500K-Z	Q13-133	U48	Phono
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
R4A	500K	½	V367	B-60	A47-500K-Z	Q13-133	U48	Microphone 2
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
R5A	500K	½	V367	B-60	A47-500K-Z	Q13-133	U48	Microphone 1
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING OHMS	RATING WATT	CHALLENGER PART No.	NOTES
R6	3.3meg			
R7	220K			
R8	3.3meg			
R9	220K			
R10	220K			
R11	220K			
R12	270K			
R13	220K			
R14	470Ω			
R15	220K			
R16	100K			
R17	33K			
R18	47K			
R19	220K			
R20	220K			
R21	390Ω			

ITEM No.	RATING OHMS	RATING WATT	CHALLENGER PART No.	NOTES
R22	82K			
R23	100K	1		
R24	470K			
R25	220K			
R26	10K	1		
R27	2200Ω			
R28	220K			
R29	47K			
R30	5000Ω	7		
R31	15K	10		
R32	225Ω	7		
R33	270K			
R34	2200Ω	2		
R35	.68Ω			
R36	.68Ω			
R37	47Ω			

TRANSFORMER (POWER)

ITEM No.	RATING PRI.	RATING SEC. 1	RATING SEC. 2	RATING SEC. 3	REPLACEMENT DATA CHALLENGER PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordorson PART No.	Triad PART No.
T1	117V @1.1A	800VCT @.130A	5V @4A	6.3VCT @ 2.8A	T365-2					R-24B

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE PRI.	IMPEDANCE SEC.1	REPLACEMENT DATA CHALLENGER PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordorson PART No.	Triad PART No.	NOTES
T2	6000Ω CT	70V	T279-1						
		SEC. 2 16ΩTap @ 8Ω & 4Ω							

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA CHALLENGER PART No. FUSE	CHALLENGER PART No. HOLDER	LITTELFUSE PART No. FUSE	LITTELFUSE PART No. HOLDER	BUSS PART No. FUSE	BUSS PART No. HOLDER
M1	3AG	2A 250V S/B			313002. (3AG 2A 250V S/B)	342001	MDL2	HKP

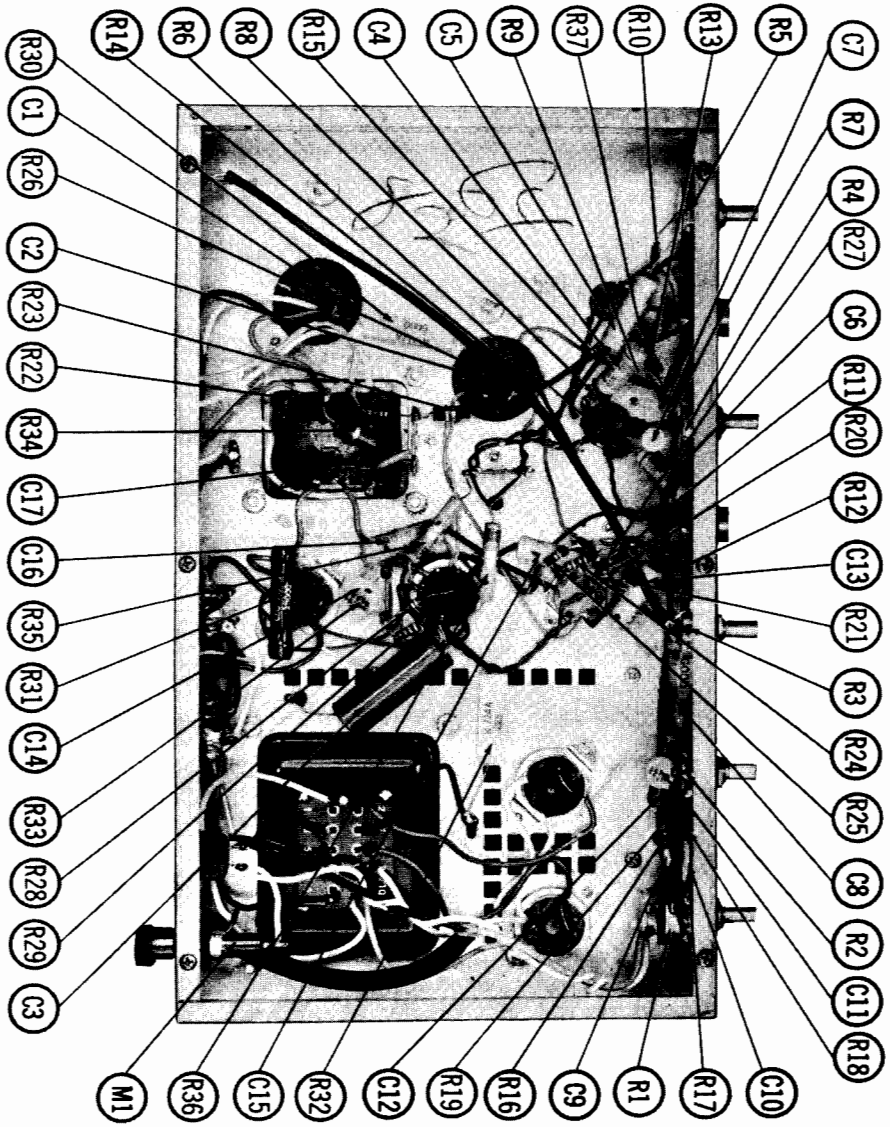
MISCELLANEOUS

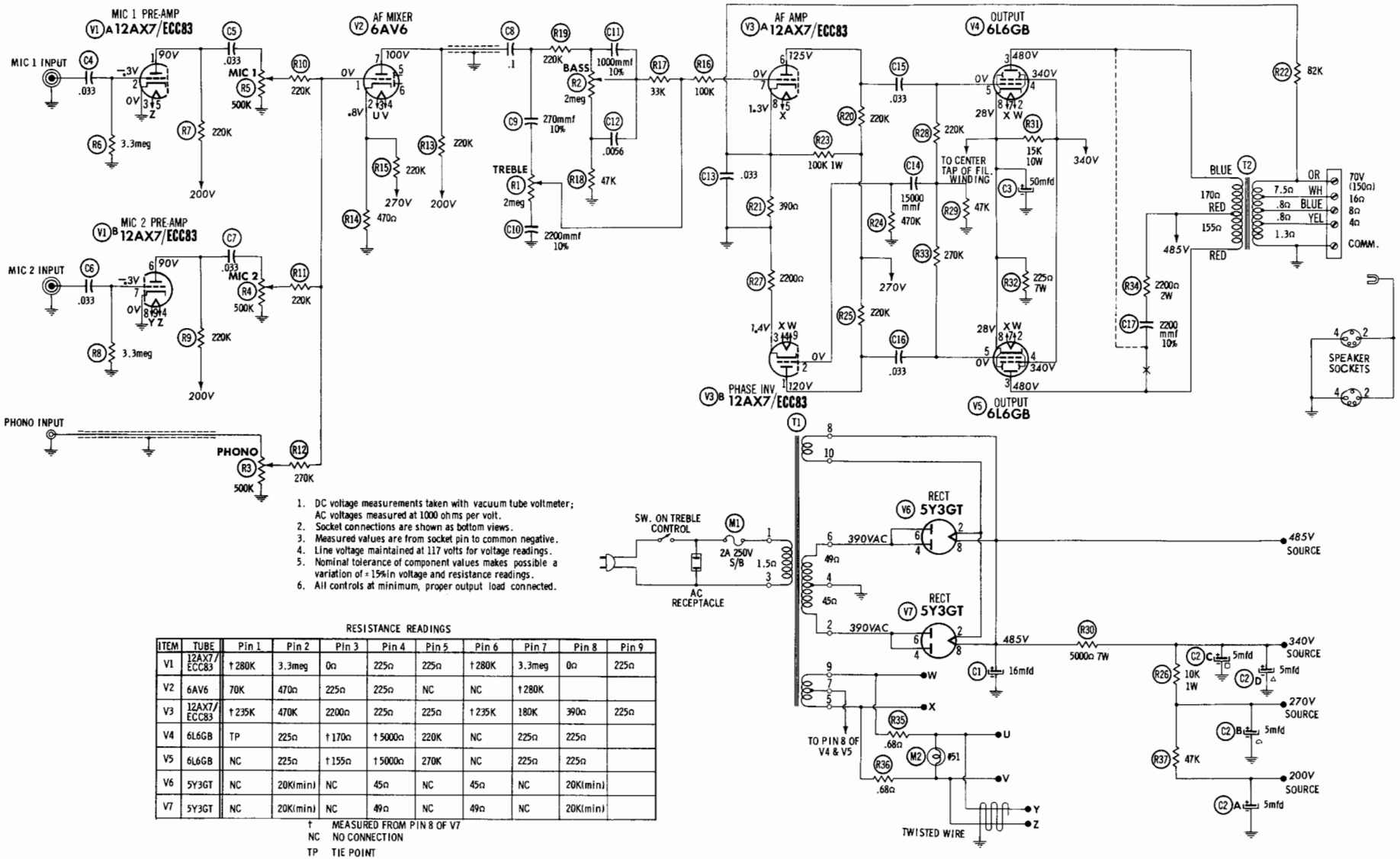
ITEM No.	PART NAME	CHALLENGER PART No.	NOTES
M2	Pilot Lamp		#51

WIRING DATA

General-use Unshielded Hook-up Wire	Use BELDEN No. 8530 (Solid) Available in Ten Colors 8524 (Stranded) Available in Ten Colors
Power Cord	Use BELDEN No. 1765-B (6 Ft. Length) 1725-K (7½ Ft. Length)
Low-Loss Shielded Lead (Interconnecting)	Use BELDEN No. 8401
Phono Pick-up Arm Cable	Use BELDEN No. 8430 (Two Conductor - Twisted)

CHASSIS—BOTTOM VIEW





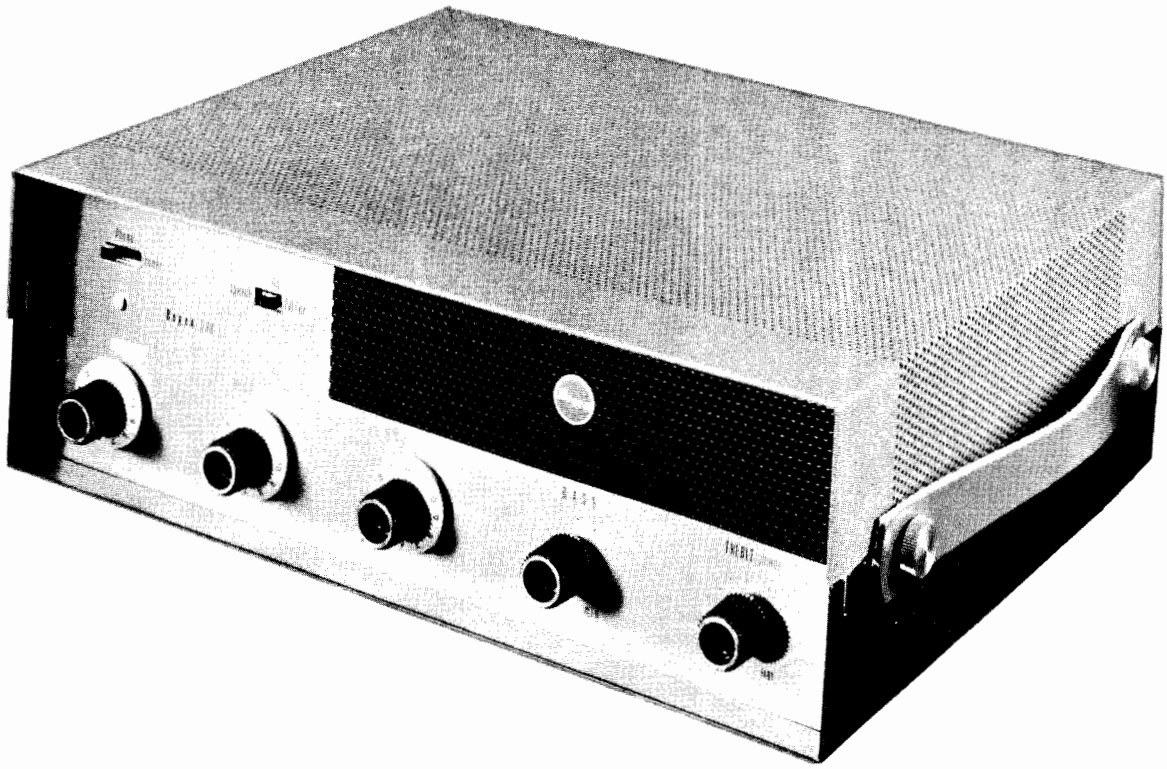
1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ± 15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7/ ECC83	†280K	3.3meg	0Ω	225Ω	225Ω	†280K	3.3meg	0Ω	225Ω
V2	6AV6	70K	470Ω	225Ω	225Ω	NC	NC	†280K		
V3	12AX7/ ECC83	†235K	470K	2200Ω	225Ω	225Ω	†235K	180K	390Ω	225Ω
V4	6L6GB	TP	225Ω	†170Ω	†5000Ω	220K	NC	225Ω	225Ω	
V5	6L6GB	NC	225Ω	†155Ω	†5000Ω	270K	NC	225Ω	225Ω	
V6	5Y3GT	NC	20K(min)	NC	45Ω	NC	45Ω	NC	20K(min)	
V7	5Y3GT	NC	20K(min)	NC	49Ω	NC	49Ω	NC	20K(min)	

† MEASURED FROM PIN 8 OF V7
NC NO CONNECTION
TP TIE POINT

A PHOTOFACT STANDARD NOTATION SCHEMATIC
Howard W. Sams & Co., Inc. 1958



DAVID BOGEN
MODEL L60

TRADE NAME	David Bogen Model L60
MANUFACTURER	David Bogen Co., Inc. P.O. Box500, Paramus, N.J.
TYPE SET	AC Operated 6 Channel 60 Watt Audio Amplifier
TUBES	Twelve
POWER SUPPLY	110-120 Volts AC-60 Cycle RATING 1.1 Amp. @ 117 Volts AC (130 Watts)

VOLTAGE REGULATOR ADJUSTMENT (R6)

The voltage regulator (R6) should be adjusted if V5, V6, V7, V8 or V9 tubes are replaced.

1. Set "Volt Reg." Control (R6) and volume controls (R1, R2, R3) at minimum Allow the amplifier to warm up for four minutes.
2. Using an accurate low range DC voltmeter, connect the positive lead to terminal 1 of the "CUR MON" test strip. Connect the negative lead to ground.
3. Turn the voltage regulator (R6) for a SLIGHT meter deflection. Measure the voltage at terminals 1, 2, 3, and 4 on the "CUR MON" strip. Keep the meter connected to that terminal which measures the highest voltage.
4. Turn the voltage regulator (R6) until the meter indicates .25 volt.

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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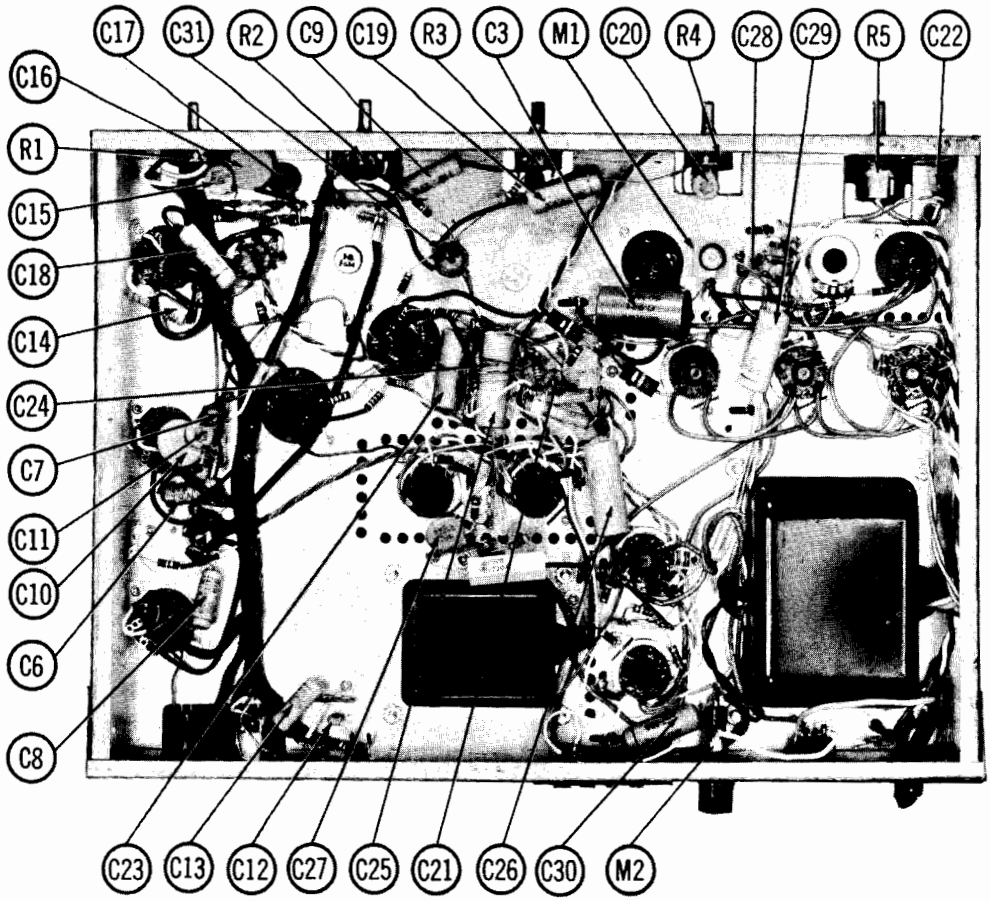
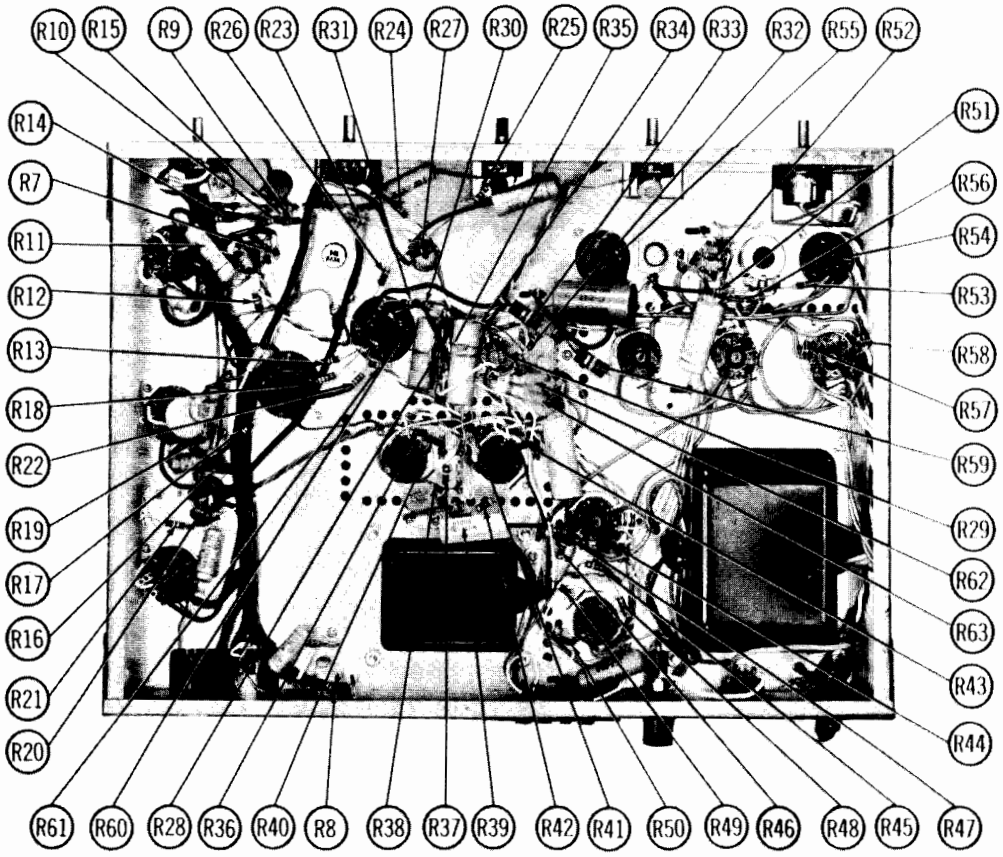


CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION



CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE
V1	Mic 1-Tuner-Phono Preamp.	12AX7/ECC83
V2	Mic 2-Mic3 Preamplifier	12AX7/ECC83
V3	AF Amplifier	6AV6
V4	AF Amp. -Phase Inv.	6U8
V5	Output	6AV5GA
V6	Output	6AV5GA

ITEM No.	USE	TYPE
V7	Output	6AV5GA
V8	Output	6AV5GA
V9	Volt. Reg. -Reg. Cont.	6CM7
V10	Rectifier	5Y3GT
V11	Rectifier	5Y3GT
V12	Rectifier	5Y3GT

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA						
	CAP.	VOLT.	DAVID BOGEN PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1	30	400		AFH1-51	A0470	FP145	TMS-56	S-265	TVL-1720
C2	30	400		AFH1-51	A0470	FP145	TMS-56	S-265	TVL-1720
C3	50	100		PRS150V50	BR5015	TC49	TD-50-150	MT-1550	TVA-1414
C4A	▲5	200		AFH4-09	D0080	WP433.6	TMQ-9	Q-027	TVL-4759.7
B	5	200							
C	■5	200							
D	▲5	200							
C5A	▲10	350		AFH4-19-10	D0179.3	FP474.5	TMQ-113	Q-035	TVL-4826
B	10	350						MT-4510	
C	■20	450							
D	▲20	450							

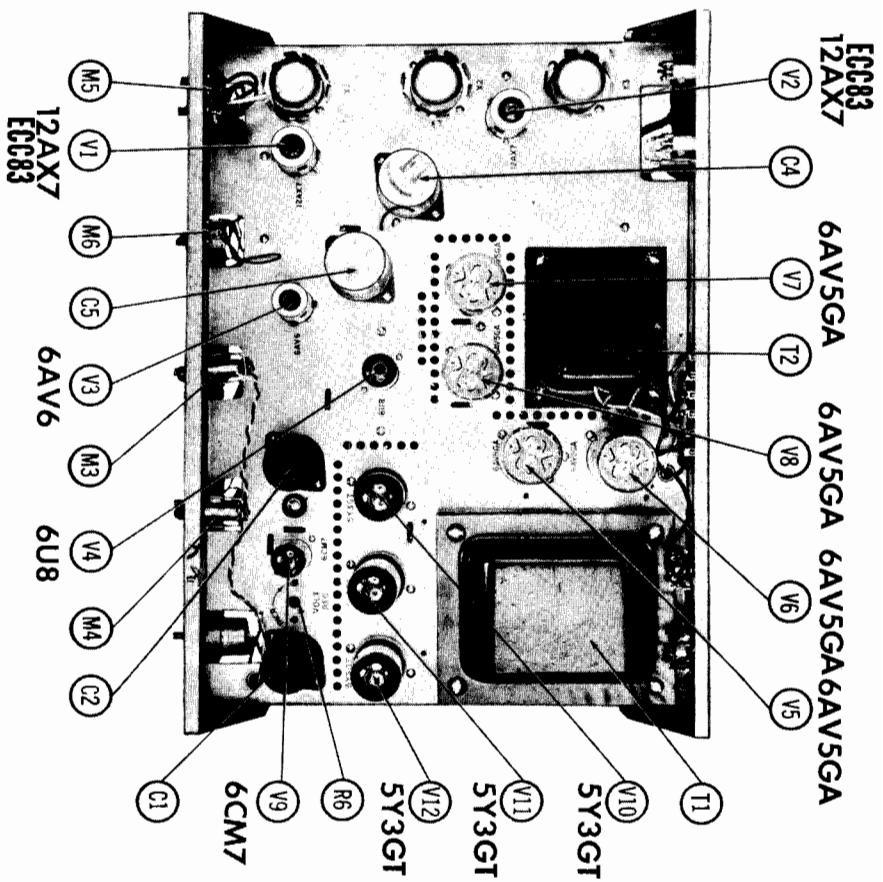
FIXED CAPACITORS

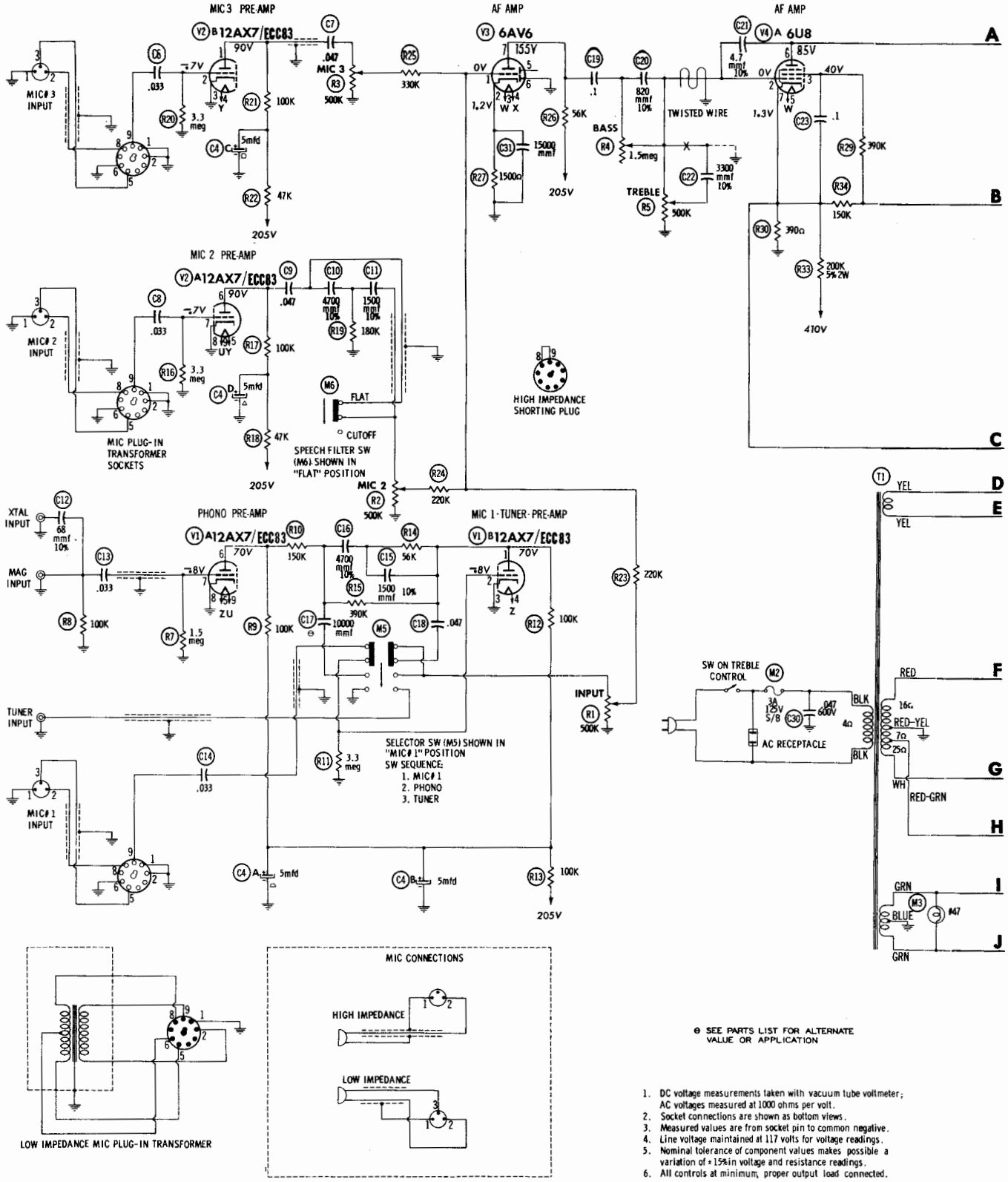
Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA							NOTES
	CAP.	VOLT	DAVID BOGEN PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C6	.033	200		P288N-033	DF-303	CUB6S33		GEM-4133	6TM-S33	
C7	.047	200		P288N-047	DF-503	CUB2S47		GEM-4147	2TM-S47	
C8	.033	200		P288N-033	DF-303	CUB6S33		GEM-4133	6TM-S33	
C9	.047	200		P288N-047	DF-503	CUB2S47		GEM-4147	2TM-S47	
C10	4700					1R5D47	CY20C472K		MS-247	10%
C11	1500					1R5D15	ED-1500		MS-215	10%
C12	68			NP0-DI68	DD-680	L10Q68	ED-68		MS-468	10%
C13	.033	200		P288N-033	DF-303	CUB6S33		GEM-4133	6TM-S33	
C14	.033	200		P288N-033	DF-303	CUB6S33		GEM-4133	6TM-S33	
C15	1500					1R5D15	ED-1500		MS-215	10%
C16	4700					1R5D47	CY20C472K		MS-247	10%
C17	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	①
C18	.047	200		P288N-047	DF-503	CUB2S47		GEM-4147	2TM-S47	
C19	.1	200		P288N-1	DF-104	CUB2P1		GEM-201	2TM-P1	
C20	820					1R5T82	ED-820		MS-382	10%
C21	4.7			NP0-DI4.7	TCZ-4R7	C10V47C	TC0-4.7	ZT-5547	5TCCB-V47	10%
C22	3300					1R5D33	CY20C332K		MS-233	10%
C23	.1	200		P288N-1	DF-104	CUB2P1		GEM-201	2TM-P1	
C24	100			NP0-DI100	DD-101	L10T1	ED-100	MCB235	MS-31	10%
C25	.1	600		P688N-1	DF-104	CUB6P1		GEM-601	6TM-P1	
C26	.1	600		P688N-1	DF-104	CUB6P1		GEM-601	6TM-P1	
C27	3300	1000								10%
C28	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C29	.1	600		P688N-1	DF-104	CUB6P1		GEM-601	6TM-P1	
C30	.047	600		P688N-047	DF-503	CUB6S47		GEM-6147	6TM-S47	
C31	15000			BPD-015	DD16-153	BYA10S15	ED-015		5HK-S15	

① Some version many use 15000mmf in this application.

CHASSIS—TOP VIEW

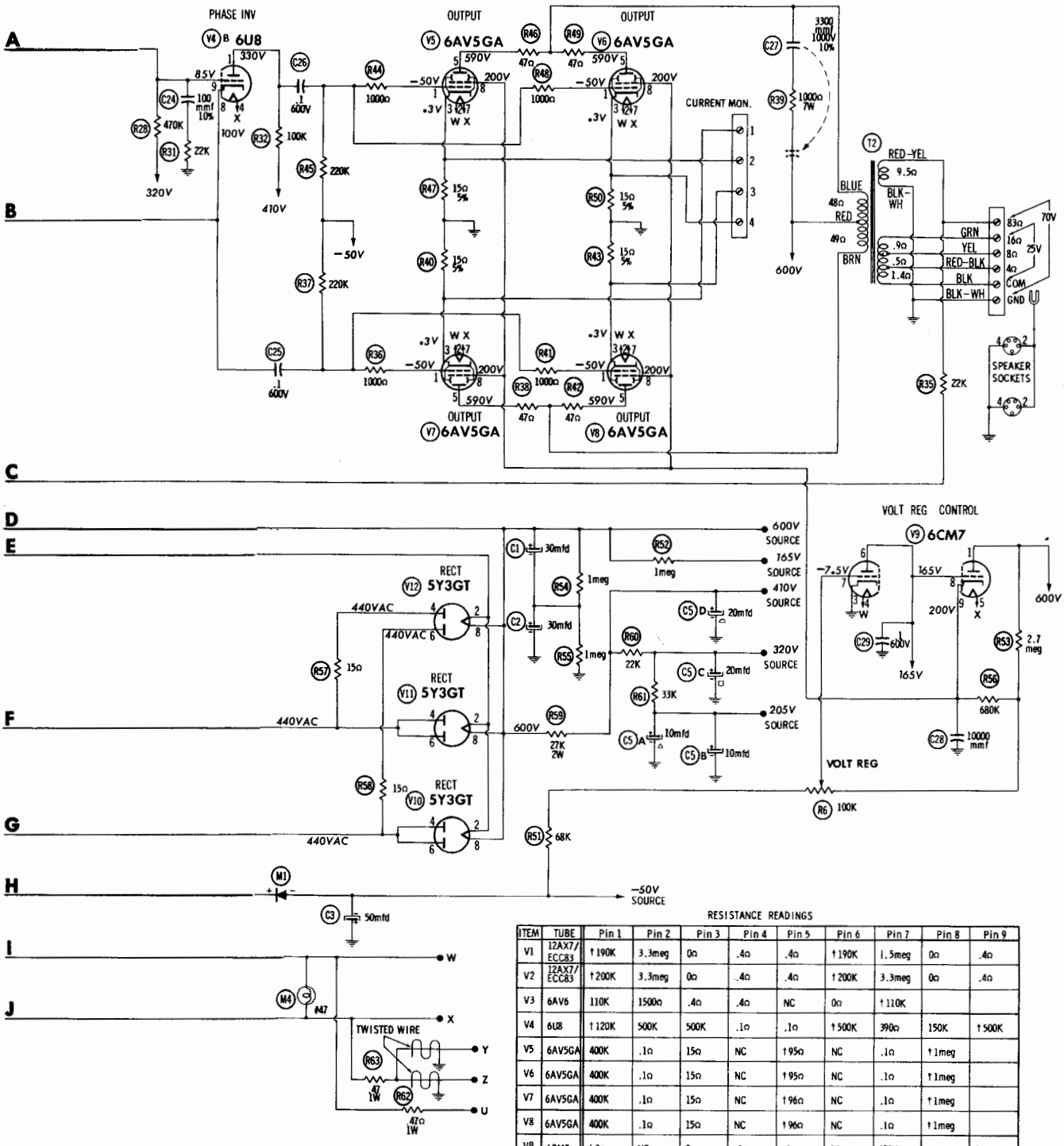




⊖ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

A PHOTOFACT STANDARD NOTATION SCHEMATIC
Howard W. Sams & Co., Inc. 1958



RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7/ ECC83	†190K	3.3meg	0Ω	.4Ω	.4Ω	†190K	1.5meg	0Ω	.4Ω
V2	12AX7/ ECC83	†200K	3.3meg	0Ω	.4Ω	.4Ω	†200K	3.3meg	0Ω	.4Ω
V3	6AV6	110K	1500Ω	.4Ω	.4Ω	NC	0Ω	†110K		
V4	6U8	†120K	500K	500K	.1Ω	.1Ω	†500K	390Ω	150K	†500K
V5	6AV5GA	400K	.1Ω	15Ω	NC	†95Ω	NC	.1Ω	†1meg	
V6	6AV5GA	400K	.1Ω	15Ω	NC	†95Ω	NC	.1Ω	†1meg	
V7	6AV5GA	400K	.1Ω	15Ω	NC	†96Ω	NC	.1Ω	†1meg	
V8	6AV5GA	400K	.1Ω	15Ω	NC	†96Ω	NC	.1Ω	†1meg	
V9	6CM7	†0Ω	NC	0Ω	.1Ω	.1Ω	†1meg	320K	†1meg	1meg
V10	5Y3GT	NC	20K(min)	NC	16Ω	NC	16Ω	NC	20K(min)	
V11	5Y3GT	NC	20K(min)	NC	32Ω	NC	32Ω	NC	20K(min)	
V12	5Y3GT	NC	20K(min)	TP	40Ω	NC	40Ω	TP	20K(min)	

† MEASURED FROM PIN 2 OF V12
NC NO CONNECTION
TP TIE POINT

PARTS LIST AND DESCRIPTIONS (Continued)

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	DAVID BOGEN PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	
R1A	500K	½	V367	B-60	A47-500K-Z	Q13-133	U48	Input
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
R2A	500K	½	V367	B-60	A47-500K-Z	Q13-133	U48	Mic 2
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
R3A	500K	½	V367	B-60	A47-500K-Z	Q13-133	U48	Mic 3
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
R4A	1.5meg	½	V407	B-76	A47-2meg-Z	Q13-139	U55	Bass
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
R5A	500K	½*	V377	B-60	A47-500K-Z	Q13-133	U48	Treble
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
C	Switch			KB-1	SWE-12	76-1	US-26	
R6A	100K	½	V392	AB-40*	A47-100K-S*	B11-128	TA15L	Volt Regulator
B	Shaft			AK-1	FKS-1/4	TM1-Kit	Not Req.	

* Enlarge Mounting Hole to 3/8"

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		DAVID BOGEN PART No.	NOTES
	OHMS	WATT		
R7	1.5meg			
R8	100K			
R9	100K			
R10	150K			
R11	3.3meg			
R12	100K			
R13	100K			
R14	56K			
R15	390K			
R16	3.3meg			
R17	100K			
R18	47K			
R19	180K			
R20	3.3meg			
R21	100K			
R22	47K			
R23	220K			
R24	220K			
R25	330K			
R26	56K			
R27	1500Ω			
R28	470K			
R29	390K			
R30	390Ω			
R31	22K			
R32	100K			
R33	200K 5%	2		
R34	150K			
R35	22K			

ITEM No.	RATING		DAVID BOGEN PART No.	NOTES
	OHMS	WATT		
R36	1000Ω			
R37	220K			
R38	47Ω			
R39	1000Ω	7		
R40	15Ω 5%			
R41	1000Ω			
R42	47Ω			
R43	15Ω 5%			
R44	1000Ω			
R45	220K			
R46	47Ω			
R47	15Ω 5%			
R48	1000Ω			
R49	47Ω			
R50	15Ω 5%			
R51	68K			
R52	1meg			
R53	2.7meg			
R54	1meg			
R55	1meg			
R56	680K			
R57	15Ω			
R58	15Ω			
R59	27K	2		
R60	22K			
R61	33K			
R62	0.47	1		
R63	0.47	1		

PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	DAVID BOGEN PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117V @ 1.1A	870VCT @ .052A Tap @ 37V @ .001A	5V @ 6A	6.3VCT @ 7A	T3150					

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC. 1	DAVID BOGEN PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	
T2	3300Ω CT	70V (83Ω) SEC2 16Ω Tap @ 8Ω, 4Ω	T2124						

RECTIFIER

ITEM No.	RATING	REPLACEMENT DATA				NOTES
	CURRENT (Measured)	DAVID BOGEN PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	SARKES TARZIAN PART No.	
M1	.001A	H373	1263A	RS065	10	

FUSE

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			DAVID BOGEN PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M2	3AG	3A 125V S/B			313003. (3AG 3A 125V S/B)	342001	MDX3	HKP

MISCELLANEOUS

ITEM No.	PART NAME	DAVID BOGEN PART No.	NOTES
M3	Pilot Lamp		#47
M4	Pilot Lamp		#47
M5	Switch	S475	Selector (Slide Type DPDT)
M6	Switch	S361	Speech Filter (Slide Type SPDT)

WIRING DATA

General-use Unshielded Hook-up Wire ..... Use BELDEN No. 8530 (Solid) Available in Ten Colors
8524 (Stranded) Available in Ten Colors

Power Cord ..... Use BELDEN No. 1765-B (6 Ft. Length)
1725-K (7½ Ft. Length)

Low-Loss Shielded Lead (Interconnecting)..... Use BELDEN No. 8401

Phono Pick-up Arm Cable ..... Use BELDEN No. 8430 (Two Conductor - Twisted)

DAVID BOGEN
MODEL PR100A

TRADE NAME	David Bogen Model PR100A		
MANUFACTURER	David Bogen Co., Inc., P. O. Box 500, Paramus, N. J.		
TYPE SET	AC Operated 8 Channel Equalizer Preamplifier		
TUBES (Five)	Types 12AU7/ECC82 Phono Preamplifier, 12AX7/ECC83 Phono AF Amplifier, 12AT7/ECC81 AF Amplifier, 12AU7/ECC82 AF Amp. - Cath. Follower, 6X4 Rectifier		
POWER SUPPLY	110-120 Volts AC-60 Cycles	RATING	.23 Amp. @ 117 Volts AC (23 Watts)

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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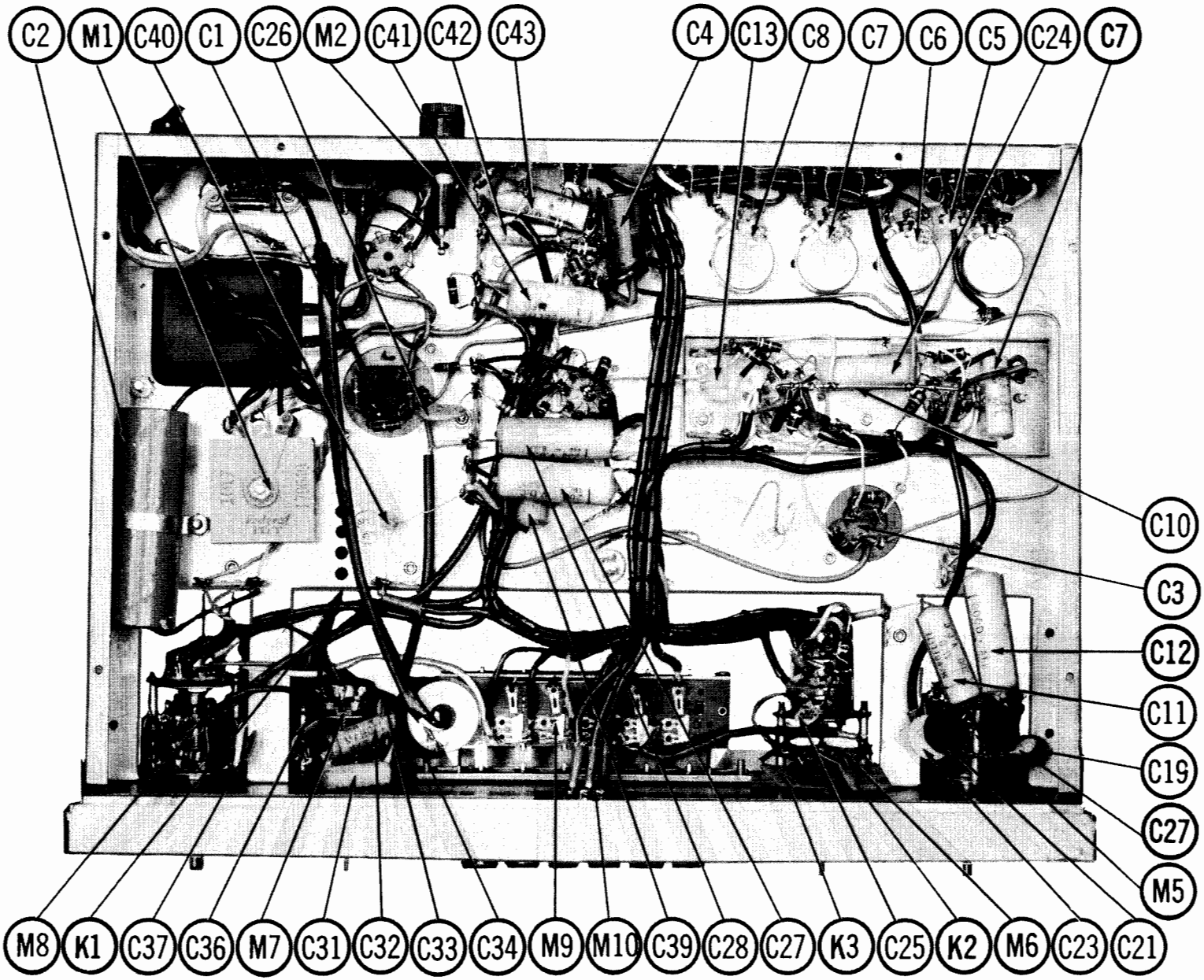
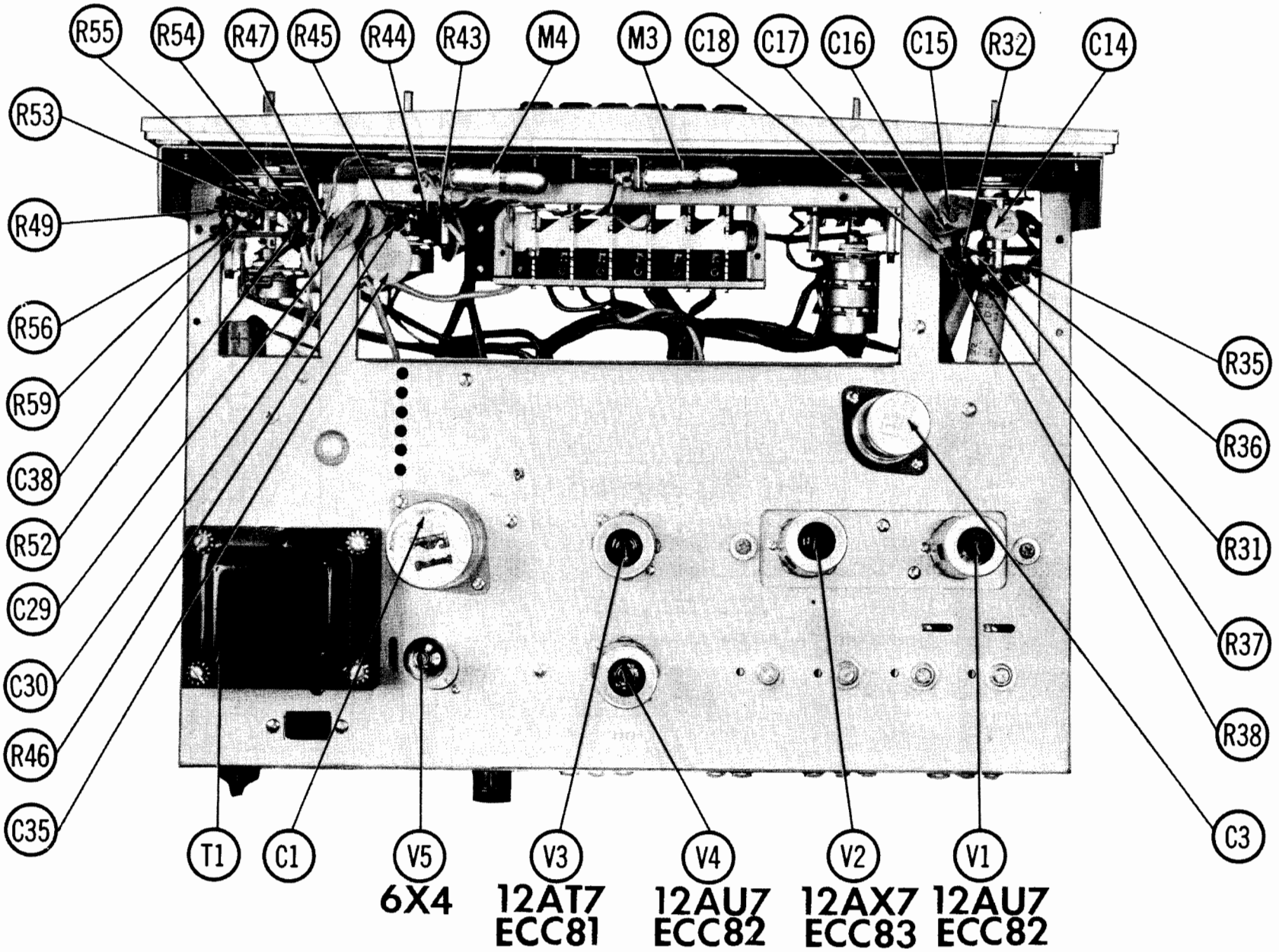
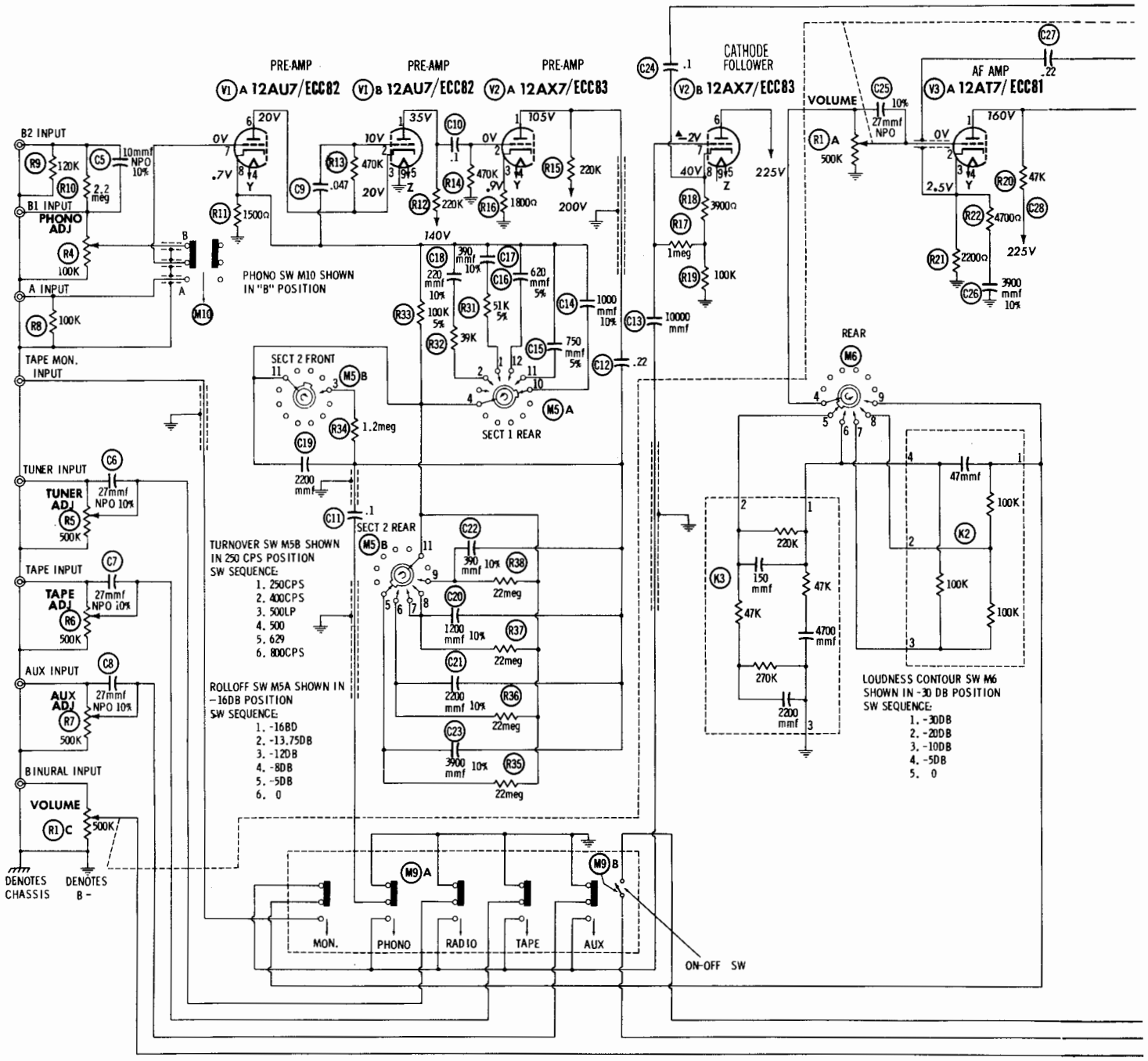


CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION



CHASSIS TOP VIEW



1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

⊖ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

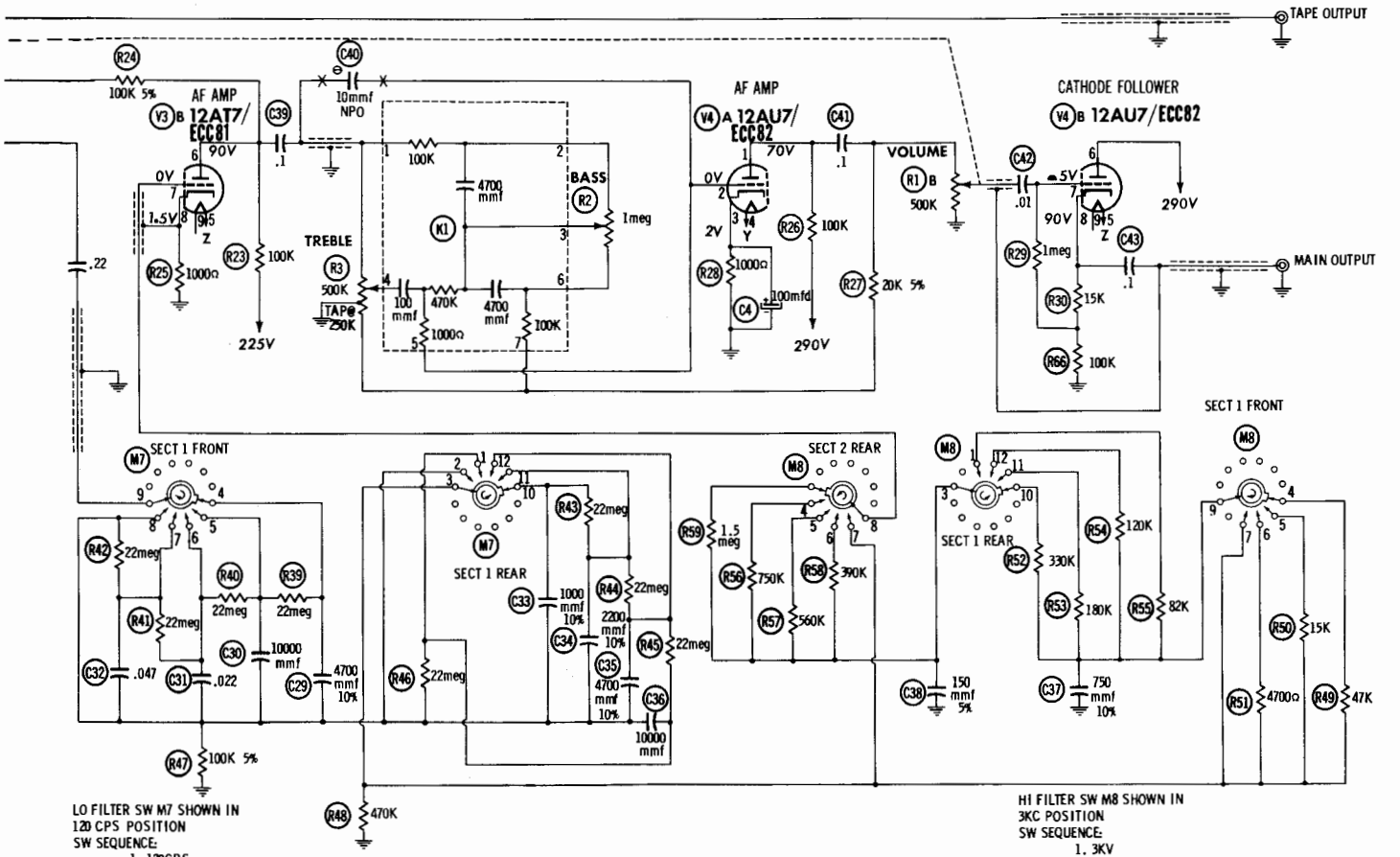
RESISTANCE READINGS

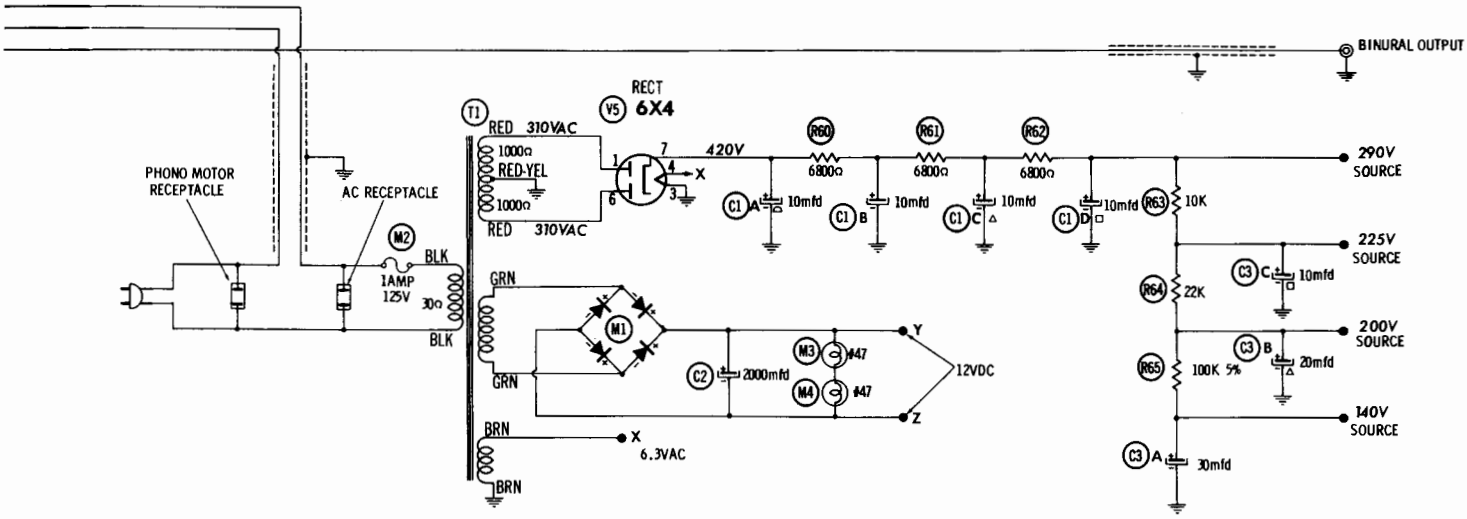
ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AU7/ ECC82	† 370K	INF	INF	6Ω	6Ω	INF	100K	1500Ω	0Ω
V2	12AX7/ ECC83	† 250K	470K	1800Ω	6Ω	6Ω	† 30K	1.1Meg	100K	9Ω
V3	12AT7/ ECC81	† 77K	0Ω	2200Ω	6Ω	6Ω	† 130K	2.2Meg	1000Ω	9Ω
V4	12AU7/ ECC82	† 120K	600K	1000Ω	6Ω	6Ω	† 20K	1.1Meg	115K	9Ω
V5	6X4	1000Ω	NC	0Ω	.3Ω	NC	1000Ω	20K(Min)		

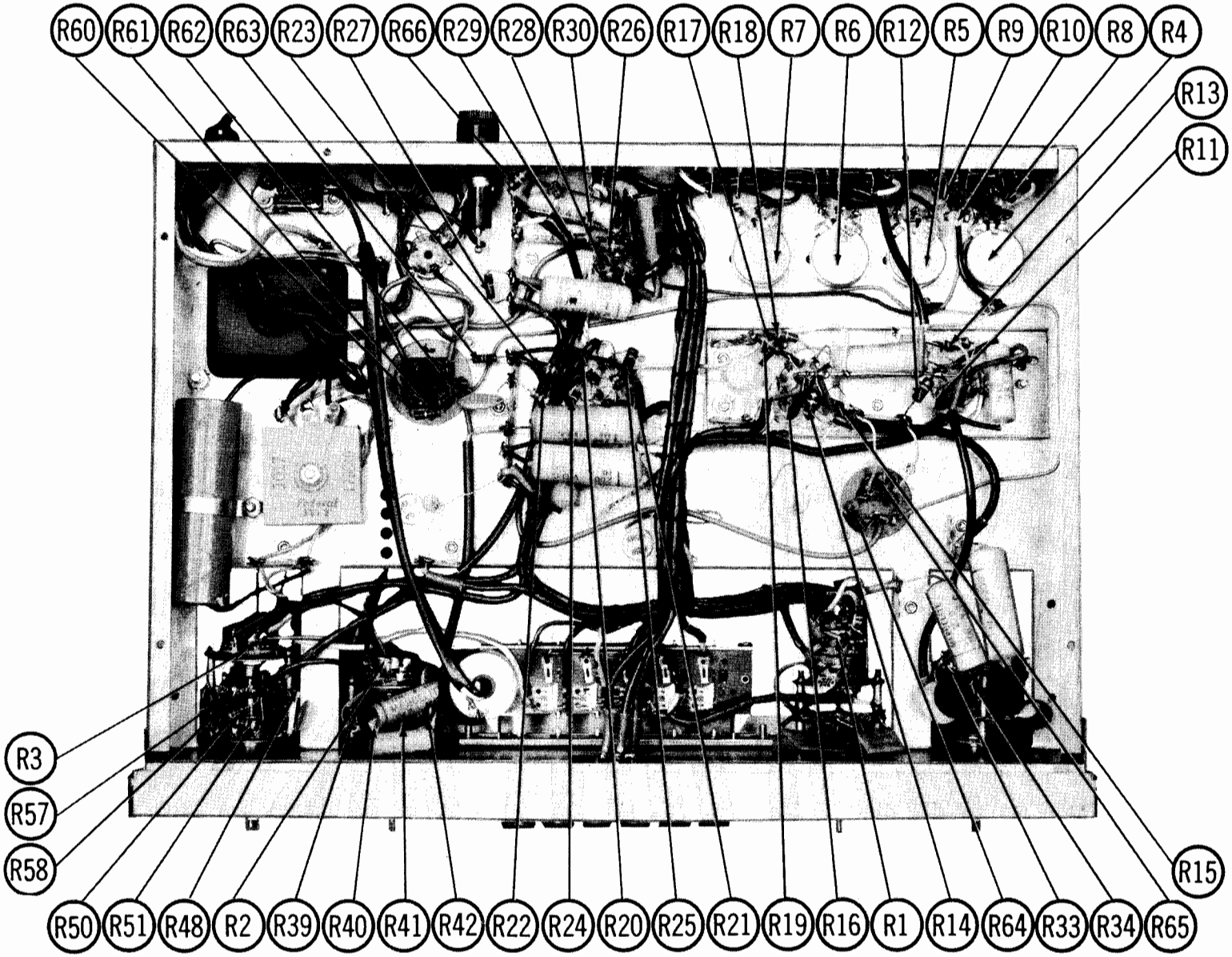
ALL MEASUREMENTS TAKEN IN "AUX" POSITION
- ▲ MEASURED FROM PIN 8 OF V4
- ▲ MEASURED FROM PIN 8 OF V2
- ↕ MEASURED FROM PIN 7 OF V5

NC NO CONNECTION

A PHOTOFACT STANDARD NOTATION SCHEMATIC
Howard W. Sams & Co., Inc. 1957


TAPE OUTPUT
AF AMP
V3B 12AT7/ ECC81
AF AMP
V4A 12AU7/ ECC82
CATHODE FOLLOWER
V4B 12AU7/ECC82
VOLUME
BASS
TREBLE
MAIN OUTPUT
225V
290V
SECT 1 FRONT
SECT 1 REAR
SECT 2 REAR
LO FILTER SW M7 SHOWN IN 120 CPS POSITION
SW SEQUENCE:
1. 120CPS
2. 60CPS
3. 30CPS
4. 15CPS
5. FLAT
HI FILTER SW M8 SHOWN IN 3KC POSITION
SW SEQUENCE:
1. 3KV
2. 6KC
3. 8KC
4. 10KV
5. FLAT


BINURAL OUTPUT
RECT V5 6X4
PHONO MOTOR RECEPTACLE
AC RECEPTACLE
1AMP 125V
RED 310VAC
RED-YEL
420V
290V SOURCE
225V SOURCE
200V SOURCE
140V SOURCE
12VDC
6.3VAC



CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE
V1	Phono Preamplifier	12AU7/ECC82
V2	Phono AF Amplifier	12AX7/ECC83
V3	AF Amplifier	12AT7/ECC81
V4	AF Amp. - Cath. Follower	12AU7/ECC82
V5	Rectifier	6X4

ELECTROLYTIC CAPACITORS

ITEM No.	RATING CAP.	RATING VOLT.	REPLACEMENT DATA David Bogen PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▲10	450		AFH4-10	D0090	FP434	TMQ-10	Q-030	TVL-4760
B	10	450							
C	▲10	450							
D	■10	450							
C2	2000	15		AFH1-03	BR20001	TC1501 TC1501	TD-1000-15 TD-1000-15	S-025	R2425 *
C3A	30	150		AFH3-17		FP330. 3 TC47		D335 MT-1530	TVL-3537
B	▲20	200							
C	■10	250							
C4	100	6		PRS6V100	BBR100-6	TC2501	TD-100-6	MTH-0610	TVA-1101

*NON CATALOG ITEM

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING CAP.	RATING VOLT	REPLACEMENT DATA David Bogen PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C5	10			NP0-SI 10	TCZ-10	C10Q1C	TCO-10	ZT-541	5TCC-Q1	NP0 10%
C6	27				TCZ-27	C10Q27C	TCO-27			NP0 10%
C7	27				TCZ-27	C10Q27C	TCO-27			NP0 10%
C8	27				TCZ-27	C10Q27C	TCO-27			NP0 10%
C9	.047	200		P288N-047	DF-503	CUB2S47		GEM-4147	2TM-S47	
C10	.1	200		P288N-1	DF-104	CUB2P1		GEM-201	2TM-P1	
C11	.1	200		P288N-1	DF-104	CUB2P1		GEM-201	2TM-P1	
C12	.22	200		P288N-22		CUB2P22		CUB2P22	2TM-P22	
C13	10000			BPD-01	DD-103	BYA6SI	ED-01	DC511	5HK-SI	
C14	1000						ED-1000			10%
C15	750									5%
C16	620									5%
C17	390				D6-391	L10T39	ED-390			10%
C18	220				D6-221	L10T22	ED-220			10%
C19	2200			BPD-0022	DD-222	BYA10D22	ED-0022	UC-5222	5GA-D22	
C20	1200						ED-1200			10%
C21	2200									10%
C22	390				D6-391	L10T39	ED-390			10%
C23	3900									10%
C24	.1	200		P288N-1	DF-104	CUB2P1		GEM-201	2TM-P1	
C25	27				TCZ-27	C10Q27C	TCO-27			NP0 10%
C26	3900									10%
C27	.22	200		P288N-22		CUB2P22		GEM-2022	2TM-P22	
C28	.22	200		P288N-22		CUB2P22		GEM-2022	2TM-P22	
C29	4700									10%
C30	10000			BPD-01	DD-103	BYA6SI	ED-01	DC511	5HK-SI	
C31	.022	200		P288N-022	DD-203	CUB4S22	ED-02	GEM-4122	2TM-S22	
C32	.047	200		P288N-047	DF-503	CUB2S47		GEM-4147	2TM-S47	
C33	1000						ED-1000			10%
C34	2200									10%
C35	4700									10%
C36	10000			BPD-01	DD-103	BYA6SI	ED-01	DC511	5HK-SI	
C37	750						ED-750			10%
C38	150			NP0-SI 150	TCZ-150		TCO-150	ZT-5315	5TCC-T15	5%
C39	.1	200		P288N-1	DF-104	CUB2P1		GEM-201	2TM-P1	
C40	10			NP0-SI 10	TCZ-10	C10Q1C	TCO-10	ZT-541	5TCC-Q1	① NP0
C41	.1	400		P488N-1	DF-104	CUB4P1		GEM-401	4TM-P1	
C42	.01	200		P288N-01	DD-103	CUB4SI	GP-10000	GEM-411	4TM-SI	
C43	.1	200		P288N-1	DF-104	CUB2P1		GEM-201	2TM-P1	

① Not used in some versions.

PARTS LIST AND DESCRIPTIONS (Continued)

CONTROLS

ITEM No.	RATING RESISTANCE	RATING WATTS	REPLACEMENT DATA David Bogen PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	500K	½	S452B			Q13-133		Volume
B	500K	½				M13-133		Volume
C	500K	½				M13-133		Volume
R2A	1Meg	½		B-69	A47-1Meg-S	Q11-137	U54	Bass
B	Shaft			Not Req.	FKS ½	Not Req.	Not Req.	
R3A	500K	½		BT-65	A47F5-500K	Q19-133X	UT-431	Treble, Tap @ 250K
B	Shaft			Not Req.	FKS ½	Not Req.	Not Req.	
R4A	100K	½	V391	AB-40	A47-100K-S	Q11-128	U41	Phono Adjust.
B	Shaft			AK-1	FKS-1/4	RQ	Not Req.	
R5A	500K	½	V275B	AB-60	A47-500K-Z	Q13-133	U48	Tuner Adjust.
B	Shaft			AK-1	FKS-1/4	RQ	Not Req.	
R6A	500K	½	V275B	AB-60	A47-500K-Z	Q13-133	U48	Tape Adjust.
B	Shaft			AK-1	FKS-1/4	RQ	Not Req.	
R7A	500K	½	V275B	AB-60	A47-500K-Z	Q13-133	U48	Aux Adjust.
B	Shaft			AK-1	FKS-1/4	RQ	Not Req.	

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING OHMS	RATING WATT	David Bogen PART No.	NOTES
R8	100K			
R9	120K			
R10	2. 2Meg			
R11	1500Ω			
R12	220K			
R13	470K			
R14	470K			
R15	220K			
R16	1800Ω			
R17	1Meg			
R18	3900Ω			
R19	100K			
R20	47K			
R21	2200Ω			
R22	4700Ω			
R23	100K			
R24	100K 5%			
R25	1000Ω			
R26	100K			
R27	20K 5%			
R28	1000Ω			
R29	1Meg			
R30	15K			
R31	51K 5%			
R32	39K			
R33	100K 5%			
R34	1. 2Meg			
R35	22Meg			
R36	22Meg			
R37	22Meg			

ITEM No.	RATING OHMS	RATING WATT	David Bogen PART No.	NOTES
R38	22Meg			
R39	22Meg			
R40	22Meg			
R41	22Meg			
R42	22Meg			
R43	22Meg			
R44	22Meg			
R45	22Meg			
R46	22Meg			
R47	100K 5%			
R48	470K			
R49	47K			
R50	15K			
R51	4700Ω			
R52	330K			
R53	180K			
R54	120K			
R55	82K			
R56	750K			
R57	560K			
R58	390K			
R59	1. 5Meg			
R60	6800Ω			
R61	6800Ω			
R62	6800Ω			
R63	10K			
R64	22K			
R65	100K 5%			
R66	100K			

TRANSFORMER (POWER)

ITEM No.	RATING PRI.	RATING SEC. 1	RATING SEC. 2	RATING SEC. 3	REPLACEMENT DATA David Bogen PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordorson PART No.	Triad PART No.
T1	117VAC @ .23A	640VCT @ .008A	6. 3VAC @ .6A	12VAC @ .135A	T3133-1					

PARTS LIST AND DESCRIPTIONS (Continued)

COMPONENT COMBINATIONS

ITEM No.	USE	DESCRIPTION	David Bogen PART No.	REPLACEMENT DATA
K1	Tone Compensation	4700MMF, 4700MMF, 100MMF 100K, 470K, 1000Ω, 100K	C392	Centralab PC190
K2	Tone Compensation	47MMF, 100K, 100K, 100K	C419	Sprague 104C-11
K3	Tone Compensation	150MMF, 4700MMF, 2200MMF 47K, 47K, 270K, 220K	C420	Sprague 102C-22

SELENIUM RECTIFIER

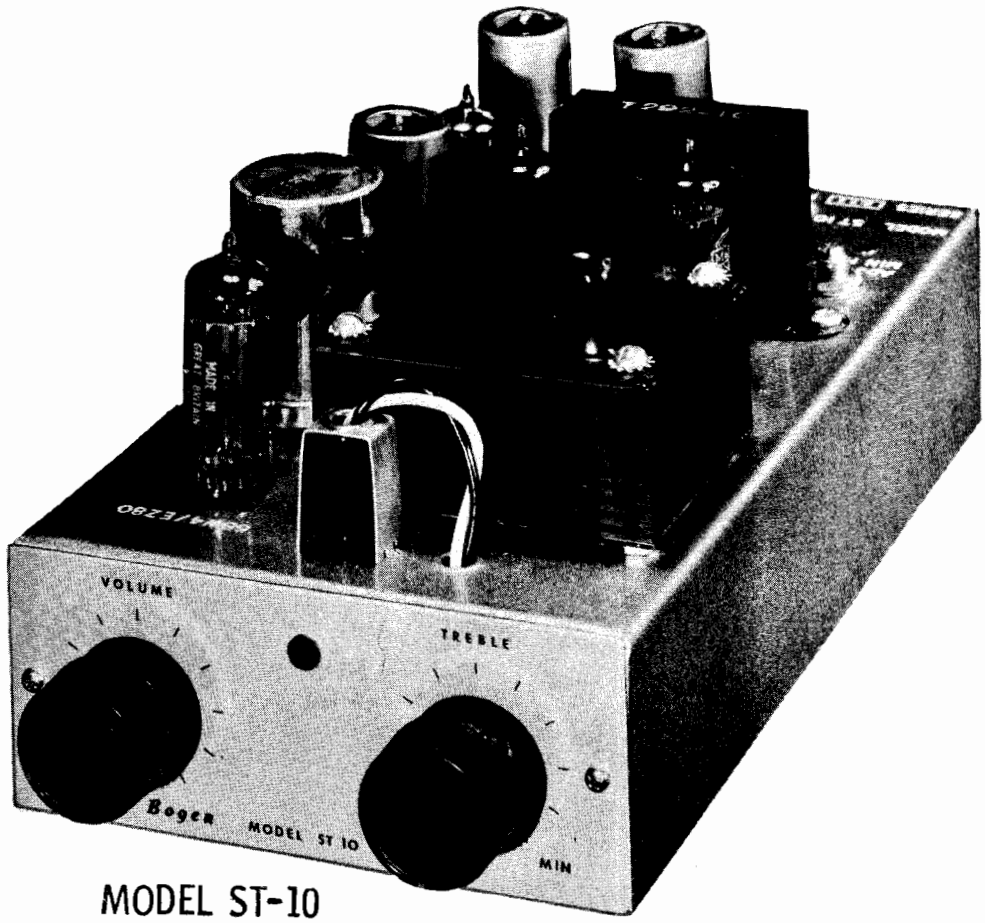
ITEM No.	RATING	REPLACEMENT DATA				NOTES
	CURRENT (Measured)	David Bogen PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	SARKES TARZIAN PART No.	
M1	.720A	H-432	1017	C1B	604B	

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			David Bogen PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M2	3AG	1A 125V Slo-Blo			313001. (3AG 1A 125V S/B)	342001	MDL1	HKP

MISCELLANEOUS

ITEM No.	PART NAME	David Bogen PART No.	NOTES
M3	Pilot Lamp		#47
M4	Pilot Lamp		#47
M5A	Switch	S422A	Rolloff (Rotary Wafer Type)
B	Switch		Turnover (Rotary Wafer Type)
M6	Switch	S452A	Contour (Rotary Wafer Type)
M7	Switch	S424C	Lo Filter (Rotary Wafer Type)
M8	Switch	S425C	Hi Filter (Rotary Wafer Type)
M9A	Switch	S426E	Input Selector Assy (Pushbutton Slide Type)
B	Switch		On-Off (Pushbutton Slide Type)
M10	Switch	S476	Phono (A & B) (Slide Type SPST)



MODEL ST-10

DAVID BOGEN
MODELS ST-10, ST-10G

TRADE NAME	David Bogen Models ST-10, ST-10G
MANUFACTURER	David Bogen Co., Inc., P. O. Box 500, Paramus, N. J.
TYPE SET	AC Operated Audio Amplifier
TUBES (Seven)	Types ECC83/12AX7 (or) 12AD7 Ch. 2 Preamplifier, 6C4 Ch. 2 Cathode Follower, ECC83/12AX7 (or) 12AD7 Ch. 1 Preamplifier, 6U8 Ch. 1 AF Amp. - Phase Inv., (2) 6AQ5 Ch. 1 Output, EZ80/6V4 (or) EZ81/6BW4 Rectifier
POWER SUPPLY	110-120 Volts AC-60 Cycles RATING .52 Amp. @ 117 Volts AC (52 Watts)

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Ch. 2 Preamplifier	ECC63/ 12AX7	Note 1
V2	Ch. 2 Cathode Follower	6C4	
V3	Ch. 1 Preamplifier	ECC63/ 12AX7	Note 1
V4	Ch. 1 AF Amp. - Phase Inv.	6U8	
V5	Ch. 1 Output	6AQ5	
V6	Ch. 1 Output	6AQ5	
V7	Rectifier	EZ80/ 6V4	Note 2

Note 1. Type 12AD7 may be used in some versions.
Note 2. Type EZ81/6BW4 may be used in some versions.

ELECTROLYTIC CAPACITORS

ITEM No.	RATING CAP.	RATING VOLT.	REPLACEMENT DATA David Bogen PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▲30	350		AFH4-49	D0080				
B	■5	350			BR3035				
C	▲5	350							
D	10	25							
C2	8	250	①	PRS250V6	BBR8-250	TC51	TD-8-250	MT-2508	TVA-1503

① Some versions may use 20MFD in this application.

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

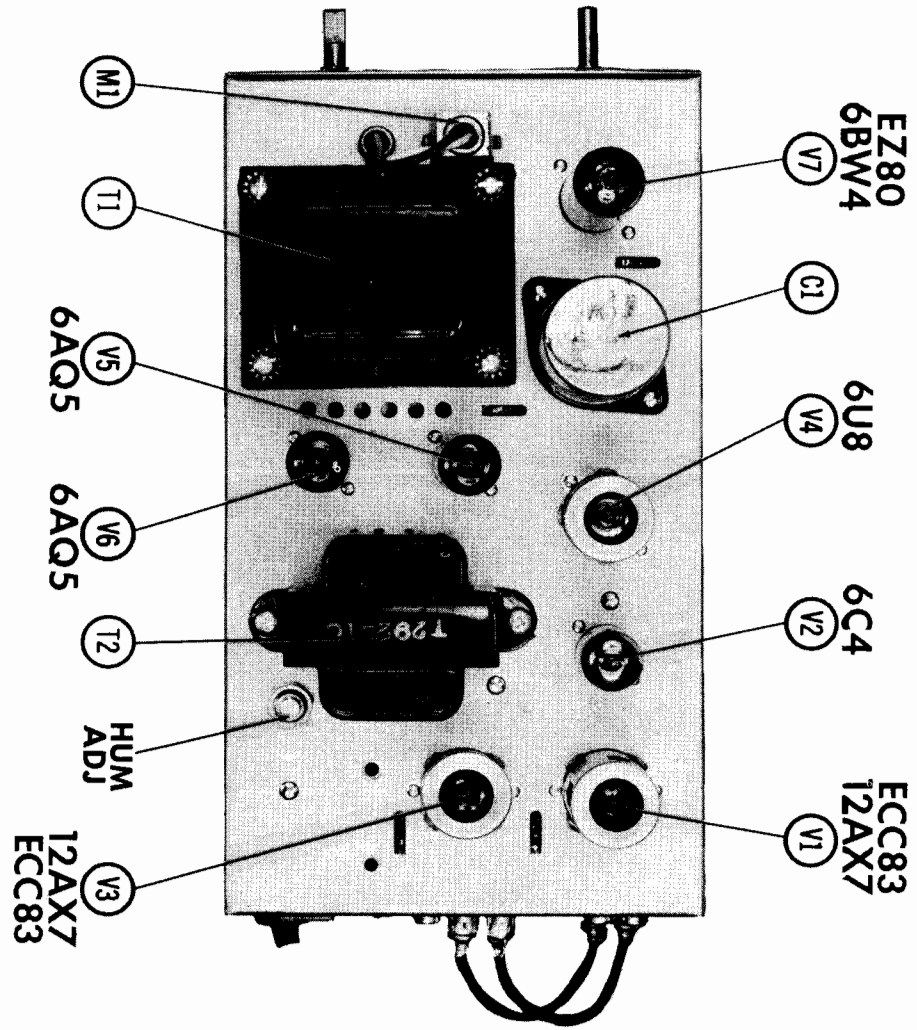
ITEM No.	RATING CAP.	RATING VOLT	REPLACEMENT DATA David Bogen PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C3	.022	200		P288N-022	DD-203	CUB4S22	ED-02	GEM-4122	2TM-S22	
C4	.022	200		P288N-022	DD-203	CUB4S22	ED-02	GEM-4122	2TM-S22	
C5	270			BPD-00027	DD-271	L10T27	ED-270	UC-5327	5GA-T27	
C6	.033	200		P288N-033	DF-303	CUB6S33		GEM-4133	6TM-S33	
C7	.1	200		P288N-1	DF-104	CUB2P1		GEM-201	2TM-P1	
C8	.022	200		P288N-022	DD-203	CUB4S22	ED-02	GEM-4122	2TM-S22	
C9	.022	200		P288N-022	DD-203	CUB4S22	ED-02	GEM-4122	2TM-S22	
C10	270			BPD-00027	DD-271	L10T27	ED-270	UC-5327	5GA-T27	
C11	.033	200		P288N-033	DF-303	CUB6S33		GEM-4133	6TM-S33	
C12	.0022	200		P288N-0022	D6-222	CUB6D22	GP-2200	GEM-6222	6TM-D22	
C13	.033	200		BPD-033	DF-303	CUB6S33		GEM-4133	6TM-S33	
C14	.022	400		P486N-022	DD-203	CUB4S22	ED-02	GEM-4122	4TM-S22	①
C15	680			BPD-00068	DD-681	BYA10T68	ED-680	UC-5368	5GA-T68	②
C16	68			BPD-000068	DD-680	L10Q68	ED-68	UC-5468	5GA-Q68	③
C17	15000			BPD-015	DD16-153	BYA10S15	ED-015		5HK-S15	
C18	15000			BPD-015	DD16-153	BYA10S15	ED-015		5HK-S15	
C19	1000			BPD-001	DD-102	BYA6D1	ED-1000	DC521	5HK-D1	③

① Some versions may use .033MFD in this application.
② Some versions may use 270MMF in this application.
③ Not used in some versions.

CONTROLS

ITEM No.	RATING RESISTANCE	RATING WATTS	REPLACEMENT DATA David Bogen PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	500K	½	V41A	BB-104	AD47-500K-Z	Q13-133	UE1402	Volume
B	500K	½		Not Req.	Not Req.	M13-133	Not Req.	Volume
C	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
R2A	500K	½	V323A	B-60	A47-500K-S	Q13-133	U48	Treble
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
C	Switch			KB-1	SWE-12	76-1	US-26	
D	Cover			KB-5				
R3A	50Ω	2	V113A	WN-500	A43-50	WPK50	R50L	Hum Balance (Wire Wound)
B	Shaft			Not Req.	FKS-1/4	Not Req.	Not Req.	

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	David Bogen PART No.	IRC PART No.	
R4	100K			BTS-100K	
R5	3.3Meg			BTS-3.3Meg	
R6	220K			BTS-220K	
R7	180K			BTS-180K	
R8	3.3Meg			BTS-3.3Meg	
R9	220K			BTS-220K	
R10	47K			BTS-47K	
R11	100K			BTS-100K	
R12	3.3Meg			BTS-3.3Meg	
R13	220K			BTS-220K	
R14	180K			BTS-180K	
R15	3.3Meg			BTS-3.3Meg	
R16	220K			BTS-220K	
R17	150K			BTS-150K	Note 1
R18	47K			BTS-47K	
R19	470K			BTS-470K	
R20	390K			BTS-390K	
R21	390Ω			BTS-390	
R22	100K			BTS-100K	
R23	6800Ω			BTS-6800	Note 2
R24	150K			BTS-150K	Note 3
R25	22K			BTS-22K	Note 4
R26	110K 5%			BTS-110K 5%	Note 5
R27	22K			BTS-22K	
R28	680K			BTS-680K	
R29	1200Ω	1		BTA-1200	Note 6
R30	300Ω	7		PW7-300	
R31	680K			BTS-680K	
R32	2200Ω	2		BTB-2200	
R33	.47Ω	1		BTA-.47	
R34	.47Ω	1		BTA-.47	
R35	.27Ω 5%	1		BTA-.27 5%	
R36	.27Ω 5%	1		BTA-.27 5%	

Note 1. Some versions may use 100K in this application.
Note 2. Some versions may use 22K in this application.
Note 3. Some versions may use 110K in this application.
Note 4. Some versions may use 33K in this application.
Note 5. Some versions may use 82K in this application.
Note 6. Not used in some versions.

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	David Bogen PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117VAC @ .52A	580VCT @ .068A	6.3VAC @ 2.6A		T3174 ①				22R02 ②	R-5B

① Alternate Part #T3159

② Tape 5V@ 2A winding and center tap on 6.3V winding.

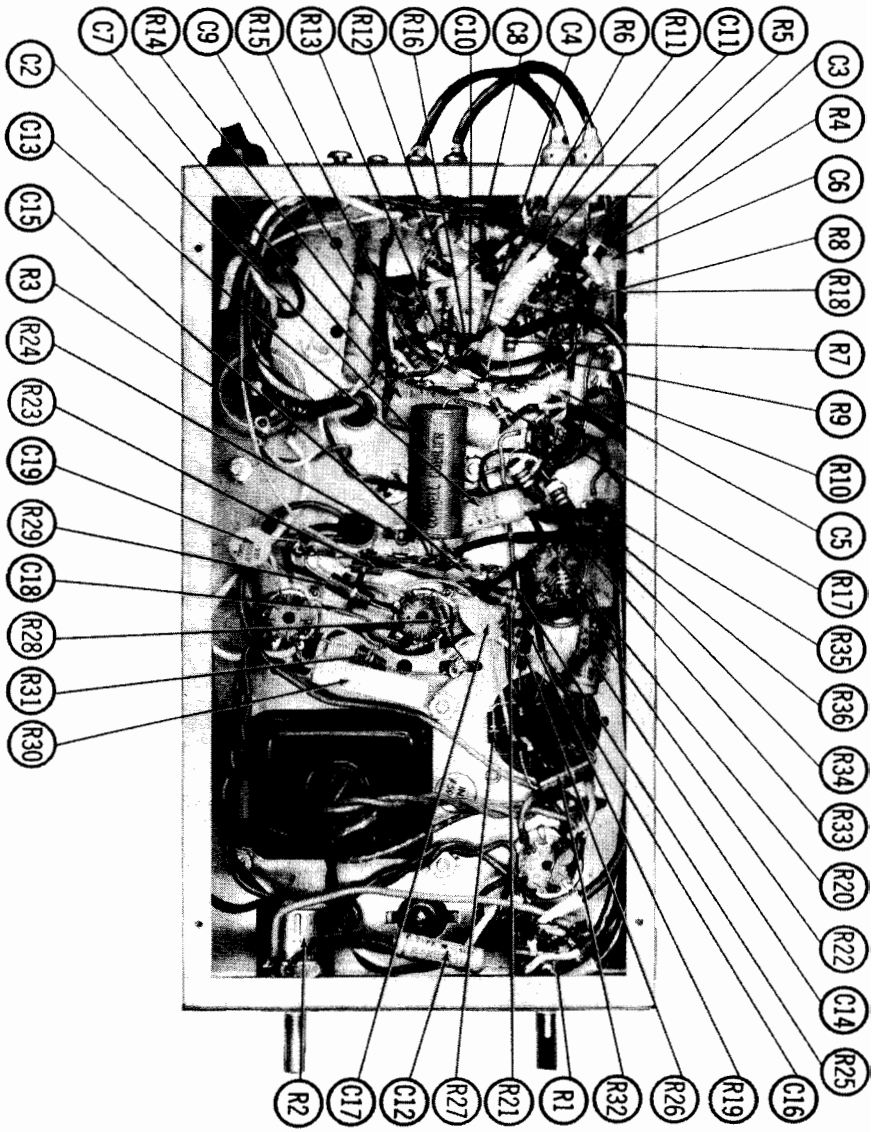
TRANSFORMER (AUDIO OUTPUT)

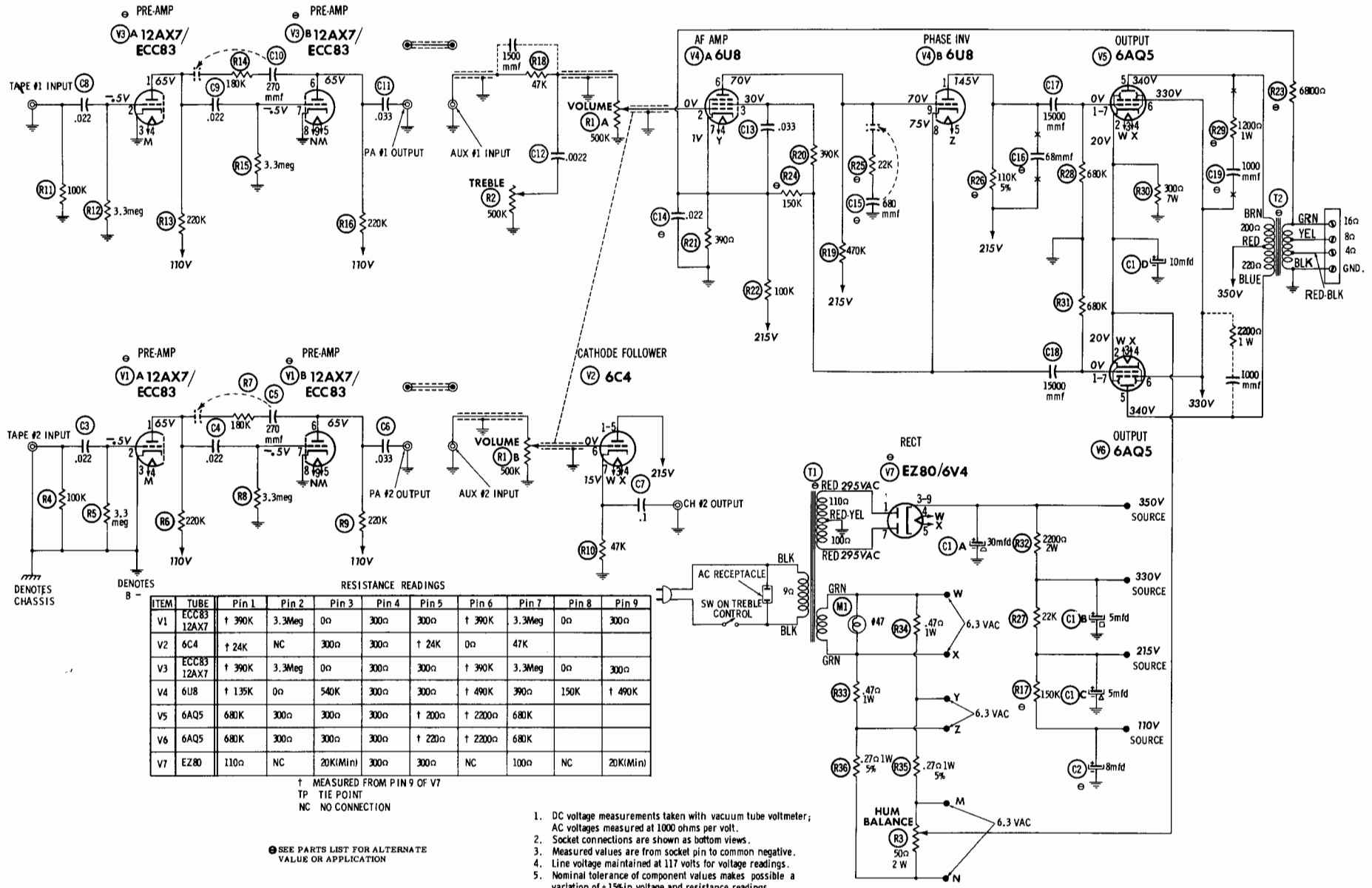
ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	David Bogen PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	
T2	7800Ω CT	16Ω Tap@ 8Ω, 4Ω	T292-1	Z1112	A-3027			S-28X	① Alternate Part Number ② Drill new mounting hole
	3600Ω CT	16Ω Tap@ 8Ω, 4Ω	T292-3 ①	Z1404 ②		A-3870	26S59		

MISCELLANEOUS

ITEM No.	PART NAME	David Bogen PART No.	NOTES
M1	Pilot Light		#47

CHASSIS—BOTTOM VIEW





RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	ECC83 12AX7	† 390K	3.3Meg	0Ω	300Ω	300Ω	† 390K	3.3Meg	0Ω	300Ω
V2	6C4	† 24K	NC	300Ω	300Ω	† 24K	0Ω	47K		
V3	ECC83 12AX7	† 390K	3.3Meg	0Ω	300Ω	300Ω	† 390K	3.3Meg	0Ω	300Ω
V4	6U8	† 135K	0Ω	540K	300Ω	300Ω	† 490K	390Ω	150K	† 490K
V5	6AQ5	680K	300Ω	300Ω	300Ω	† 200Ω	† 2200Ω	680K		
V6	6AQ5	680K	300Ω	300Ω	300Ω	† 220Ω	† 2200Ω	680K		
V7	EZ80	110Ω	NC	20K(Min)	300Ω	300Ω	NC	100Ω	NC	20K(Min)

† MEASURED FROM PIN 9 OF V7
TP TIE POINT
NC NO CONNECTION

⊖ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

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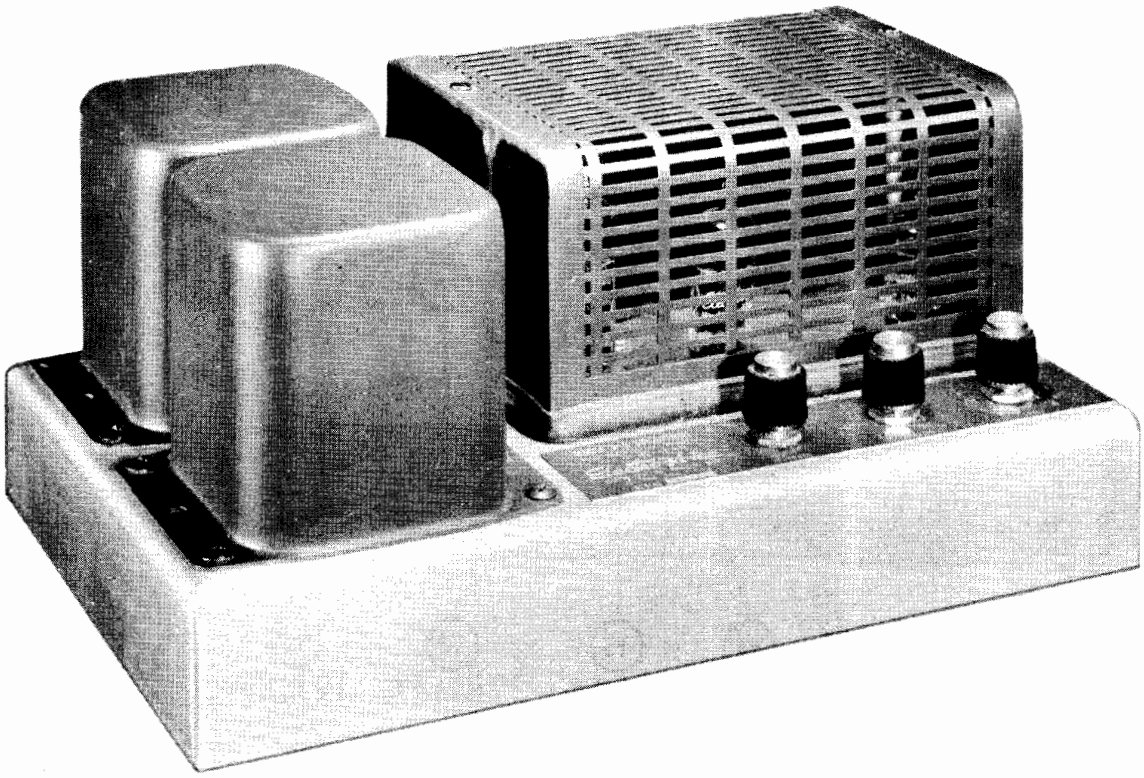
ELECTRO-VOICE MODEL A15



ELECTRO-VOICE MODEL A15

TRADE NAME	Electro-Voice Model A15
MANUFACTURER	Electro-Voice, Inc., Buchanan, Mich.
TYPE SET	AC Operated Amplifier
TUBES (Six)	Types 12AX7 AF Amp.-Phase Inv., 12BH7A Driver , (2) EL84 Output, (2) 6X4 Rectifier
POWER SUPPLY	105-125 Volts AC-60 Cycles RATING .48 Amp. @ 117 Volts AC

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PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	AF Amp.-Phase Inv.	12AX7	
V2	Driver	12BH7A	
V3	Output	EL84	
V4	Output	EL84	
V5	Rectifier	6X4	
V6	Rectifier	6X4	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA						
	CAP.	VOLT.	Electro-Voice PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▲40	400	4208	AFH2-57	B0450	FP238	TMD-43	D-185	TVL-2764
B	▲40	400							
C2A	▲40	400	4208	AFH2-57	B0450	FP238	TMD-43	D-185	TVL-2764
B	▲40	400							
C3	20	400	4207	AFH1-45	A0460	FP144	TMS-50	S-260	TVL-1660
C4	50	100	4242	PRS150V50	BR5015	TC49	TD-50-150	FM-1550	TVA-1414

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA							NOTES
	CAP.	VOLT	Electro-Voice PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C5	.1	200	4265	P288N-1	DF-104	CUB2P1		PT401	2TM-P1	
C6	100		4281	BPD-0001	DD-101	G042	831-101	UC-531	5GA-T1	
C7	.022	400	4260	BPD-02	DD-203	CUB4S22	817-02	PT4122	4TM-S22	
C8	.047	400	4243	BPD-05	DF-503	CUB4S47		PT4147	4TM-S47	
C9	.047	400	4243	BPD-05	DF-503	CUB4S47		PT4147	4TM-S47	
C10	10000		4257	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C11	.1	600	4241	P688N-1	DF-104	CUB6P1		PT601	6TM-P1	
C12	.1	600	4241	P688N-1	DF-104	CUB6P1		PT601	6TM-P1	
C13	.047	400	4243	BPD-05	DF-503	CUB4S47		PT4147	4TM-S47	
C14	.047	400	4243	BPD-05	DF-503	CUB4S47		PT4147	4TM-S47	

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	Electro-Voice PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	
R1A	250K	½	J4686	B-51	A47-250K-Z	Q13-130	U44	Level
B	Shaft		Not Req.	Not Req.	FS-3	Not Req.	Not Req.	Attach to R1A
R2A	1Ω	2	K4686					Damping Factor-wire wound
B	1800Ω	2						Damping Factor- wire wound

RESISTORS

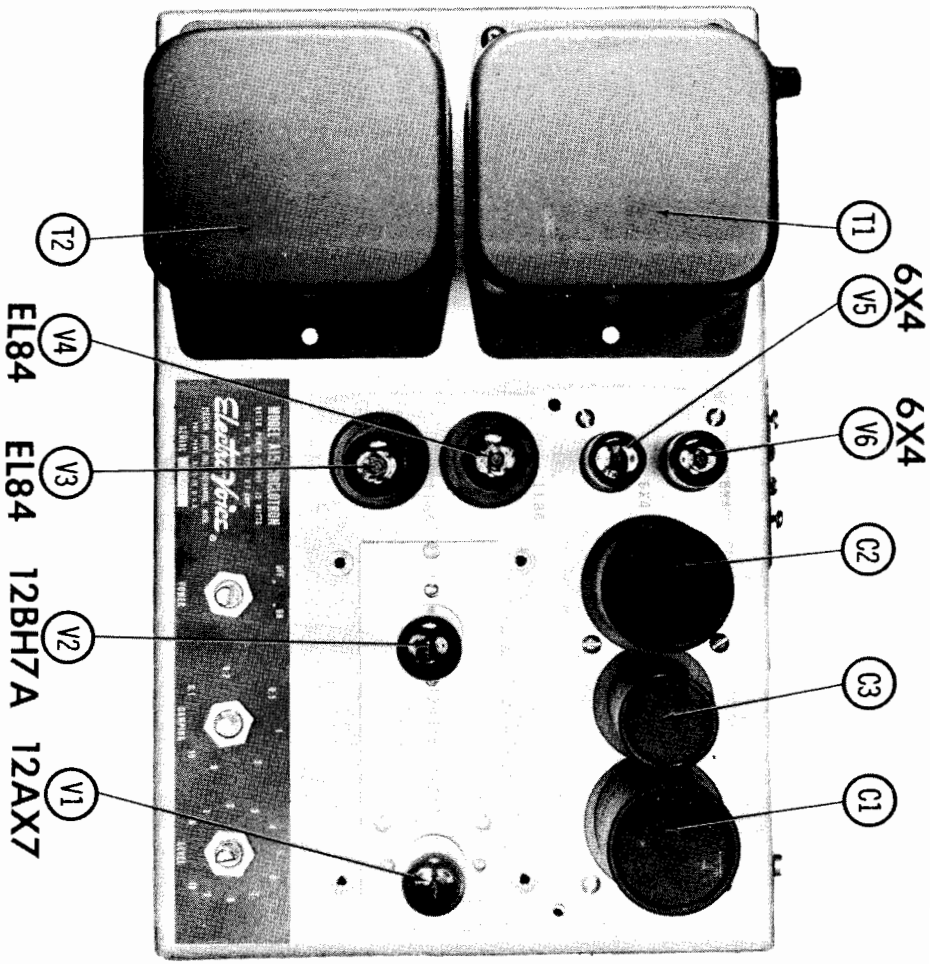
All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	Electro-Voice PART No.	IRC PART No.	
R3	270K		4669	BTS-270K	
R4	22K		4651	BTS-22K	
R5	1.2Meg		4656	BTS-1.2Meg	
R6	27K		4651	BTS-27K	
R7	470Ω		4654	BTS-470	
R8	27K		4651	BTS-27K	
R9	470K		4650	BTS-470K	
R10	470K		4650	BTS-470K	
R11	470K		4650	BTS-470K	Note 1
R12	12K	2	4679	BTB-12K	
R13	12K	2	4679	BTS-12K	

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	Electro-Voice PART No.	IRC PART No.	
R14	1200Ω		4658	BTS-1200	
R15	120Ω		4607	BTS-120	
R16	470K		4650	BTS-470K	
R17	470K		4650	BTS-470K	
R18	120Ω		4607	BTS-120	
R19	47K		4668	BTS-47K	
R20	1800Ω			BTS-1800	Note 2
R21	56K		4652	BTS-56K	
R22	56K		4652	BTS-56K	
R23	100Ω	2	4655	BTB-100	
R24	100Ω	2	4655	BTB-100	

Note 1. Not used in some versions.
Note 2. Some versions use 3300Ω in this application (Part #46017).

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	Electro-Voice PART No.	Holldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triod PART No.
T1	117VAC @.48A	550VCT @.024A	550VCT @.025A	6.3VAC @3.6A SEC. 4 20V *	1591					

* Bias Supply.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	Electro-Voice PART No.	Holldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triod PART No.	
T2	2000Ω	16Ω tap @ 8Ω,4Ω	1590						

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			Electro-Voice PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M1	3AG S/B	1½A 125V	20171		31301.5 (3AG S/B 1½A)	342001	MDX 1½	HKP

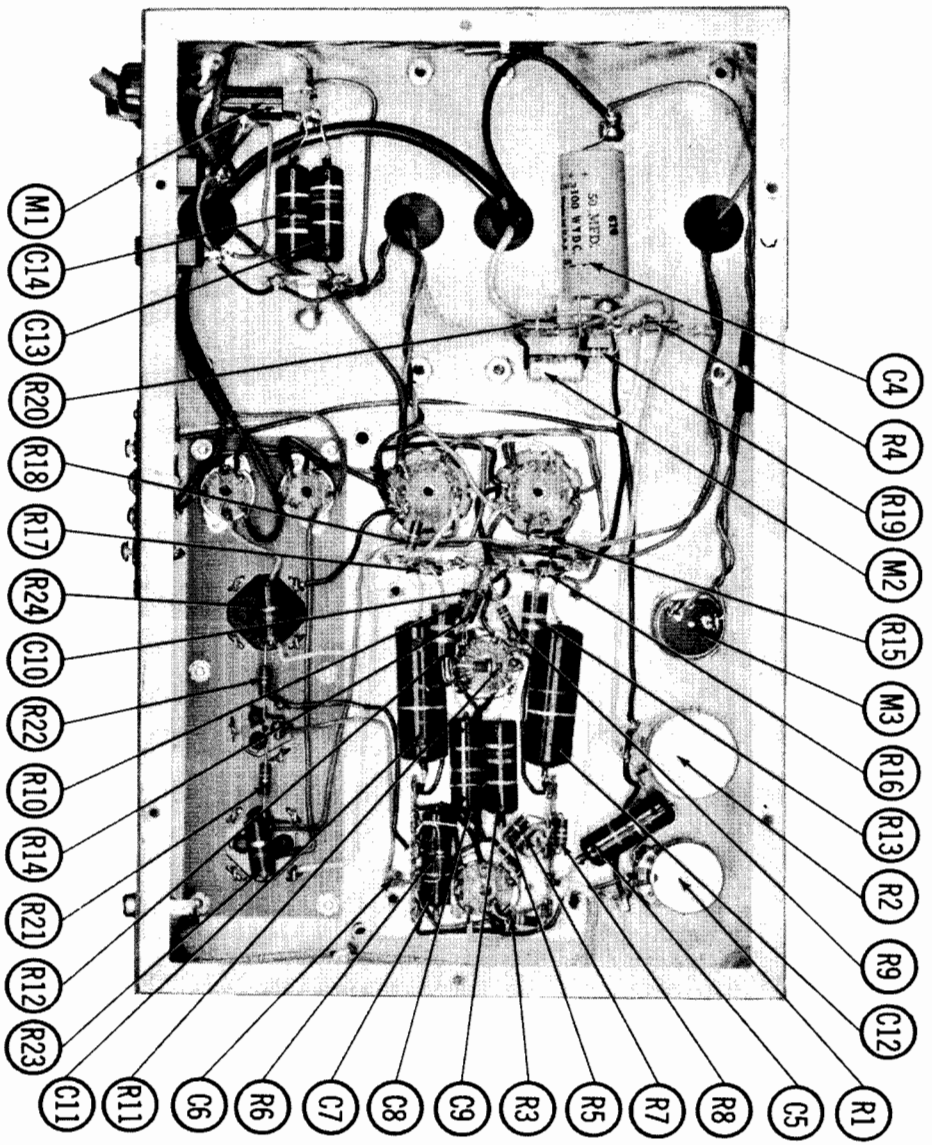
SELENIUM RECTIFIER

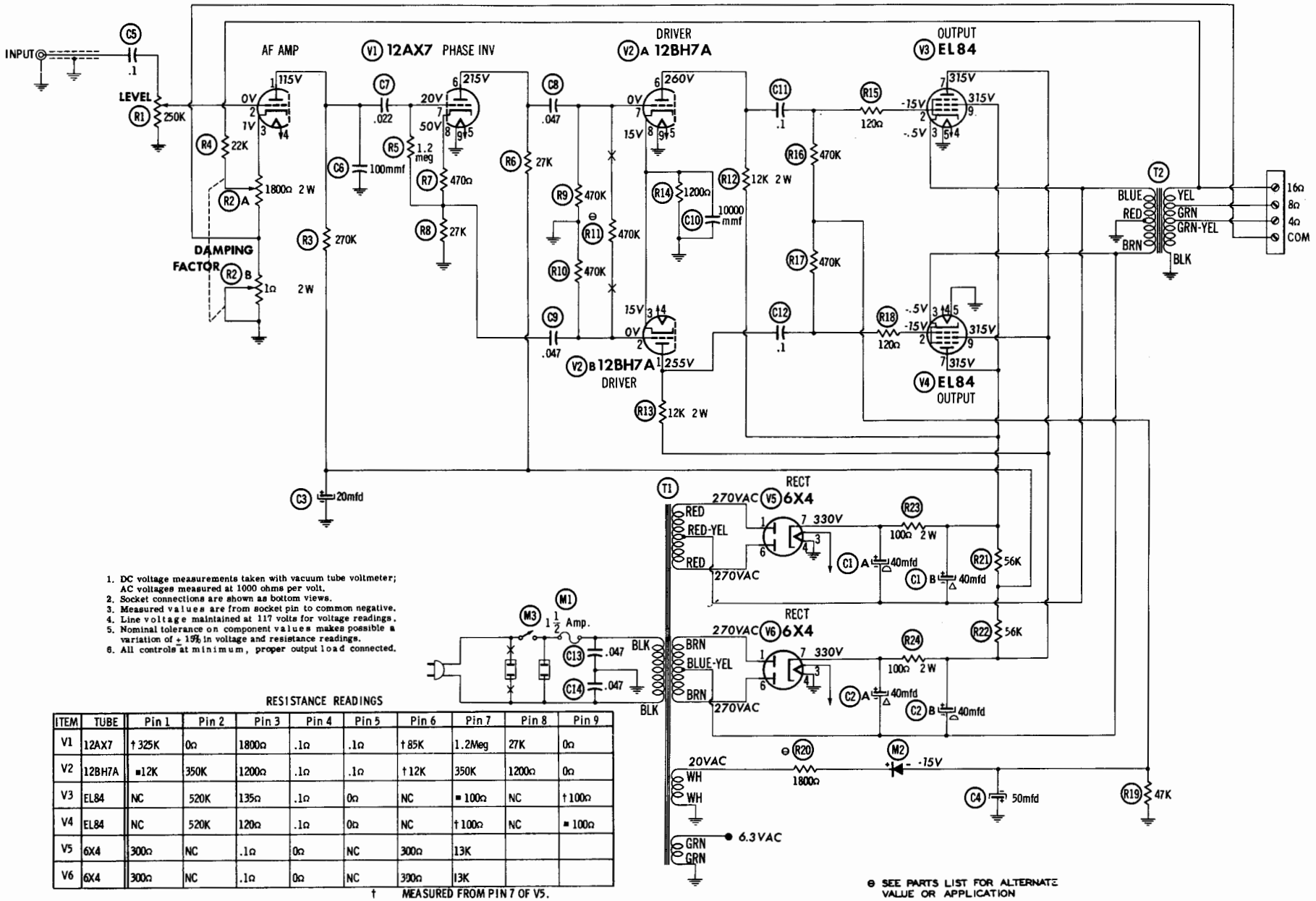
ITEM No.	RATING	REPLACEMENT DATA						NOTES
	CURRENT	Electro-Voice PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	MALLORY PART No.	RADIO RECEPTOR PART No.	SARKES TARZIAN PART No.	
M2		5914	1159	CR10	8S20		10	

MISCELLANEOUS

ITEM No.	PART NAME	Electro-Voice PART No.	NOTES
M3	Switch	B5641	On-off (Power) SPST

CHASSIS—BOTTOM VIEW





1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7	†325K	0Ω	1800Ω	.1Ω	.1Ω	†85K	1.2Meg	27K	0Ω
V2	12BH7A	▪12K	350K	1200Ω	.1Ω	.1Ω	†12K	350K	1200Ω	0Ω
V3	EL84	NC	520K	135Ω	.1Ω	0Ω	NC	▪100Ω	NC	†100Ω
V4	EL84	NC	520K	120Ω	.1Ω	0Ω	NC	†100Ω	NC	▪100Ω
V5	6X4	300Ω	NC	.1Ω	0Ω	NC	300Ω	13K		
V6	6X4	300Ω	NC	.1Ω	0Ω	NC	300Ω	13K		

† MEASURED FROM PIN 7 OF V5.
▪ MEASURED FROM PIN 7 OF V6.
NC NO CONNECTION.

⊖ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

A PHOTOFACT STANDARD NOTATION SCHEMATIC

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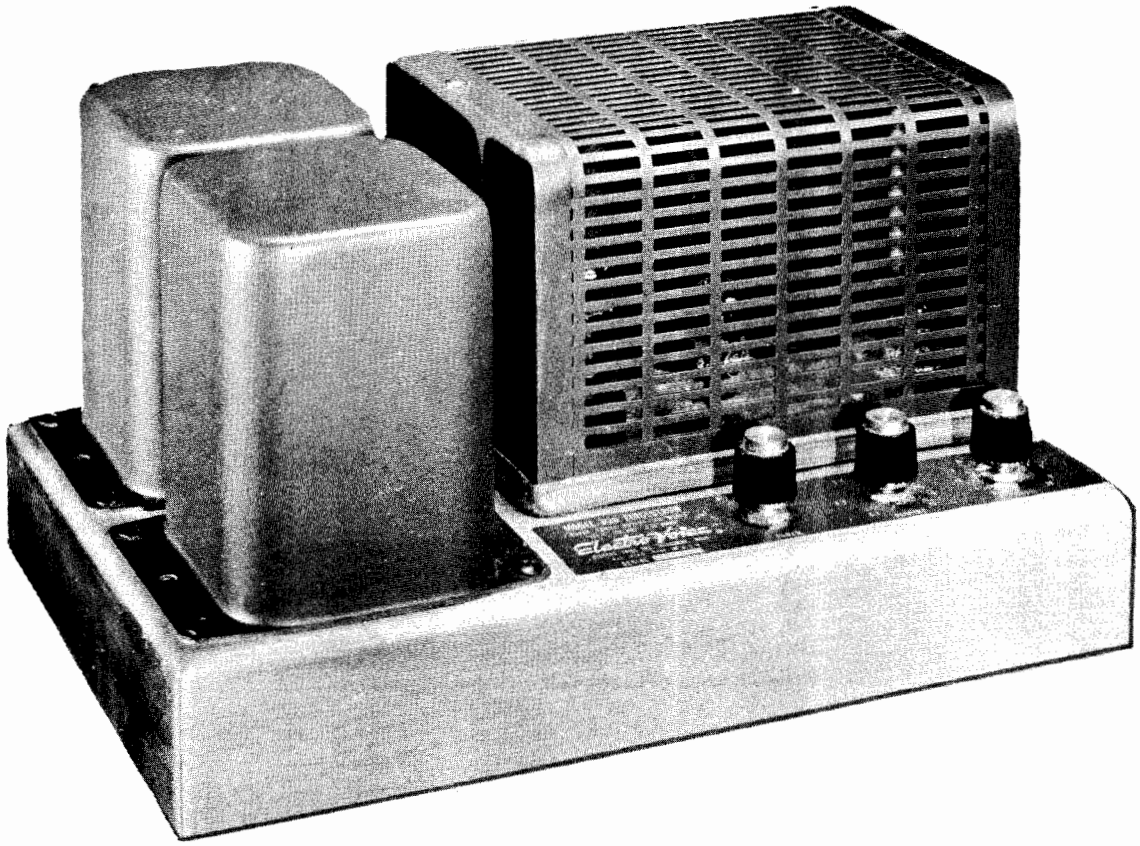


ELECTRO-VOICE
MODEL A20

TRADE NAME	Electro-Voice Model A20
MANUFACTURER	Electro-Voice, Inc., Buchanan, Mich.
TYPE SET	AC Operated 20 Watt Amplifier
TUBES (Six)	Types 12AX7 AF Amplifier-Phase Inverter, 12BH7A Driver, (2) 6V6GT Output, (2) 6X4 Rectifier
POWER SUPPLY	105-125 Volts AC - 60 Cycles RATING .59 Amp. @ 117 Volts AC

"The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co., Inc., as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co., Inc., by the manufacturers of the particular type of replacement part listed." "Reproduction or use, without express permission, of editorial or pictorial content, in any manner, is prohibited. No patent liability is assumed with respect to the use of the information contained herein. Copyright 1956 by Howard W. Sams & Co., Inc., Indianapolis 5, Indiana, U. S. of America. Copyright under international Copyright Union. All rights reserved under Inter-American Copyright Union (1910) by Howard W. Sams & Co., Inc." Printed in U. S. of America

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	AF Amp.-Phase Inv.	12AX7	
V2	Driver	12BH7A	
V3	Output	6V6GT	

ITEM No.	USE	TYPE	NOTES
V4	Output	6V6GT	
V5	Rectifier	6X4	
V6	Rectifier	6X4	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA						
	CAP.	VOLT.	Electro-Voice PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▲40	500	4247	AFH2-72	B053	FP288	TMD-62	D-275	R1495 *
B	▲40	500							
C2A	▲40	500	4247	AFH2-72	B053	FP288	TMD-62	D-275	R1495 *
B	▲40	500							
C3	20	450	4246	AFH1-50	A046	FP144	TMS-55	S-260	TVL-1714
C4	50	100	4242	PRS150V50	BR5015	TC49	TD-50-150	FM-1550	TVA-1414

* Non-catalog item.

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA							NOTES
	CAP.	VOLT	Electro-Voice PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C5	.1	200	4265	P288N-1	DF-104	CUB2P1		PT401	2TM-P1	
C6	100		4281	BPD-0001	DD-101	G042 •	831-101	UC-531	5GA-T1	
C7	.022	400	4260	BPD-02	DD-203	CUB4S22	817-02	PT4122	4TM-S22	
C8	.047	400	4243	BPD-05	DF-503	CUB4S47		PT4147	4TM-S47	
C9	.047	400	4243	BPD-05	DF-503	CUB4S47		PT4147	4TM-S47	
C10	10000		4257	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C11	.1	600	4241	P688N-1	DF-104	CUB6P1		PT601	6TM-P1	
C12	.1	600	4241	P688N-1	DF-104	CUB6P1		PT601	6TM-P1	
C13	.047	400	4243	BPD-05	DF-503	CUB4S47		PT4147	4TM-S47	
C14	.047	400	4243	BPD-05	DF-503	CUB4S47		PT4147	4TM-S47	

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	Electro-Voice PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	
R1A	250K	½	J4686	B-51	A47-250K-Z	Q13-130	U44	Level
B	Shaft		Not Req.	Not Req.	FS-3	Not Req.	Not Req.	Attach to R1A
R2A	1Ω	2	K4686					Damping factor- wire wound
B	1800Ω	2						Damping factor- wire wound

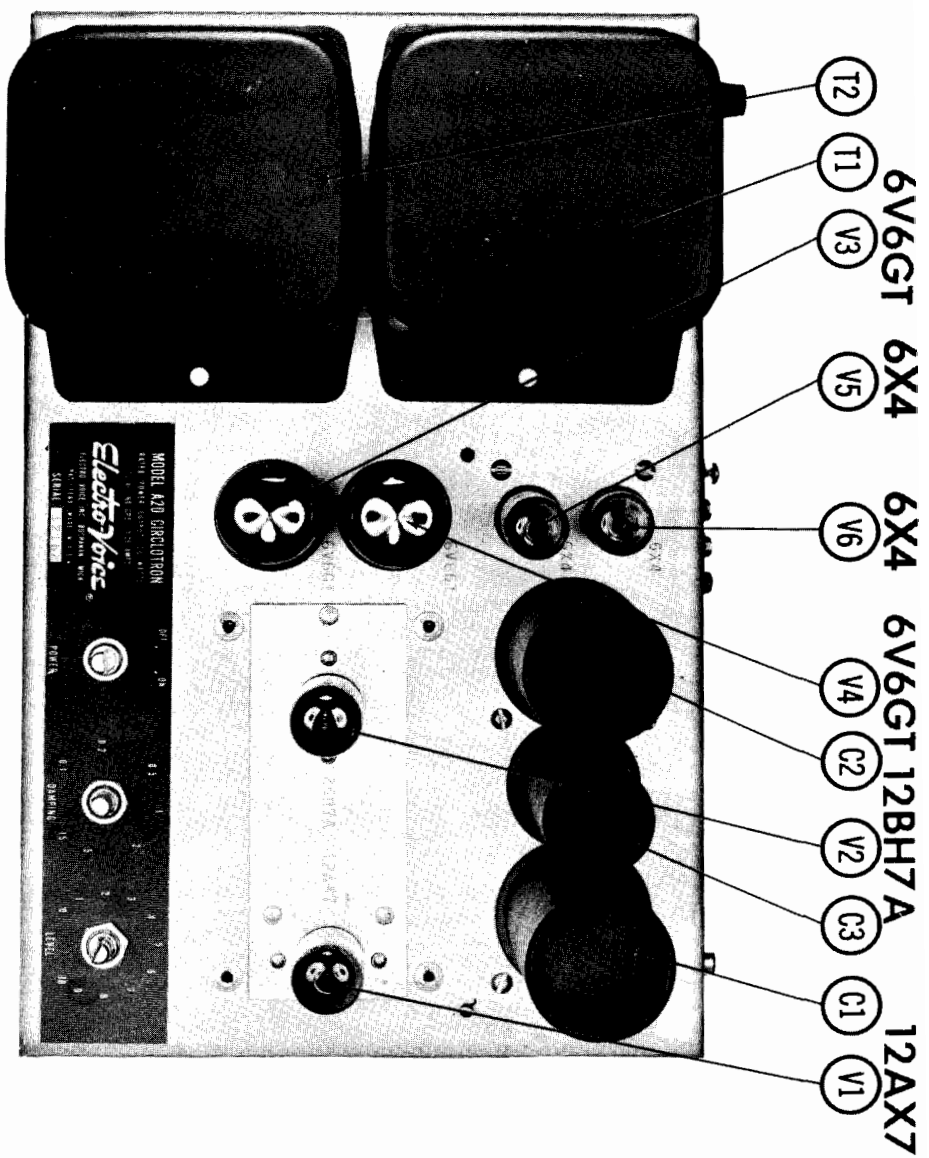
RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	Electro-Voice PART No.	IRC PART No.	
R3	270K		4669	BTS-270K	
R4	27K		4651	BTS-27K	
R5	1.2Meg		4656	BTS-1.2Meg	
R6	27K		4651	BTS-27K	
R7	470Ω		4654	BTS-470	
R8	27K		4651	BTS-27K	
R9	470K		4650	BTS-470K	
R10	470K		4650	BTS-470K	
R11	12K	2	4679	BTB-12K	
R12	12K	2	4679	BTB-12K	
R13	1200Ω		4658	BTS-1200	

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	Electro-Voice PART No.	IRC PART No.	
R14	120Ω		4607	BTS-120	
R15	470K		4650	BTS-470K	
R16	470K		4650	BTS-470K	
R17	120Ω		4607	BTS-120	
R18	47K		4668	BTS-47K	
R19	1000Ω		4693	BTS-1000	
R20	56K		4652	BTS-56K	
R21	56K		4652	BTS-56K	
R22	100Ω	2	4655	BTB-100	
R23	100Ω	2	4655	BTB-100	

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	Electro-Voice PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117VAC @ .59A	710VCT @ .029A	715VCT @ .025A	6.3VAC @ 3.05A SEC. 4 20VAC *	1580					

* Bias supply.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	Electro-Voice PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	
T2	2000Ω	16Ω tap @ 8Ω, 4Ω	1579						

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			Electro-Voice PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M1	3AG S/B	1½A 125V			31301.5 (3AG S/B 1½A)	342001	MDL 1½	HKP

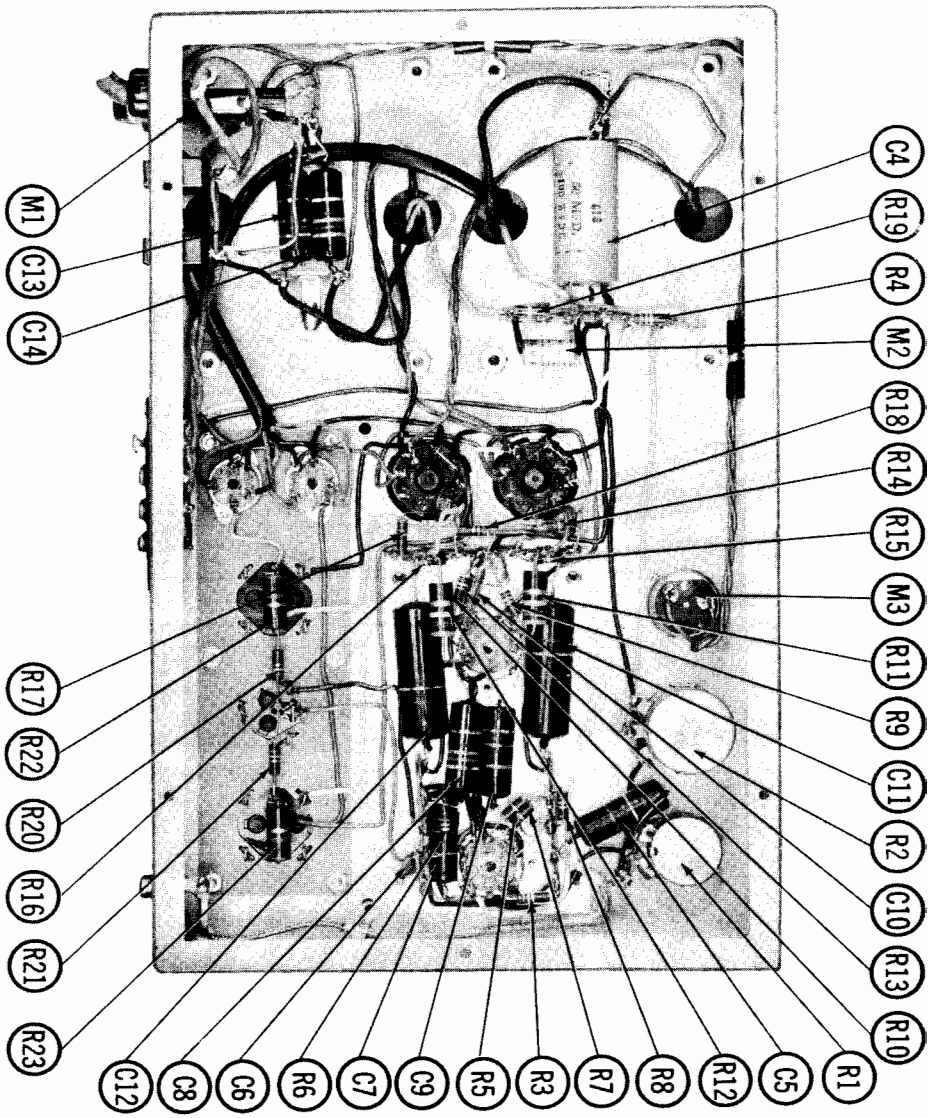
SELENIUM RECTIFIER

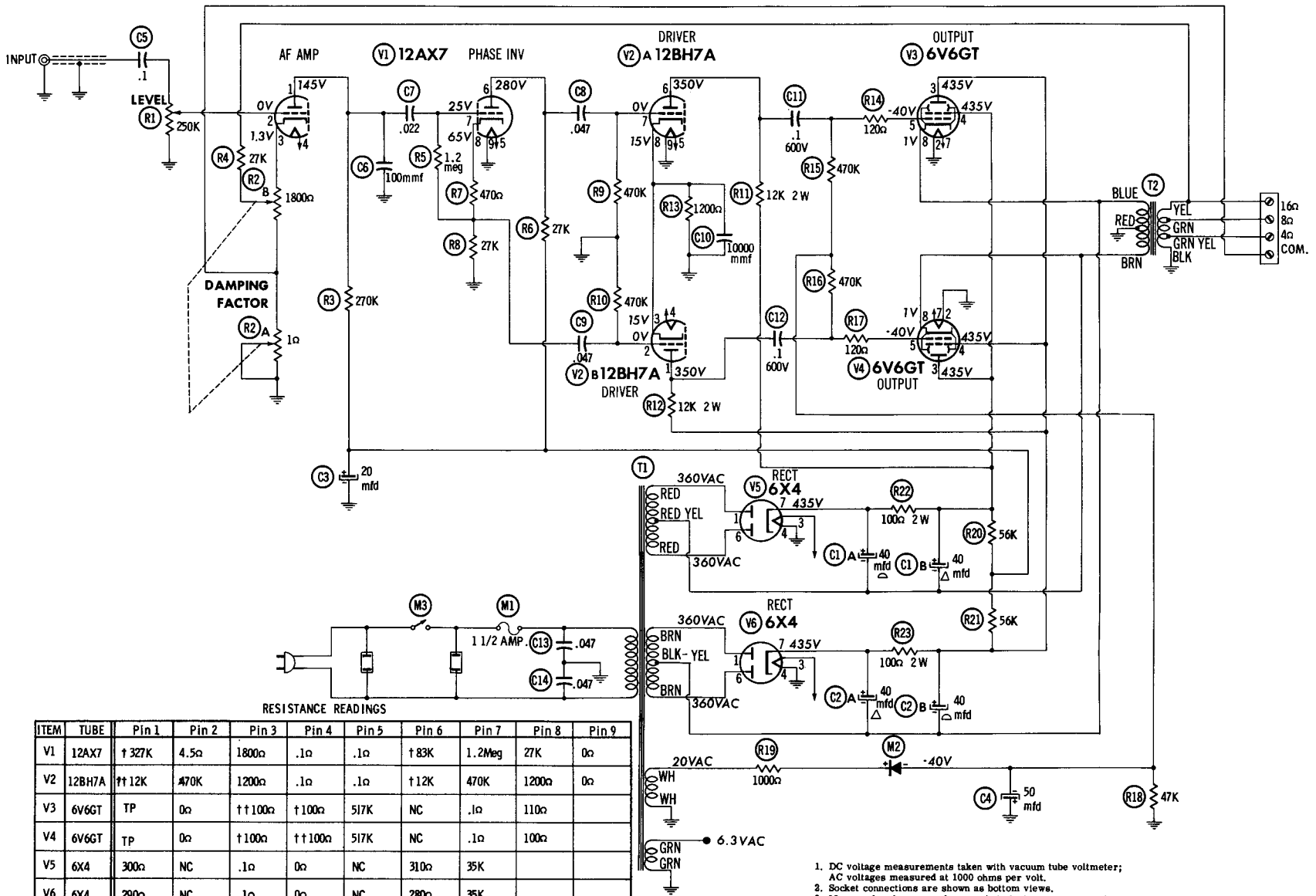
ITEM No.	RATING	REPLACEMENT DATA						NOTES
	CURRENT	Electro-Voice PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	MALLORY PART No.	RADIO RECEPTOR PART No.	SARKES TARZIAN PART No.	
M2		5914	1159	CR10	8820		10	

MISCELLANEOUS

ITEM No.	PART NAME	Electro-Voice PART No.	NOTES
M3	Switch	B5641	On-off (power) SPST

CHASSIS—BOTTOM VIEW





RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7	†327K	4.5Ω	1800Ω	.1Ω	.1Ω	†83K	1.2Meg	27K	0Ω
V2	12BH7A	††12K	470K	1200Ω	.1Ω	.1Ω	†12K	470K	1200Ω	0Ω
V3	6V6GT	TP	0Ω	††100Ω	†100Ω	517K	NC	.1Ω	110Ω	
V4	6V6GT	TP	0Ω	†100Ω	††100Ω	517K	NC	.1Ω	100Ω	
V5	6X4	300Ω	NC	.1Ω	0Ω	NC	310Ω	35K		
V6	6X4	290Ω	NC	.1Ω	0Ω	NC	280Ω	35K		

† MEASURED FROM PIN 7 OF V5. TP TIE POINT.
†† MEASURED FROM PIN 7 OF V6.
NC NO CONNECTION.

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

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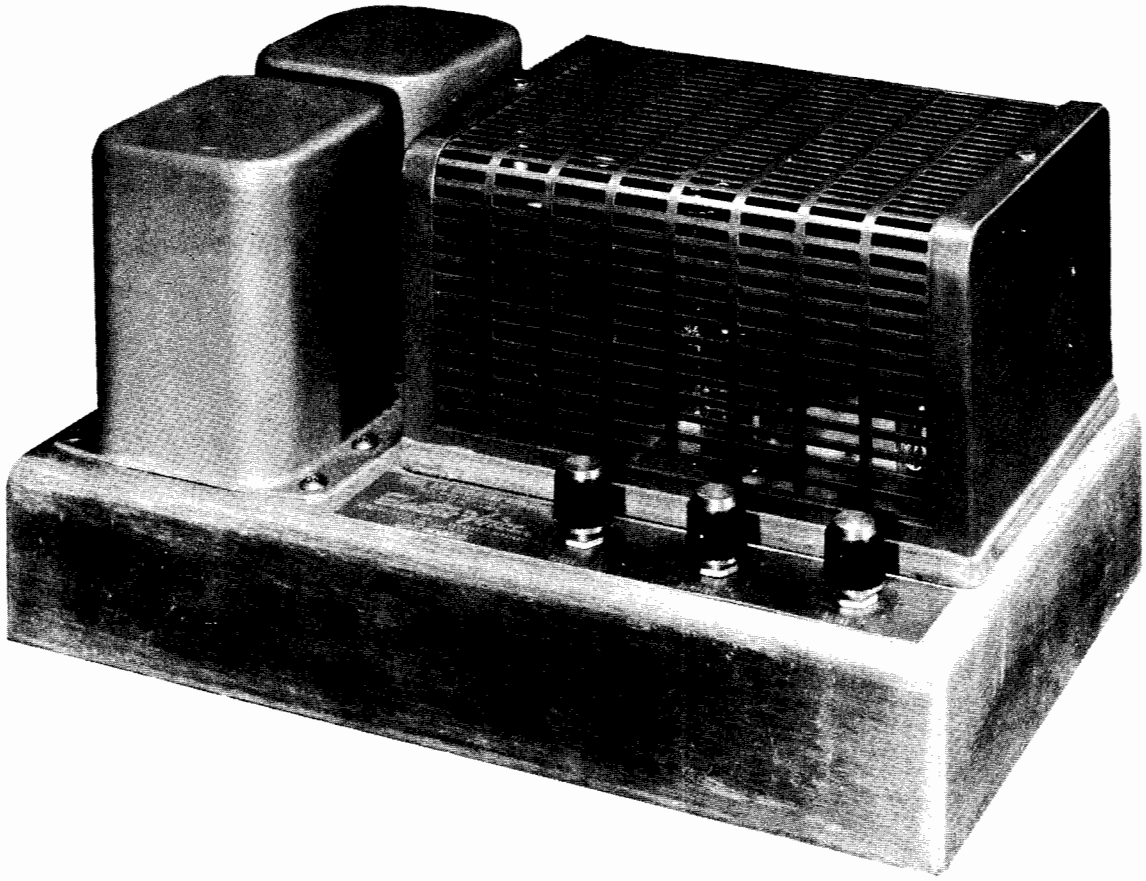
ELECTRO-VOICE MODEL A30



ELECTRO-VOICE MODEL A30

TRADE NAME	Electro-Voice Model A30
MANUFACTURER	Electro-Voice, Inc., Buchanan, Michigan
TYPE SET	AC Operated 30 Watt Audio Amplifier
TUBES (Six)	Types 12AX7 AF Amp. -Phase Inv., 12BH7A Driver, (2) 1614 Output, (2) 5Y3GT Rectifier
POWER SUPPLY	105-125 Volts AC - 60 Cycles RATING 1 Amp. @ 117 Volts AC (110 Watts)

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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G353

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	AF Amp. -Phase Inverter	12AX7	
V2	Driver	12BH7A	
V3	Output	1614	
V4	Output	1614	
V5	Rectifier	5Y3GT	
V6	Rectifier	5Y3GT	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING CAP.	RATING VOLT.	REPLACEMENT DATA Electro-Voice PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▲40	500	4247	AFH2-72	BO530	FP288	TMD-62	D-275	TVL-2940
B	▲40	500							
C2A	▲40	500	4247	AFH2-72	BO530	FP288	TMD-62	D-275	TVL-2940
B	▲40	500							
C3	20	450	4246	AFH1-50	AO460	FP144	TMS-55	S-260	TVL-1714
C4	50	100	4242	PRS150V5	BR5015	TC49	TD-50-150	FM-1550	TVA-1414

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING CAP.	RATING VOLT	REPLACEMENT DATA Electro-Voice PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C5	.1	200	4265	P288N-1	DF-104	CUB2P1		GEM-401	2TM-P1	
C6	100		4281	BPD-0001	DD-101	L10T1	ED-100	UC-531	5GA-T1	
C7	.022	400	4260	BPD-02	DD-203	CUB4S22	ED-02	GEM-4122	4TM-S22	
C8	.022	400	4260	BPD-02	DD-203	CUB4S22	ED-02	GEM-4122	4TM-S22	
C9	.1	600	4241	P688N-1	DF-104	CUB6P1		GEM-601	6TM-P1	
C10	10000		4257	BPD-01	DD-103	BYA6S1	GP-10000	DC511	5HK-S1	
C11	.022	400	4260	BPD-02	DD-203	CUB4S22	ED-02	GEM-4122	4TM-S22	
C12	.1	600	4241	P688N-1	DF-104	CUB6P1		GEM-601	6TM-P1	
C13	.047	400	4243	BPD-05	DF-503	CUB4S47		GEM-4147	4TM-S47	
C14	.047	400	4243	BPD-05	DF-503	CUB4S47		GEM-4147	4TM-S47	
C15	.05	1600		P1688N-05		CUB16S5		GEM-1615	16TM-S5	Note 1
C16	.05	1600		P1688N-05		CUB16S5		GEM-1615	16TM-S5	Note 1

Note 1: Not used in some versions.

CONTROLS

ITEM No.	RATING RESISTANCE	RATING WATTS	REPLACEMENT DATA Electro-Voice PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	250K	½	J4686	B-51	A47-250K-Z	Q13-130	U44	Level
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
R2A	1Ω	2	K4686					Damping (Wire-wound)
B	1800Ω	2						Damping (Wire-wound)

RESISTORS

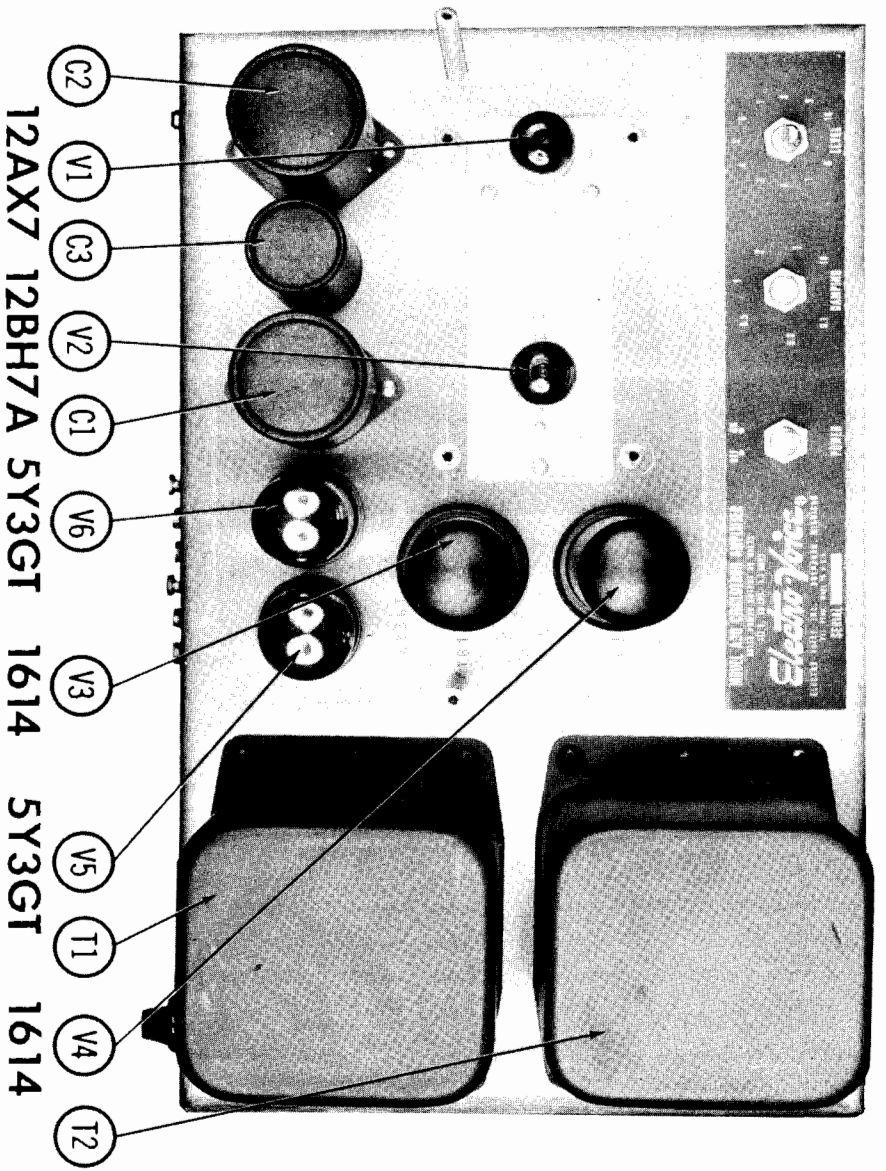
All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA Electro-Voice PART No.	REPLACEMENT DATA IRC PART No.	NOTES
R3	270K		4669	BTS-270K	
R4	2.7Ω 5%	1	4680		
R5	33K		4665	BTS-33K	
R6	1.2Meg		4656	BTS-1.2Meg	
R7	27K		4651	BTS-27K	
R8	470Ω		4654	BTS-470	
R9	27K		4651	BTS-27K	
R10	56K		4652	BTS-56K	
R11	56K		4652	BTS-56K	
R12	470K		4650	BTS-470K	
R13	12K	2	4679	BTB-12K	
R14	470K		4650	BTS-470K	
R15	12K	2	4679	BTB-12K	

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA Electro-Voice PART No.	REPLACEMENT DATA IRC PART No.	NOTES
R16	1200Ω		4658	BTS-1200	
R17	470K		4650	BTS-470K	Note 1
R18	470K		4650	BTS-470K	
R19	120Ω		4607	BTS-120	
R20	1000Ω		4693	BTS-1000	
R21	47K		4668	BTS-47K	
R22	470K		4650	BTS-470K	Note 1
R23	470K		4650	BTS-470K	
R24	120Ω		4607	BTS-120	
R25	1000Ω		4693	BTS-1000	
R26	1000Ω		4693	BTS-1000	
R27	100Ω	4	4684	PW4-100	
R28	100Ω	4	4684	PW4-100	

Note 1: Not used in some versions.

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	Electro-Voice PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117VAC @ 1A	760VCT @ .050A	760VCT @ .050A	48VAC @ 0A (Bias winding)	1594					
		SEC. 4	SEC. 5	SEC. 6						
		5VAC @ 3A	5VAC @ 3A	6.3VAC @ 2.7A						

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	Electro-Voice PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	
T2	1600Ω CT Tap @ 70V	16Ω Tap @ 8Ω, 4Ω	1593						

SELENIUM RECTIFIER

ITEM No.	RATING	REPLACEMENT DATA						NOTES
	CURRENT	Electro-Voice PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	MALLORY PART No.	RADIO RECEPTOR PART No.	SARKES TARZIAN PART No.	
M1		5914	1159	CR10	8S20		10	

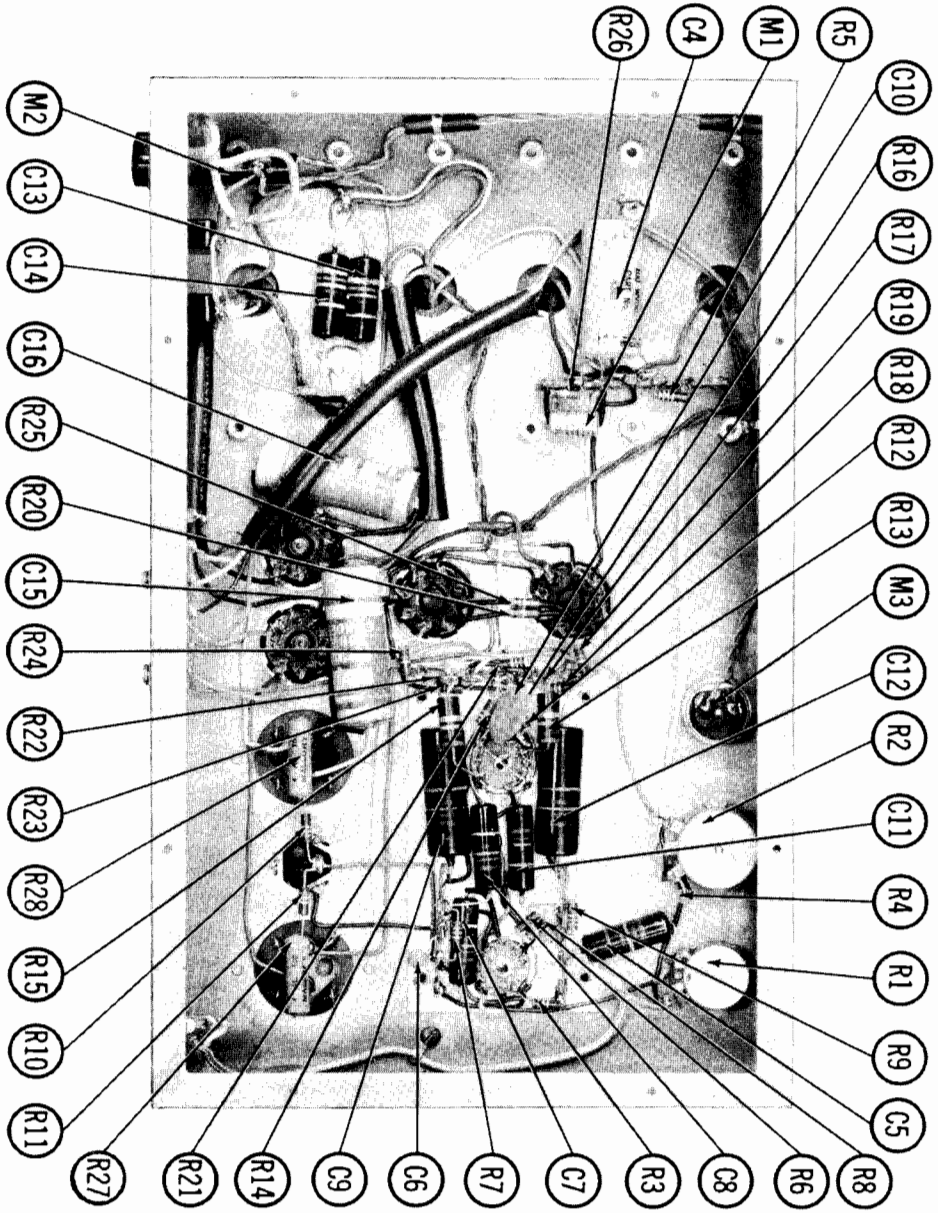
FUSES

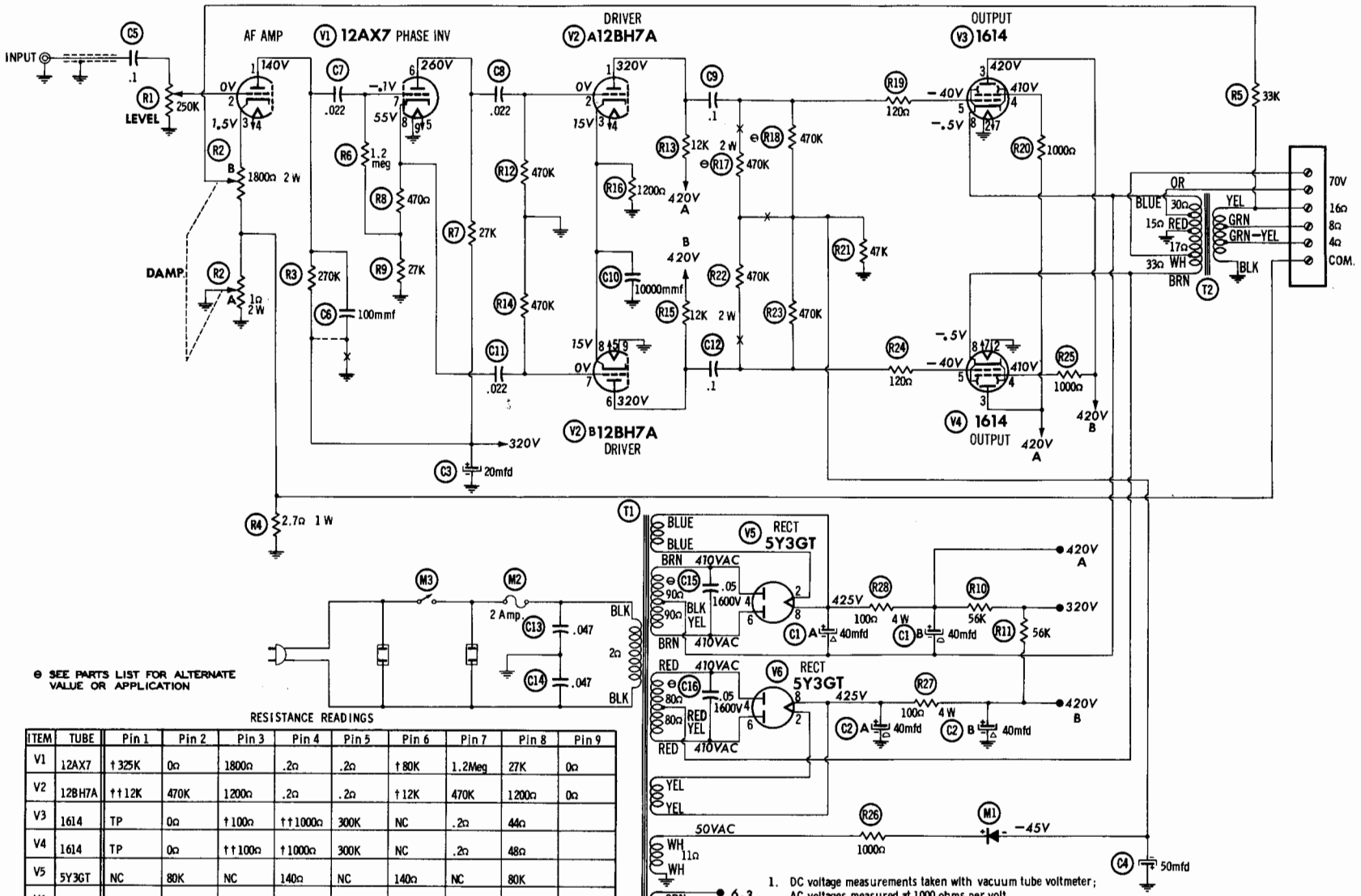
ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			Electro-Voice PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M2	3AG S/B	2A 125V	20143		313002. (3AG-S/B-2A)	342001	MDX 2	HKP

MISCELLANEOUS

ITEM No.	PART NAME	Electro-Voice PART No.	NOTES
M3	Switch	B5641	On-Off, Rotary

CHASSIS—BOTTOM VIEW





⊖ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7	†325K	0Ω	1800Ω	.2Ω	.2Ω	†80K	1.2Meg	27K	0Ω
V2	12BH7A	††12K	470K	1200Ω	.2Ω	.2Ω	†12K	470K	1200Ω	0Ω
V3	1614	TP	0Ω	†100Ω	††1000Ω	300K	NC	.2Ω	44Ω	
V4	1614	TP	0Ω	††100Ω	†1000Ω	300K	NC	.2Ω	48Ω	
V5	5Y3GT	NC	80K	NC	140Ω	NC	140Ω	NC	80K	
V6	5Y3GT	NC	80K	NC	130Ω	NC	130Ω	NC	80K	

† MEASURED FROM PIN 8 OF V6.
†† MEASURED FROM PIN 8 OF V5.
NC NO CONNECTION
TP TIE POINT

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

A PHOTOFACT STANDARD NOTATION SCHEMATIC

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ELECTRO-VOICE MODEL PC2

ELECTRO-VOICE MODEL PC2

TRADE NAME	Electro-Voice Model PC2
MANUFACTURER	Electro-Voice Inc., Buchanan, Mich.
TYPE SET	AC Operated Equalizer Preamplifier
TUBES (Three)	Types 12AX7 Phono Preamplifier, 12AX7 AF Amplifier, 6X4 Rectifier
POWER SUPPLY	105-125 Volts AC - 60 Cycles RATING .22 Amp. @ 117 Volts AC

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PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Phono Preamplifier	12AX7	
V2	AF Amplifier	12AX7	

ITEM No.	USE	TYPE	NOTES
V3	Rectifier	6X4	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA						
	CAP.	VOLT.	Electro-Voice PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▬20	350	42045			FP434.5		Q-030	
B	▲20	350				TC62		MT-4520	
C	■20	350							
C2	12	250	(Note 1)	PRS250V12	BBR12-250	TC53	TD-12-250	FM-2512	TVA-1505
C3	20	25	42046	PRS50V20	BBR20-25	TC26	TD-25-25	FM-0225	TVA-1205

Note 1: Not used in some versions.

FIXED CAPACITORS

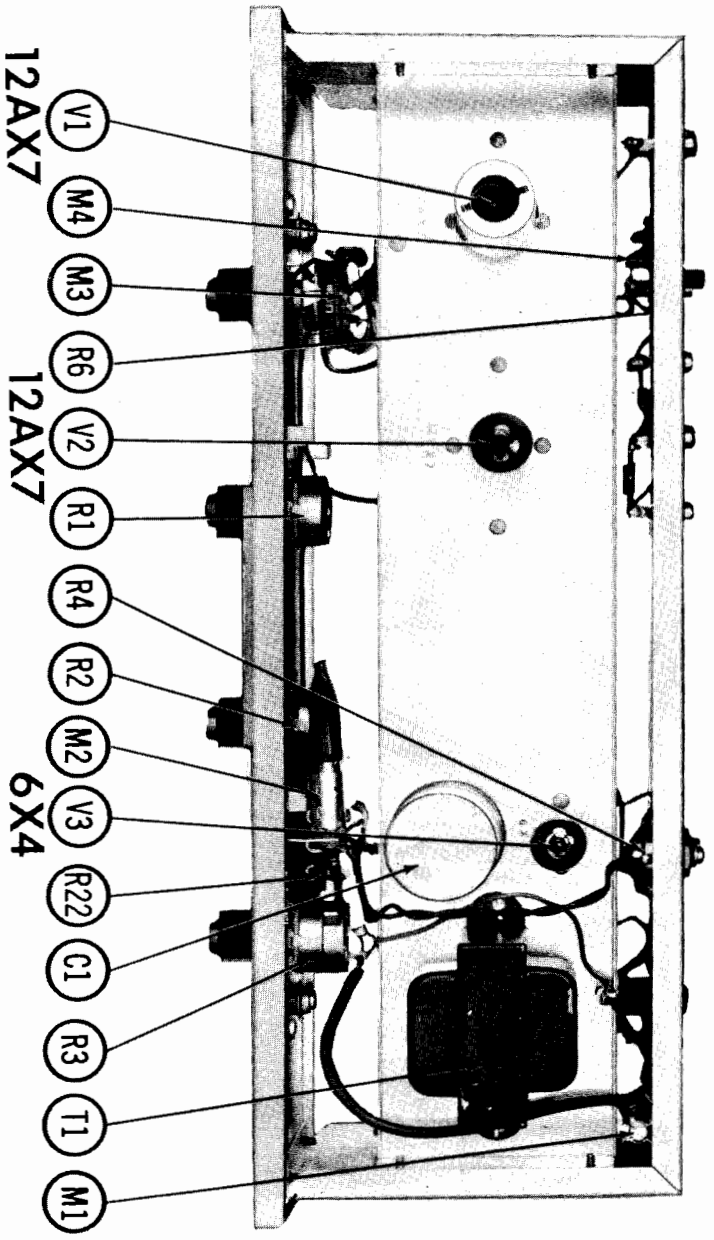
Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA							NOTES
	CAP.	VOLT	Electro-Voice PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C4	10000		4252	BPD-01	DD-103	BYA6S1	GP-10000	DC511	5HK-S1	
C5	5000		42002	BPD-005	DD-502	BYA10D5	GP-5000	DC525	5HK-D5	
C6	10000		4252	BPD-01	DD-103	BYA6S1	GP-10000	DC511	5HK-S1	
C7	2000		4259	BPD-002	DD-202	BYA10D2	GP-2000	DC522	5HK-D2	
C8	10000		4252	BPD-01	DD-103	BYA6S1	GP-10000	DC511	5HK-S1	
C9	.1	400	4245	P488N-1	DF-104	CUB4P1		GEM-401	4TM-P1	
C10	500		42003	BPD-0005	DD-501	BYA10T5	ED-500	UC-535	5GA-T5	
C11	500		42003	BPD-0005	DD-501	BYA10T5	ED-500	UC-535	5GA-T5	
C12	.1	400	4245	P488N-1	DF-104	CUB4P1		GEM-401	4TM-P1	
C13	200		4256	BPD-0002	DD-201	L10T2	ED-200	UC-532	5GA-T2	
C14	2000		4259	BPD-002	DD-202	BYA10D2	GP-2000	DC522	5HK-D2	
C15	10000		4257	BPD-01	DD-103	BYA6S1	GP-10000	DC511	5HK-S1	
C16	1000		4258	BPD-001	DD-102	BYA6D2	ED-1000	DC521	5HK-D1	
C17	.1	400	4245	P488N-1	DF-104	CUB4P1		GEM-401	4TM-P1	

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	Electro-Voice PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	
R1A	50K	½	A46086	B-32	A47-50K-Z	Q13-123	U33	Volume
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
R2A	1Meg	½	A4686	B-70	A47-1Meg-Z	Q13-137	U53	Treble
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
R3A	1Meg	½	Z4686	B-70	A47-1Meg-Z	Q13-137	U53	Bass
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
C	Switch			KB-1	SWE-12	76-1	US-26	
R4A	500Ω	1	R4686	AB-4	A47-500-S	Q11-103	U2	Hum Balance (Ceramic)
B	Shaft			AK-1	FKS-1/4	RQ	Not Req.	
R5A	500Ω	1	R4686	AB-4	A47-500-S	Q11-103	U2	Hum Balance (Magnetic)
B	Shaft			AK-1	FKS-1/4	RQ	Not Req.	

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	Electro-Voice PART No.	IRC PART No.	
R6	22Meg		4606	BTS-22Meg	
R7	47K		4668	BTS-47K	
R8	120K		4670	BTS-120K	
R9	2200Ω		4676	BTS-2200	
R10	12Meg		4672	BTS-12Meg	
R11	120K		4670	BTS-120K	
R12	1.2Meg		4656	BTS-1.2Meg	
R13	120K		4670	BTS-120K	
R14	1.2Meg		4656	BTS-1.2Meg	
R15	270K		4669	BTS-270K	
R16	270K		4669	BTS-270K	
R17	1.8Meg		4673	BTS-1.8Meg	
R18	56K		4652	BTS-56K	
R19	1200Ω		4658	BTS-1200	
R20	4700Ω		4675	BTS-4700	
R21	120K		4670	BTS-120K	
R22	12K		4649	BTS-12K	
R23	120K		4670	BTS-120K	
R24	18K		46029	BTS-18K	
R25	680Ω		46045	BTS-680	
R26	390K		46028	BTS-390K	
R27	330K		4685	BTS-330K	
R28	1.2Meg		4656	BTS-1.2Meg	
R29	47K		4668	BTS-47K	
R30	47K		4668	BTS-47K	Note 1
R31	27K		4651	BTS-27K	
R32	1.2Meg		4656	BTS-1.2Meg	Note 1
R33	120K		4670	BTS-120K	Note 1

Note 1: Not used in some versions.

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	Electro-Voice PART No.	Halldarson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117VAC @ .22A	455VCT @ .055A	6.3VAC @ .3A	6.3VAC @ 1A	15021					

FUSES

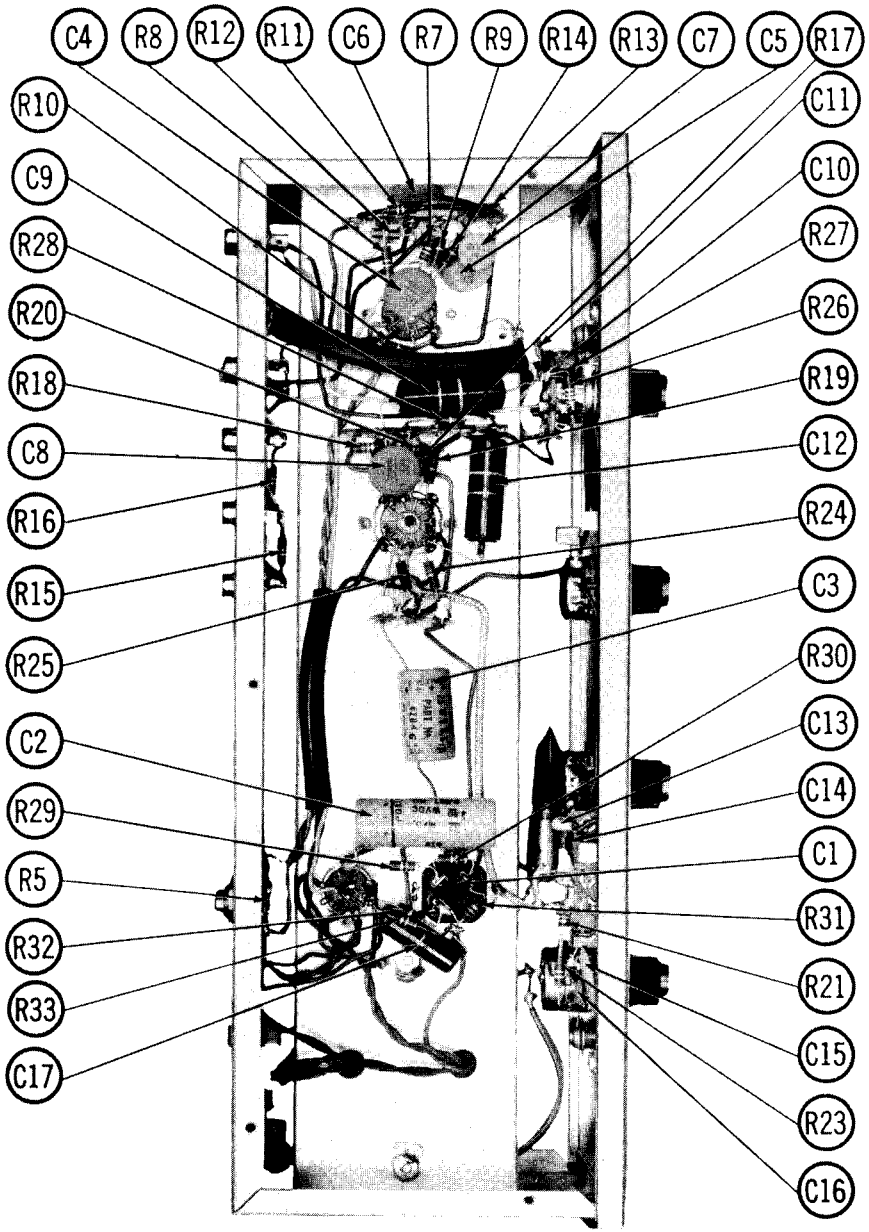
ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			Electro-Voice PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M1	3AG	1/2A 250V	(Note 1)		312.500 (3AG-½A-250V)	356001	AGC 1/2	4405

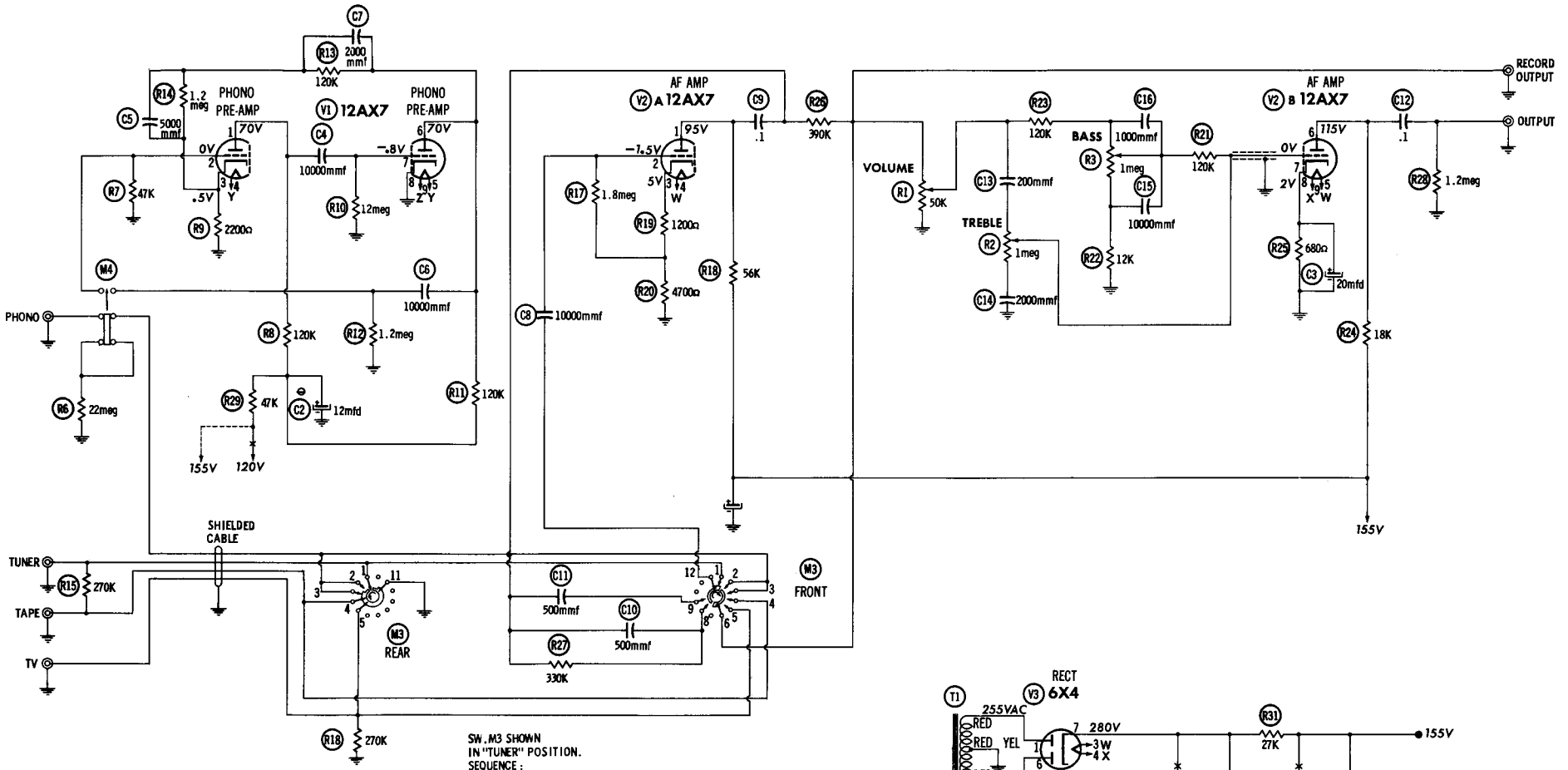
Note 1: Some versions may use 3AG, ½A, 250V, S/B (Part #Z-20066) in this application.

MISCELLANEOUS

ITEM No.	PART NAME	Electro-Voice PART No.	NOTES
M2	Pilot Light		#47
M3	Switch		Function (Rotary, Wafer Type)
M4	Switch		Ceramic-Magnetic Changeover

CHASSIS—BOTTOM VIEW





RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7	†240K	47K	2200Ω	120K	120K	†240K	12Meg	0Ω	120K
V2	12AX7	†80K	1.8Meg	6000Ω	110Ω	110Ω	†45K	130K	680Ω	110Ω
V3	6X4	680Ω	TP	110Ω	110Ω	NC	730Ω	50K		

† MEASURED FROM PIN 7 OF V3.
NC NO CONNECTION
TP TIE POINT

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

DC COIL RESISTANCE VALUES UNDER ONE OHM NOT SHOWN ON SCHEMATIC DIAGRAM.

⊖ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

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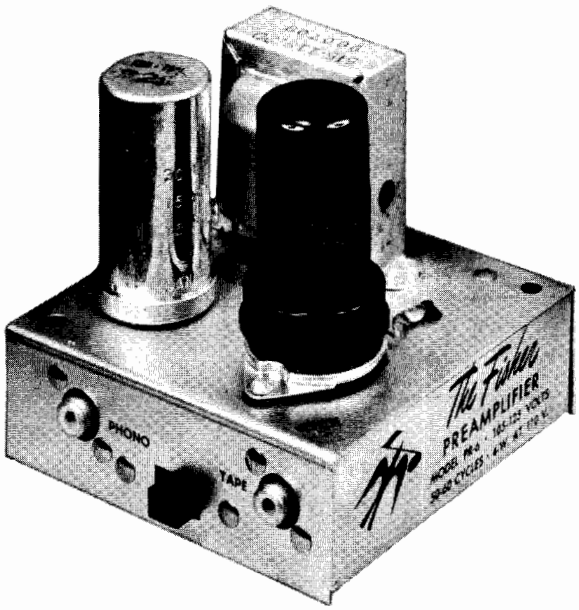
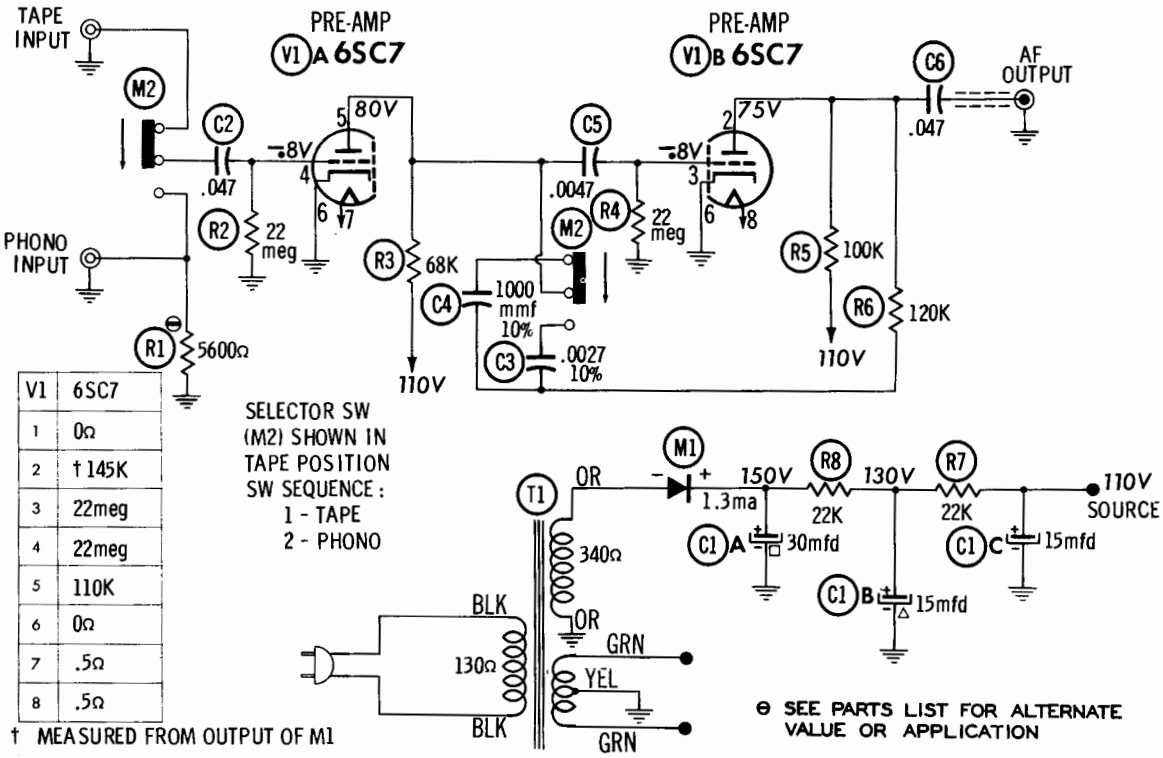


TRADE NAME	Fisher Model PR-6
MANUFACTURER	Fisher Radio Corp., 21-21 44th Drive, Long Island City 1, N. Y.
TYPE SET	AC Operated Preamplifier
TUBES (One)	Type 6SC7 Preamplifier
POWER SUPPLY	105-125 Volts AC-50/60 Cycle RATING .04 Amp. @117 Volts AC (4 Watts)



V1	6SC7
1	0Ω
2	†145K
3	22meg
4	22meg
5	110K
6	0Ω
7	.5Ω
8	.5Ω

† MEASURED FROM OUTPUT OF M1

Θ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

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PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Preamplifier	6SC7	

ITEM No.	USE	TYPE	NOTES

ELECTROLYTIC CAPACITORS

ITEM No.	RATING CAP.	RATING VOLT.	REPLACEMENT DATA FISHER PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	■30	150	C515-122	AFH3-17-50	C0070	FP311.4	TMT-7	T-035	TVL-3437
B	▲15	150							
C	15	150							

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING CAP.	RATING VOLT	REPLACEMENT DATA FISHER PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C2	.047	200	C68P473M2	P288N-047	DF-503	CUB2S47		GEM-4147	2TM-S47	
C3	0027	200	C68P272K2							10%
C4	1000		CC26GP102K5			1R5D1	ED-1000	MCB255	MS-21	10%
C5	.0047	200	C68P472F2	P288N-0047	D6-472	CUB6D47	GP-4700	GEM-6247	5TM-D47	
C6	.047	200	C68P473M2	P288N-047	DF-503	CUB2S47		GEM-4147	2TM-S47	

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING OHMS	RATING WATT	FISHER PART No.	NOTES
R1	5600Ω		RC20BF562K	Note 1
R2	22meg		RC20BF226K	
R3	68K		RC20BF683K	
R4	22meg		RC20BF226K	

ITEM No.	RATING OHMS	RATING WATT	FISHER PART No.	NOTES
R5	100K		RC20BF104K	
R6	120K		RC20BF124K	
R7	22K		RC20BF223K	
R8	22K		RC20BF223K	

Note 1 Chassis with pickering cartridge use 3900Ω in this application

TRANSFORMER (POWER)

ITEM No.	RATING PRI.	RATING SEC. 1	RATING SEC. 2	REPLACEMENT DATA FISHER PART No.	Halldorson PART No.	Merit PART No.	Ram PART No.	Stancor PART No.	Thordorson PART No.	Triod PART No.
T1	117V ⓐ .04A	115V ⓐ .0013A	6.3VCT ⓐ .300A	T-515-118						

SELENIUM RECTIFIER

ITEM No.	RATING CURRENT (Measured)	REPLACEMENT DATA FISHER PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	SARKES TARZIAN PART No.	NOTES
M1	.0013A	SR3180	1159 ①	CR-20 ①	10 ①	①Pig Tail Leads

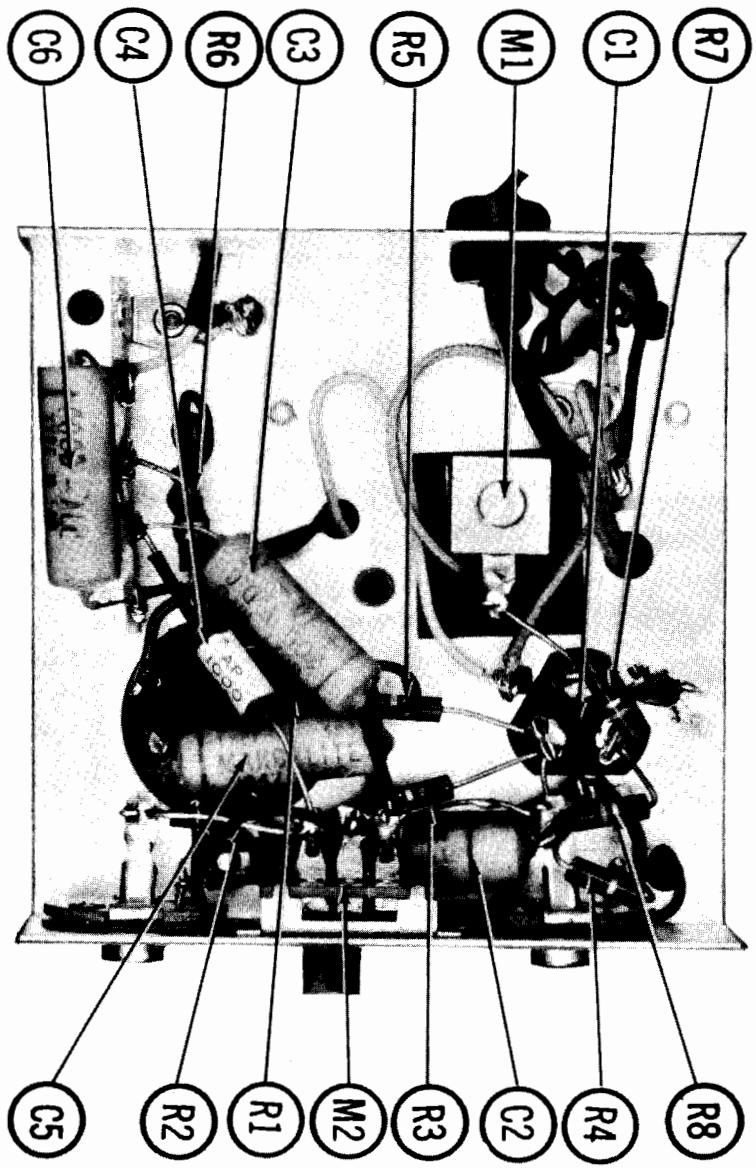
MISCELLANEOUS

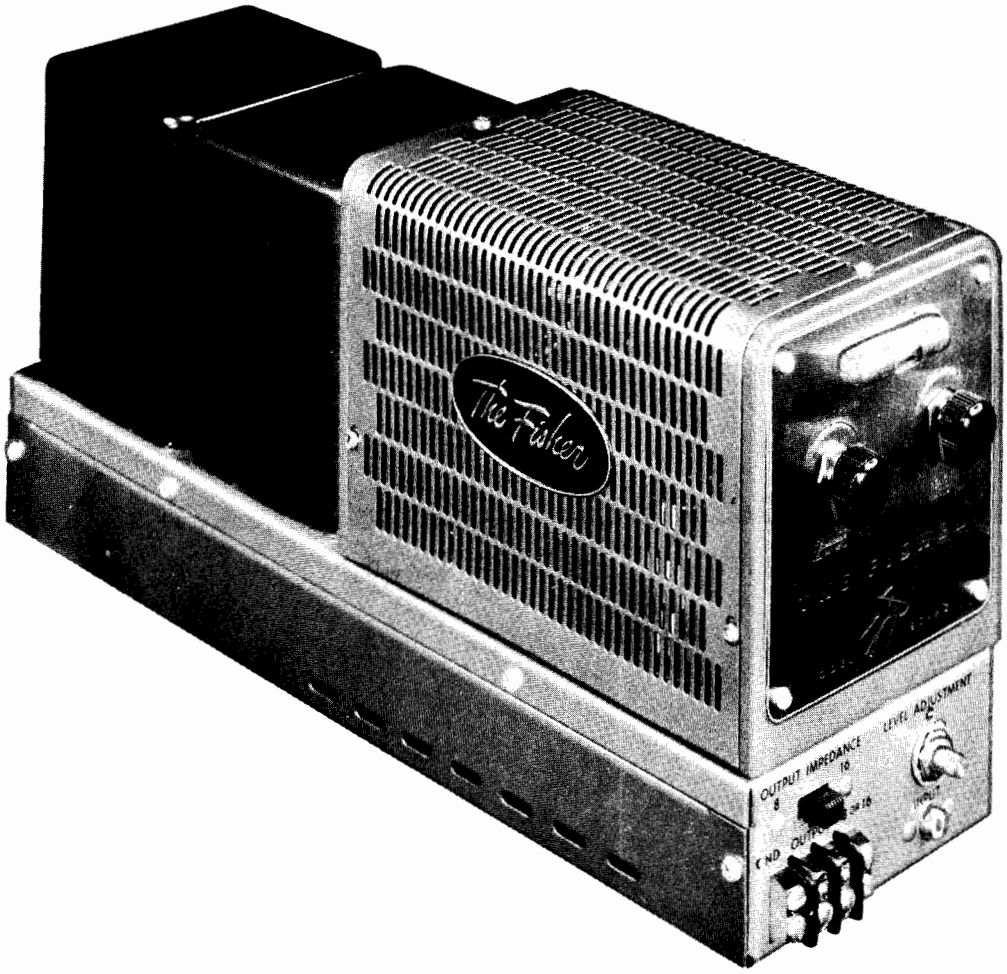
ITEM No.	PART NAME	FISHER PART No.	NOTES
M2	Switch	S-505-117	Phono-Tape (Slide Type DPDT)

WIRING DATA

General-use Unshielded Hook-up Wire ..... Use BELDEN No. 8530 (Solid) Available in Ten Colors
8524 (Stranded) Available in Ten Colors
Power Cord ..... Use BELDEN No. 1765-B (6 Ft. Length)
1725-K (7½ Ft. Length)
Low-Loss Shielded Lead (Interconnecting)..... Use BELDEN No. 8401
Phono Pick-up Arm Cable ..... Use BELDEN No. 8430 (Two Conductor - Twisted)

CHASSIS—BOTTOM VIEW





FISHER
MODEL 80-AZ

TRADE NAME	**Fisher Model 80-AZ**
MANUFACTURER	**Fisher Radio Corp., 21-21 44th. Drive, Long Island City 1, N.Y.**
TYPE SET	**AC Operated 30 Watt Audio Amplifier**
TUBES (Five)	**Types 12AT7 AF Amp.-Phase Inv., 12AU7A Driver, (2) EL-37 Output, 5V4G Rectifier**
POWER SUPPLY	**105-125 Volts AC-50/60 Cycles** **RATING 1 Amp. @ 117 Volts AC**

PHASE INVERTER BALANCE ADJUSTMENT

1. Disconnect the speaker and connect a 16 ohm, 20 watt resistor to "GND" and "8 or 16".
2. Connect the audio generator to the amplifier input.
3. Switch IMPEDANCE SELECTOR to "16".
4. Turn Z-Matic control fully counter clockwise.
5. Connect the wave analyzer or distortion analyzer across the 16 ohm resistor.
6. Set the audio generator to 1000 cycles and adjust the attenuator so that the amplifier produces 20 watts (17.85 volts RMS) across the 16 ohm resistor.
7. Tune the wave analyzer to the second harmonic of 1000 cycles or, if a distortion analyzer is used, tune it for minimum reading at 1000 cycles.
8. Adjust the phase inverter balance control (R4) for minimum distortion.

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G621

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	AF Amp.-Phase Inv.	12AT7	
V2	Driver	12AU7A	
V3	Output	EL-37	

ITEM No.	USE	TYPE	NOTES
V4	Output	EL-37	
V5	Rectifier	5V4G	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA						
	CAP.	VOLT.	FISHER PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▲40	500	C-522-114	AFH2-72	B0530	FP288	TMD-62	D-275	TVL-2940
B	▲40	500							
C2A	▲40	450	C-1798	AFH2-57	B0450	FP238	TMD-54	D-235	TVL-2764
B	▲40	450							
C3	50	50	C-508-115	PRS50V50	BR505	TC39	TD-50-50	FM-0550	TVA-1308

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA							NOTES
	CAP.	VOLT	FISHER PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C4	.22	200	C69P224V2	P288N-22		CUB2P22		PT4022	2TM-P22	
C5	220		CC-21GP221K5	NP0-SI220	D6-221	22R5T22	811-221		5TCC-T22	
C6	.022	400	68P223M4	P488N-Q22		CUB4S22	817-02	PT4122	4TM-S22	
C7	.022	400	68P223M4	P488N-022		CUB4S22	817-02	PT4122	4TM-S22	
C8	.1	400	68P104M4	P488N-1	DF-104	CUB4P1		PT401	4TM-P1	
C9	.1	400	68P104M4	P488N-1	DF-104	CUB4P1		PT401	4TM-P1	
C10	5000		C-508-122	D1-005	DD-502	K060	811-005	DC-525	5GA-D5	
C11	.047	600	C-68P473M6	BPD-05	DF-503	CUB6S47		PT6147	6TM-S47	
C12	82			1469-000082	D6-820	TZ28	801-820		MS-482	Note 1
C13	420									Note 1
C14	.01	600	C-2747	BPD-01	D6-103	CUB6S1	GP3-333-103	PT611	6TM-S1	

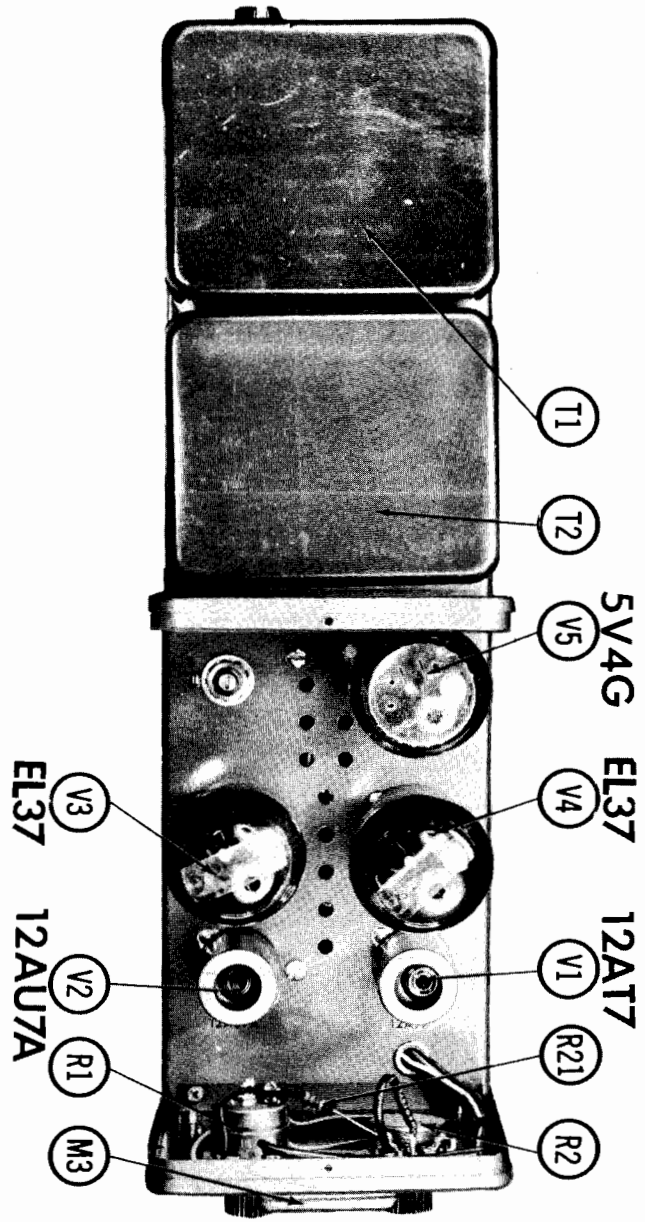
Note 1. Not used in some versions.

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	FISHER PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	
R1A	1000Ω	½	R557-128	AB-5	A47-1000-S	Q11-108	U4	Z-Matic
B	Shaft		Not Req.	AK-8	RS-3/16	NQ	DS-37	Attach to R1A
C	Switch		Not Req.	KB-1	SWE-12	76-1	US-26	Attach to R1A
R2A	100K	½	R557-121				U40	Peak Power
B	Shaft		Not Req.				DS-37	Attach to R2A
R3A	500K	½	R-2815-9	AB-59	A47-500K-S	Q11-133	SU-50	Level
B	Shaft		Not Req.	AK-1	FKS-1/4	Not Req.	Not Req.	Attach to R3A
R4A	50K	½	R-50000-5	AB-31	A47-50K-S	Q11-123	SU-35	Balance
B	Shaft		Not Req.	AK-1	FKS-1/4	RQ	Not Req.	Attach to R4A
R5	35K	½						Peak Power Indicator Note 1.

Note 1. Not used in some versions.

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA FISHER PART No.	REPLACEMENT DATA IRC PART No.	NOTES
R6	1500Ω		RC-20BF152K	BTS-1500	
R7	220K		RC-20BF224K	BTS-220K	
R8	10K		RC-20BF103K	BTS-10K	
R9	100K		RC-20BF104K	BTS-100K	
R10	68K		RC-20BF683K	BTS-68K	
R11	470K		RC-20BF474K	BTS-470K	
R12	470K		RC-20BF474K	BTS-470K	
R13	150K		RC-20BF154K	BTS-150K	
R14	150K		RC-20BF154K	BTS-150K	
R15	4700Ω		RC-20BF472K	BTS-4700	
R16	470K		RC-20BF474K	BTS-470K	
R17	470K		RC-20BF474K	BTS-470K	
R18	68Ω			BTS-68	Note 1
R19	68Ω			BTS-68	Note 1
R20	100K		RC-20BF104K	BTS-100K	
R21	6800Ω		RC-20BF682K	BTS-6800	
R22A	350Ω				
B	1Ω	10	R-557-128		
C	1Ω				
D	100Ω	5			
R23	820K		RC-20BF824K	BTS-820K	
R24	2.2Meg			BTS-2.2Meg	Note 1
R25	18K		RC-20BF183K	BTS-18K	Note 1
R26	2200Ω		RC-20BF222K	BTS-2200	
R27	330Ω		RC-20BF331K	BTS-330	
R28	2200Ω		RC-20BF222K	BTS-2200	
R29	10K		RC-20BF103K	BTS-10K	
R30	10K		RC-20BF103K	BTS-10K	

Note 1. Not used in some versions.

TRANSFORMER (POWER)

ITEM No.	RATING PRI.	RATING SEC. 1	RATING SEC. 2	RATING SEC. 3	REPLACEMENT DATA FISHER PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordorson PART No.	Triod PART No.
T1	117VAC @1A	800VCT @.110ADC	6.3VCT @3.2A		T-557-123					

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE PRI.1	IMPEDANCE SEC.	REPLACEMENT DATA FISHER PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	NOTES
T2	4300Ω CT	16Ω tap @ .94Ω	T-557-122						
	PRI. 2 260Ω CT								

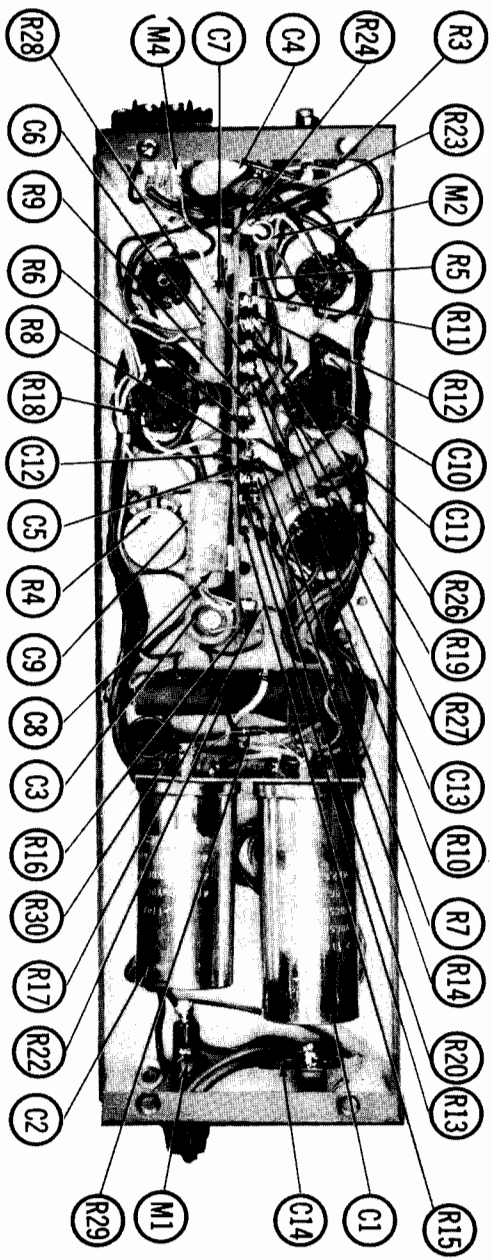
FUSES

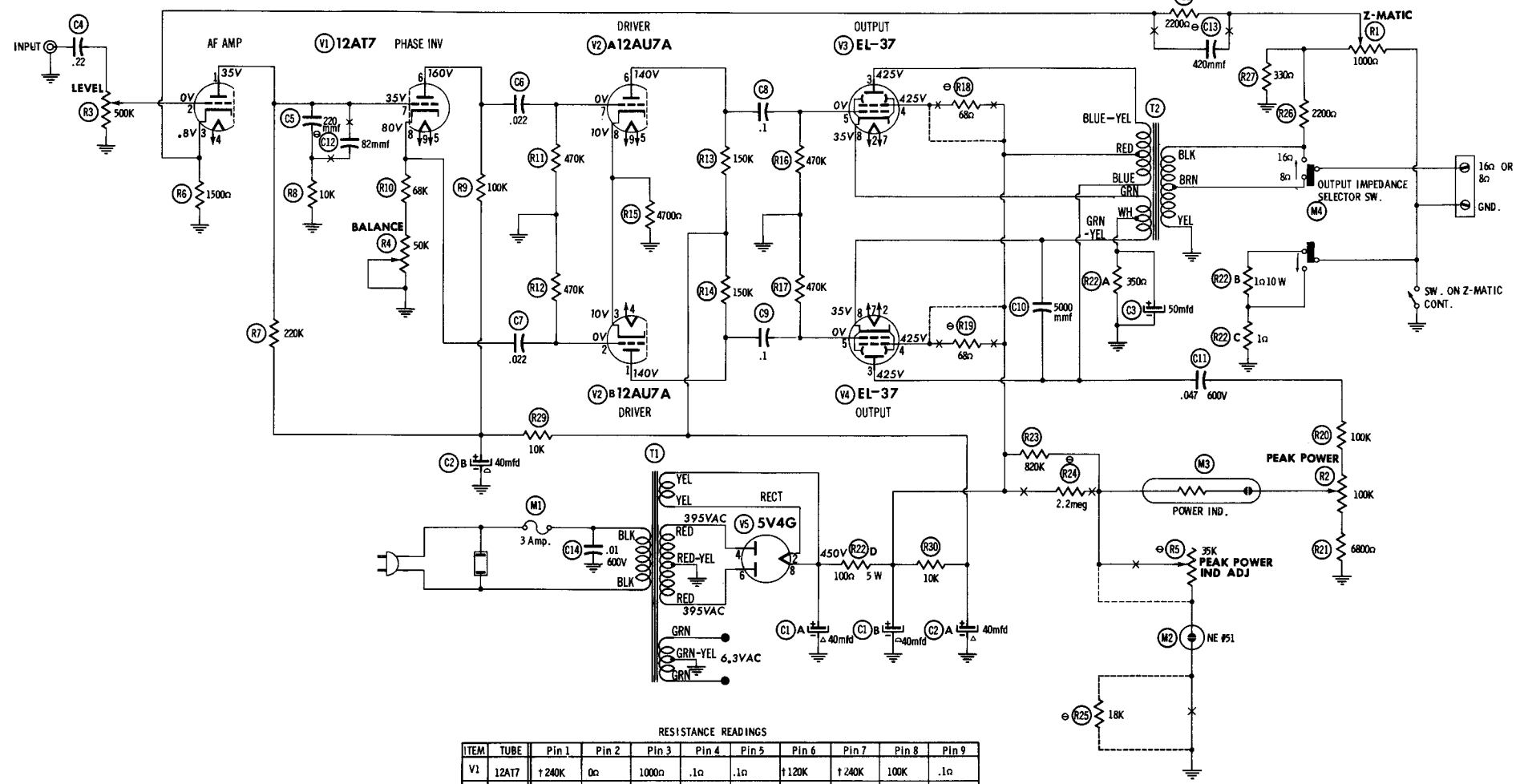
ITEM No.	TYPE	RATING	REPLACEMENT DATA FISHER PART No. FUSE	FISHER PART No. HOLDER	LITTELFUSE PART No. FUSE	LITTELFUSE PART No. HOLDER	BUSS PART No. FUSE	BUSS PART No. HOLDER
M1	3AG	3A 250V			312003. (3AG 3A)	342001	AGC 3	HKP

MISCELLANEOUS

ITEM No.	PART NAME	FISHER PART No.	NOTES
M2	Neon Bulb	V-NE-51	#NE51. Voltage Regulator
M3	Neon Bulb	1-557-120	Power Indicator
M4	Switch	S-505-117	Output Impedance Selector (DPDT-Slide Type)

CHASSIS—BOTTOM VIEW





RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AT7	†240K	0Ω	1000Ω	.1Ω	.1Ω	†120K	†240K	100K	.1Ω
V2	12AU7A	†160K	470K	4700Ω	.1Ω	.1Ω	†160K	470K	4700Ω	.1Ω
V3	EL-37	NC	.1Ω	230Ω	170Ω	470K	TP	.1Ω	370Ω	
V4	EL-37	NC	.1Ω	220Ω	170Ω	470K	TP	.1Ω	370Ω	
V5	5V4G	NC	33K	NC	95Ω	NC	90Ω	NC	33K	

† MEASURED FROM PIN 8 OF V5.
NC NO CONNECTION
TP TIE POINT

⊖ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

A PHOTOFACT STANDARD NOTATION SCHEMATIC

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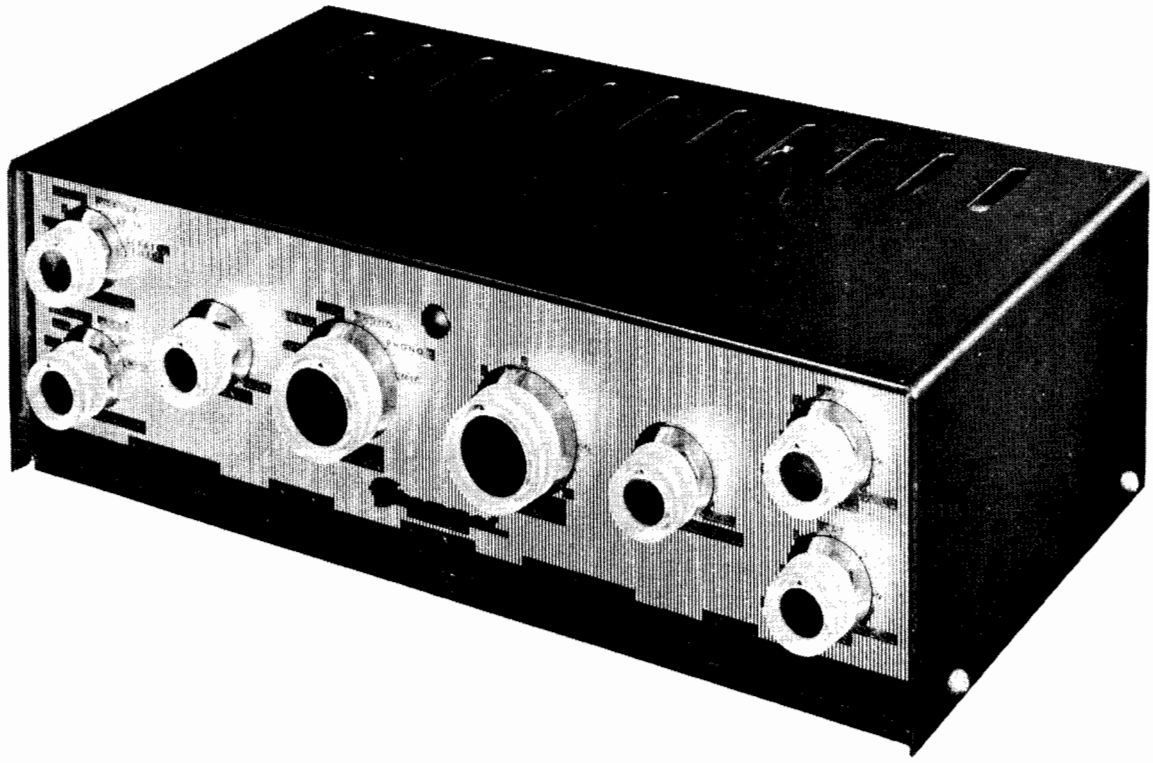
GROMMES MODEL 212



GROMMES MODEL 212

TRADE NAME	Grommes Model 212
MANUFACTURER	Precision Electronics, Inc., 9101 King Ave., Franklin Park, Ill.
TYPE SET	AC Operated 8 Channel Preamplifier
TUBES (Five)	Types 12AX7 Phono Preamplifier, 12AX7 AF Amp.-Cath. Follower, 12AX7 AF Amplifier, 12AX7 AF Amp.-Cath. Follower, 6X4 Rectifier
POWER SUPPLY	110-120 Volts AC-60 Cycles RATING .25 Amp. @ 117 Volts AC (22 Watts)

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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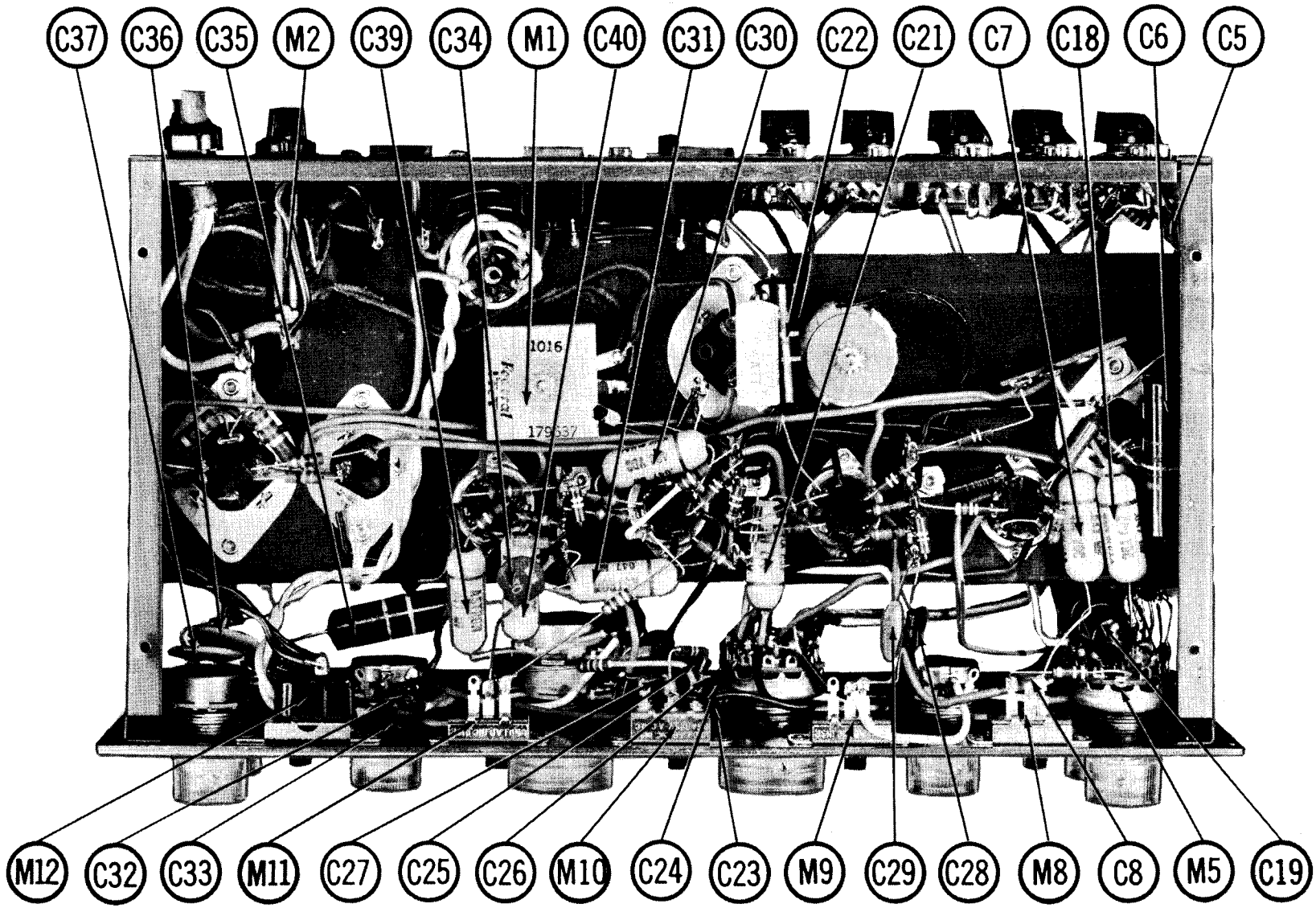
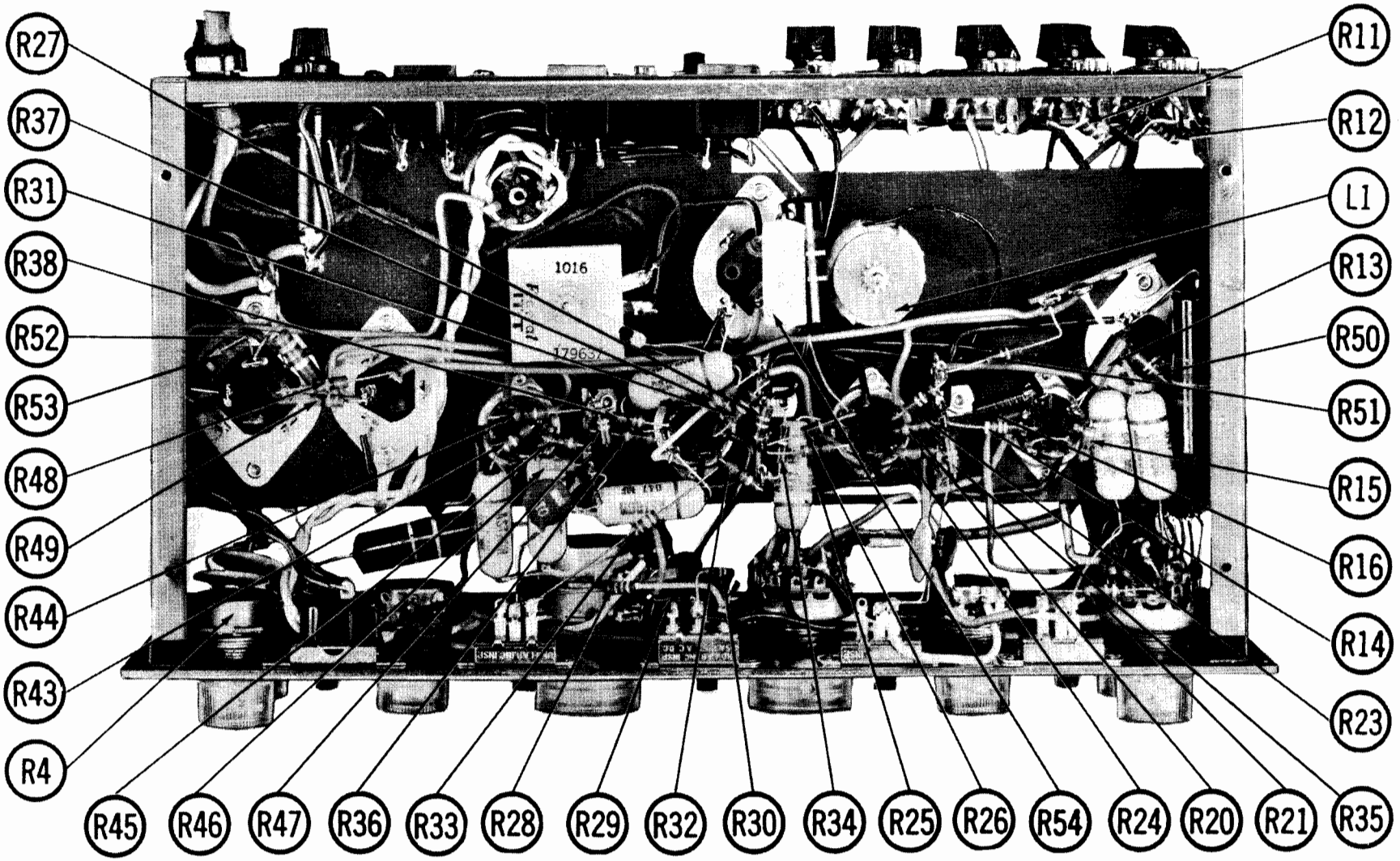
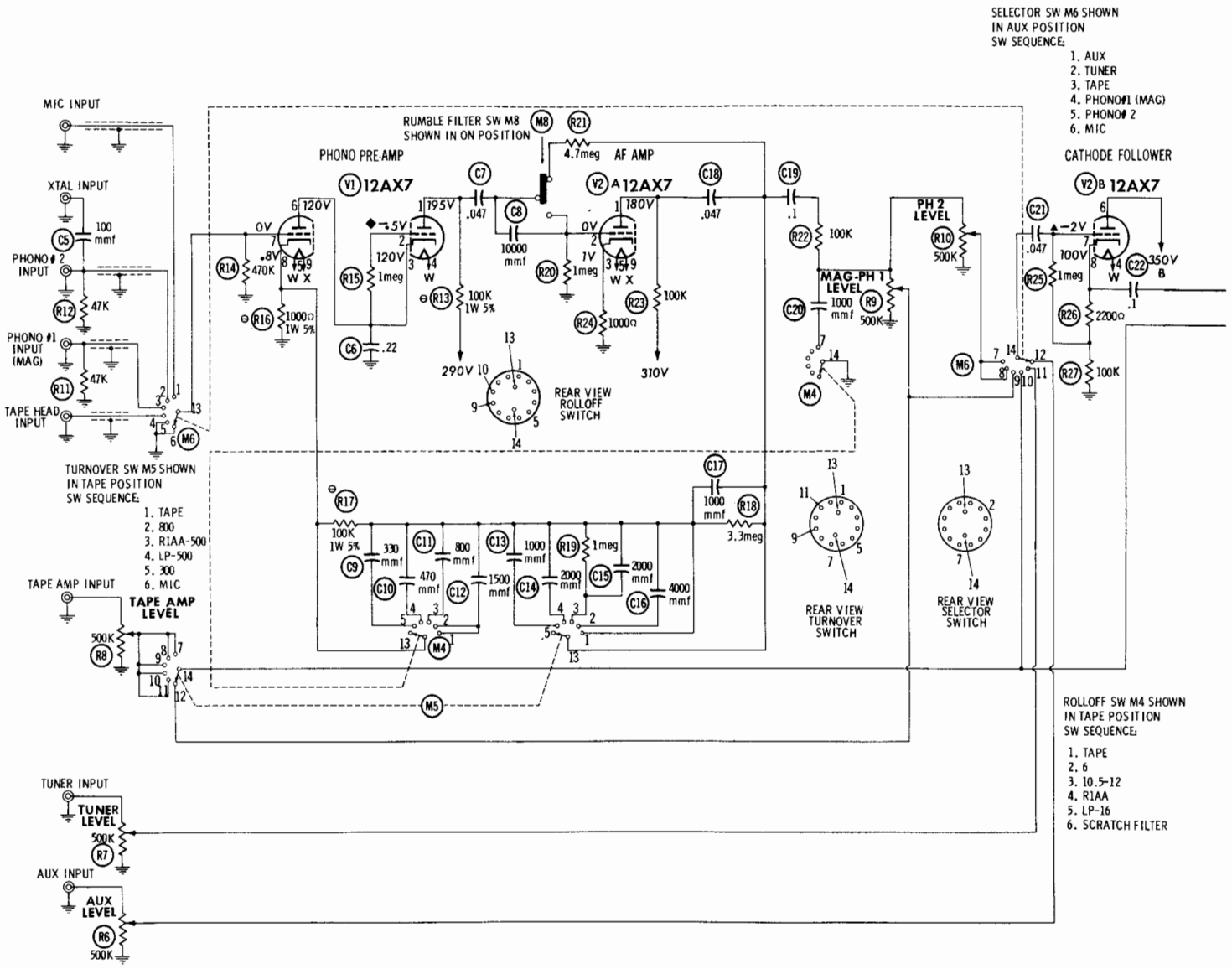


CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION



CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION



RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7	† 147K	INF	INF	3Ω	3Ω	INF	0Ω	1000Ω	0Ω
V2	12AX7	† 127K	1Meg	1000Ω	3Ω	3Ω	† 15K	1Meg	100K	6Ω
V3	12AX7	† 115K	1Meg	1000Ω	6Ω	6Ω	† 115K	0Ω	3200Ω	9Ω
V4	12AX7	† 15K	1.1Meg	100K	9Ω	9Ω	† 115K	480K	1000Ω	12Ω
V5	6X4	1100Ω	NC	INF	INF	NC	1200Ω	20K(Min)		

ALL MEASUREMENTS TAKEN IN "TAPE" POSITION
• MEASURED FROM PIN 3 OF V1
■ MEASURED FROM PIN 3 OF V4
† MEASURED FROM PIN 7 OF V5
▲ MEASURED FROM PIN 8 OF V2
NC NO CONNECTION

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

⊖ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

A PHOTOFACT STANDARD NOTATION SCHEMATIC
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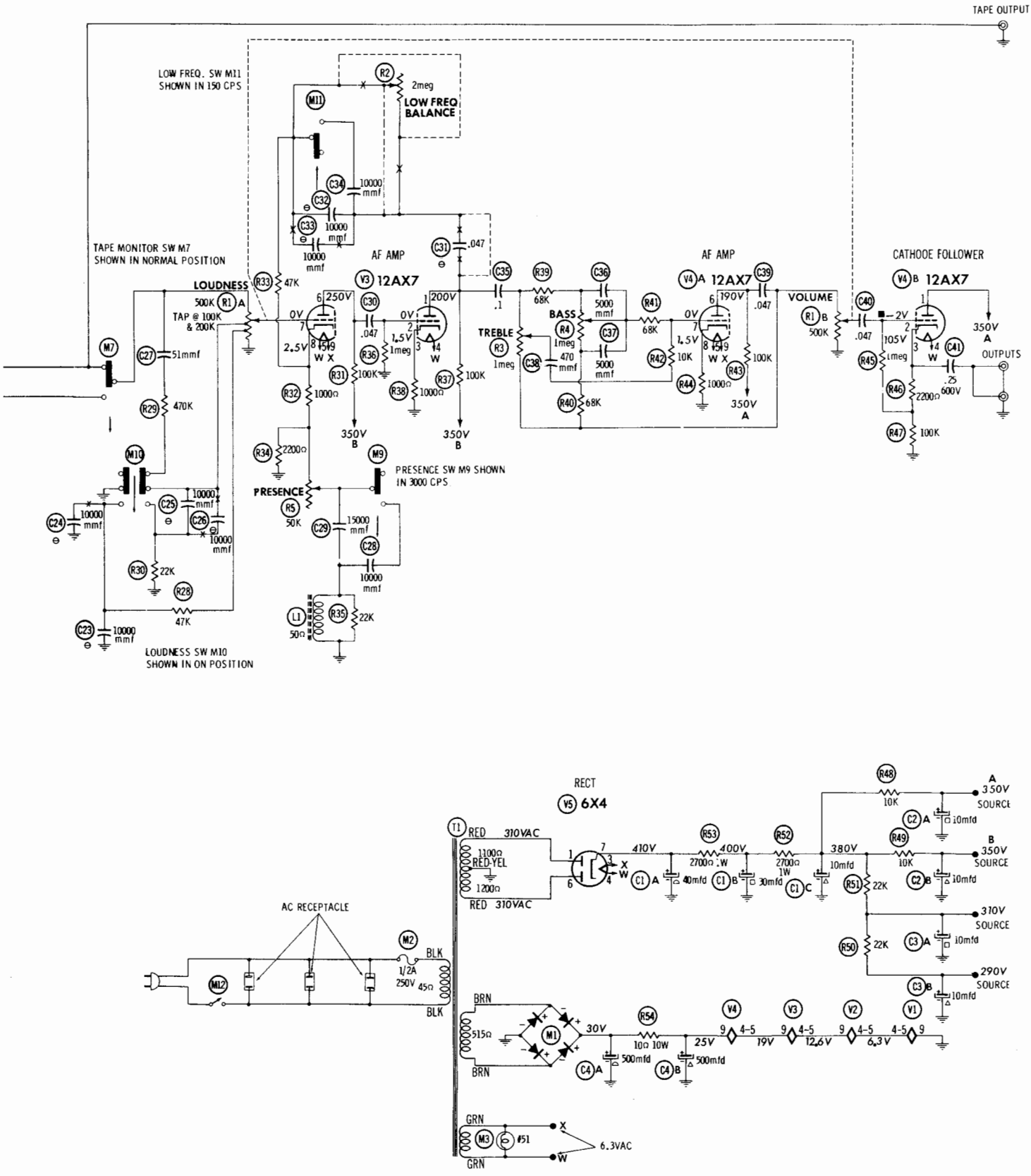
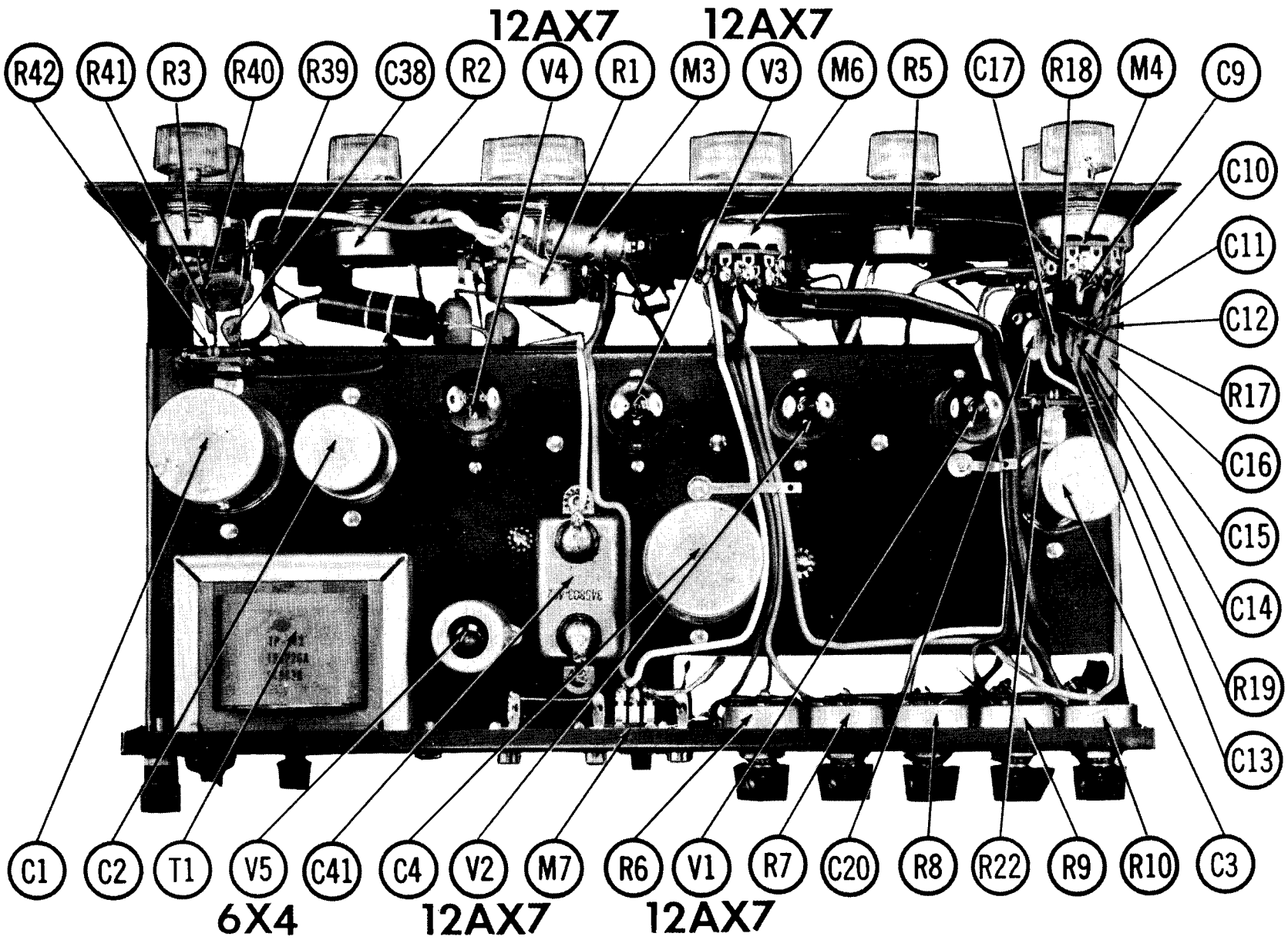

TAPE OUTPUT
LOW FREQ. SW M11
SHOWN IN 150 CPS
2meg
LOW FREQ
BALANCE
TAPE MONITOR SW M7
SHOWN IN NORMAL POSITION
AF AMP
V3 12AX7
AF AMP
V4A 12AX7
CATHODE FOLLOWER
V4B 12AX7
LOUDNESS
500K
TAP @ 100K
& 200K
VOLUME
BASS
TREBLE
350V A
350V B
OUTPUTS
PRESENCE
PRESENCE SW M9 SHOWN
IN 3000 CPS
LOUDNESS SW M10
SHOWN IN ON POSITION
RECT
V5 6X4
AC RECEPTACLE
RED 310VAC
RED-YEL
BLK
BRN
GRN
6.3VAC
#51
A 350V SOURCE
B 350V SOURCE
310V SOURCE
290V SOURCE



CHASSIS TOP VIEW

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Phono Preamplifier	12AX7	
V2	AF Amp. - Cath. Follower	12AX7	
V3	AF Amplifier	12AX7	

ITEM No.	USE	TYPE	NOTES
V4	AF Amp. - Cath. Follower	12AX7	
V5	Rectifier	6X4	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA						
	CAP.	VOLT.	GROMMES PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▲40	400		AFH4-117-48	B0420			D-400	
B	■30	350			BR1045			MT-4530	
C	▲10	300							
C2A	■10	350		AFH2-47	B0370	FP231	TMD-47	D-200	TVL-2750
B	▲10	350							
C3A	■10	350		AFH2-47	B0370	FP231	TMD-47	D-200	TVL-2750
B	▲10	350							
C4A	▲500	25			BR5002	WD065	TD-500-25	MTH-2550	TVL-2233
B	▲500	25			BR5002	TC2505	TD-500-25	MTH-2550	

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA							NOTES
	CAP.	VOLT	GROMMES PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C5	100			1468-0001	D6-101	5W5T1	ED-100	MC235	1FM-31	
C6	.22	200		P288N-22		CUB2P22		GEM-2022	2TM-P22	
C7	.047	400		BPD-05	DF-503	CUB4S47		GEM-4147	4TM-S47	
C8	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C9	330			BPD-00033	DD-331	L10T33	ED-330	UC-5333	5GA-T33	
C10	470			BPD-00047	DD-471	BYA10T47	ED-470	UC-5347	5GA-T47	
C11	800			BPD-0008	DD-801	L10T8			5GA-T8	
C12	1500			BPD-0015	DD-152	BYA10D15	ED-0015	DC5215	5HK-D15	
C13	1000			BPD-001	DD-102	BYA6D1	ED-1000	DC521	5HK-D1	
C14	2000			BPD-002	DD-202	BYA10D2	ED-002	DC522	5HK-D2	
C15	2000			BPD-002	DD-202	BYA10D2	ED-002	DC522	5HK-D2	
C16	4000			BPD-004	DD-402	BYA10D4	ED-004	UC-524	5HK-D4	
C17	1000			BPD-001	DD-102	BYA6D1	ED-1000	DC521	5HK-D1	
C18	.047	400		BPD-05	DF-503	CUB4S47		GEM-4147	4TM-S47	
C19	.1	400		P486N-1	DF-104	CUB4P1		GEM-401	4TM-P1	
C20	1000			BPD-001	DD-102	BYA6D1	ED-1000	DC521	5HK-D1	
C21	.047	400		BPD-05	DF-503	CUB4S47		GEM-4147	4TM-S47	
C22	.1	400		P488N-1	DF-104	CUB4P1		GEM-401	4TM-P1	
C23	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	①
C24	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	①
C25	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	②
C26	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	②
C27	51			SI 51			GP-51			
C28	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C29	15000			BPD-015	DD16-153	BYA10S15	ED-015		5HK-S15	
C30	.047	400		BPD-05	DF-503	CUB4S47		GEM-4147	4TM-S47	
C31	.047	400		BPD-05	DF-503	CUB4S47		GEM-4147	4TM-S47	④
C32	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	③
C33	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	③
C34	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C35	.1	400		P488N-1	DF-104	CUB4P1		GEM-401	4TM-P1	
C36	5000			BPD-005	DD-502	BYA6D5	ED-005	DC525	5HK-D5	
C37	5000			BPD-005	DD-502	BYA6D5	ED-005	DC525	5HK-D5	
C38	470			BPD-00047	DD-471	BYA10T47	ED-470	UC-5347	5GA-T47	
C39	.047	400		BPD-05	DF-503	CUB4S47		GEM-4147	4TM-S47	
C40	.047	400		BPD-05	DF-503	CUB4S47		GEM-4147	4TM-S47	
C41	.25	800								

① When C23 is 20000MMF C24 is not used.
② When C25 is 20000MMF C26 is not used.
③ When C32 is 20000MMF C33 is not used.
④ Not used in some versions.

PARTS LIST AND DESCRIPTIONS (Continued)

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	GROMMES PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	
R1A	500K		LC2X500K			Q18-133XX		Loudness, Tap @ 100K & 200K
B	500K					M11-133		Volume
R2A	2Meg		LFBC2M	B-76	A47-2Meg-Z	Q13-139	U55	Low Freq. Bal.
B	Shaft			Not Req.	RS-2	Not Req.	Not Req.	
R3A	1Meg		GTC-1M	B-69	A47-1Meg-S	Q11-137	U54	Treble
B	Shaft			Not Req.	RS-2	Not Req.	Not Req.	
R4A	1Meg		GTC-1M	B-69	A47-1Meg-S	Q11-137	U54	Bass
B	Shaft			Not Req.	RS-2	Not Req.	Not Req.	
R5A	50K		PC50K	B-34	A47-75K-V	Q14-123	U34	Presence
B	Shaft			Not Req.	RS-2	Not Req.	Not Req.	
R6A	500K		VC500K	B-60	A47-500K-Z	Q13-133	U48	Input Level AUX.
B	Shaft			Not Req.	RS-2	Not Req.	Not Req.	
R7A	500K		VC500K	B-60	A47-500K-Z	Q13-133	U48	Input Level Tuner
B	Shaft			Not Req.	RS-2	Not Req.	Not Req.	
R8A	500K		VC500K	B-60	A47-500K-Z	Q13-133	U48	Input Level Tape Amp.
B	Shaft			Not Req.	RS-2	Not Req.	Not Req.	
R9A	500K		VC500K	B-60	A47-500K-Z	Q13-133	U48	Input Level Mag. Phono #1
B	Shaft			Not Req.	RS-2	Not Req.	Not Req.	
R10A	500K		VC500K	B-60	A47-500K-Z	Q13-133	U48	Input Level Phono #2
B	Shaft			Not Req.	RS-2	Not Req.	Not Req.	

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	GROMMES PART No.	IRC PART No.	
R11	47K			BTS-47K	
R12	47K			BTS-47K	
R13	100K 5%	1			Note 1
R14	470K			BTS-470K	
R15	1Meg			BTS-1Meg	
R16	1000Ω 5%	1			Note 1
R17	100K 5%	1			Note 1
R18	3.3Meg			BTS-3.3Meg	
R19	1Meg			BTS-1Meg	
R20	1Meg			BTS-1Meg	
R21	4.7Meg			BTS-4.7Meg	
R22	100K			BTS-100K	
R23	100K			BTS-100K	
R24	1000Ω			BTS-1000	
R25	1Meg			BTS-1Meg	
R26	2200Ω			BTS-2200	
R27	100K			BTS-100K	
R28	47K			BTS-47K	
R29	470K			BTS-470K	
R30	22K			BTS-22K	
R31	100K			BTS-100K	
R32	1000Ω			BTS-1000	

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	GROMMES PART No.	IRC PART No.	
R33	47K			BTS-47K	
R34	2200Ω			BTS-2200	
R35	22K			BTS-22K	
R36	1Meg			BTS-1Meg	
R37	100K			BTS-100K	
R38	1000Ω			BTS-1000	
R39	68K			BTS-68K	
R40	68K			BTS-68K	
R41	68K			BTS-68K	
R42	10K			BTS-10K	
R43	100K			BTS-100K	
R44	1000Ω			BTS-1000	
R45	1Meg			BTS-1Meg	
R46	2200Ω			BTS-2200	
R47	100K			BTS-100K	
R48	10K			BTS-10K	
R49	10K			BTS-10K	
R50	22K			BTS-22K	
R51	22K			BTS-22K	
R52	2700Ω	1		BTA-2700	
R53	2700Ω	1		BTA-2700	
R54	10Ω	10		PW10-10	

Note 1. Low noise deposited carbon resistor.

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	GROMMES PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117VAC @ .25A	640VCT @ .010A	6.3VAC @ .6A	23VAC @ .300A	TP-212					

PARTS LIST AND DESCRIPTIONS (Continued)

COILS

ITEM No.	USE	REPLACEMENT DATA				NOTES
		GROMMES PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	
L1	Tone Choke					220 Millihenries

SELENIUM RECTIFIER

ITEM No.	RATING	REPLACEMENT DATA				NOTES
	CURRENT (Measured)	GROMMES PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	SARKES TARZIAN PART No.	
M1	.3A		1017	C1B	604B	

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			GROMMES PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M2	3AG	½A 250V			312.500 (3AG ½A 250V)	342001	AGC½	HKP

MISCELLANEOUS

ITEM No.	PART NAME	GROMMES PART No.	NOTES
M3	Pilot Lamp		#51
M4	Switch		Rolloff DB (Rotary Wafer Type)
M5	Switch		Turnover CPS (Rotary Wafer Type)
M6	Switch		Input Selector (Rotary Wafer Type)
M7	Switch		Tape Monitor (Slide Type SPDT)
M8	Switch		Rumble Filter (Slide Type SPDT)
M9	Switch		Presence (Slide Type SPDT)
M10	Switch		Loudness (Slide Type DPST)
M11	Switch		Low Freq. (Slide Type SPDT)
M12	Switch		Power On-Off (Slide Type SPDT)

GROMMES
MODELS 221

TRADE NAME	Grommes Model 221
MANUFACTURER	Precision Electronics, Inc. 9101 King Ave., Franklin Park, Ill.
TYPE SET	AC Operated Audio Amplifier
TUBES (Five)	Types 12AU7 AF Amplifier, 12AU7 AF Amp. - Phase Inv., (2) 6L6GB (or) 5881 Output, 5U4GB Rectifier
POWER SUPPLY	110-120 Volts AC - 60 Cycles RATING .9 Amp. @ 117 Volts AC (9 Watts)

The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co., Inc., as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co., Inc., by the manufacturers of the particular type of replacement part listed. Reproduction or use, without express permission, of editorial or pictorial content, in any manner, is prohibited. No patent liability is assumed with respect to the use of the information contained herein. © 1957 Howard W. Sams & Co., Inc., Indianapolis 5, Indiana. Printed in U.S. of America

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	AF Amplifier	12AU7	
V2	AF Amp. - Phase Inv.	12AU7	
V3	Output	6L6GB	Note 1

ITEM No.	USE	TYPE	NOTES
V4	Output	6L6GB	Note 1
V5	Rectifier	5U4GB	

Note 1. Some versions may use type 5881

ELECTROLYTIC CAPACITORS

ITEM No.	RATING CAP.	RATING VOLT.	REPLACEMENT DATA GROMMES PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▪40	450		AFH3-50-05	C0372	FP396.1	TMQ-12	Q-040	TVL-3842
B	■20	450							
C	▲20	450							
C2	10	250		PRS350V10	BR1045	TC52	TD-10-250	MT-4510	TVA-1504
C3	50	50		PRS50V50	BR505	TC39	TD-50-50	MT-0550	TVA-1308

FIXED CAPACITORS

Copacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING CAP.	RATING VOLT	REPLACEMENT DATA GROMMES PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C4	.22	200		P268N-22		CUB2P22		GEM-2022	2TM-P22	
C5	250			BPD-00025	DD-251	L10T25	ED-250	UC-5325	5GA-T25	
C6	.22	200		P288N-22		CUB2P22		GEM-2022	2TM-P22	
C7	.1	400		P488N-1	DF-104	CUB4P1		GEM-401	4TM-P1	
C8	.1	400		P488N-1	DF-104	CUB4P1		GEM-401	4TM-P1	
C9	20			NP0-SI 20	D6-200	L10Q2	ED-20			10%

CONTROLS

ITEM No.	RATING RESISTANCE	RATING WATTS	REPLACEMENT DATA GROMMES PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	500K	½	VC500K	B-60	A47-500K-Z	Q13-133	U48	Gain
B	Shaft			Not Req.	RS-2	Not Req.	Not Req.	
R2A	1Ω	4						Damping (Wire Wound)
B	1Ω	4						Damping (Wire Wound)

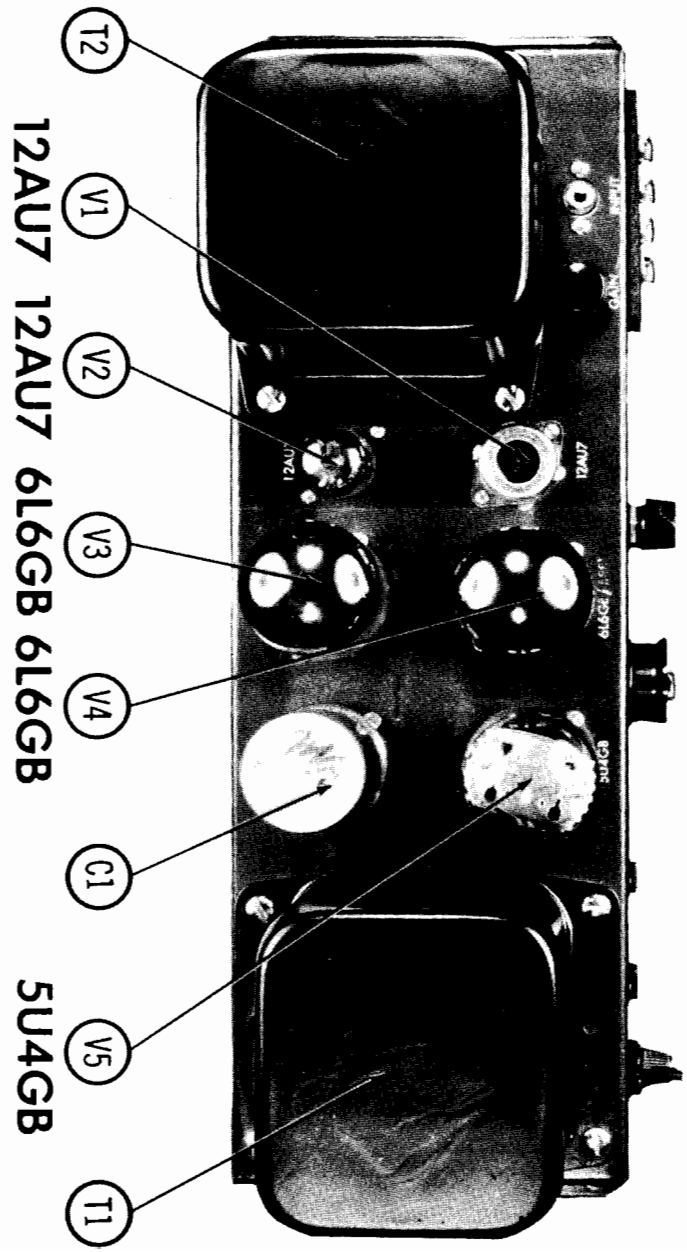
RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA GROMMES PART No.	REPLACEMENT DATA IRC PART No.	NOTES
R3	1Meg			BTS-1Meg	
R4	22K			BTS-22K	
R5	100K	1		BTA-100K	
R6	100K			BTS-100K	
R7	1000Ω			BTS-1000	
R8	22K			BTS-22K	
R9	2200Ω			BTS-2200	
R10	1Meg			BTS-1Meg	
R11	47K	1		BTA-47K	

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA GROMMES PART No.	REPLACEMENT DATA IRC PART No.	NOTES
R12	56K	1		BTA-56K	
R13	22K	2		BTB-22K	
R14	1000Ω			BTS-1000	
R15	100K			BTS-100K	
R16	1000Ω			BTS-1000	
R17	100K			BTS-100K	
R18	400Ω	10		1 3/4A-400	
R19	22K			BTS-22K	
R20	22K	2		BTB-22K	
R21	10K	1		BTA-10K	

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	GROMMES PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117VAC @ .9A	760VCT @ .110A	5VAC @ 3A	6.3VCT @ 2.5A	TP5UA				25R06	HSM-207 ①

① Drill new mounting holes.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	GROMMES PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	
T2	6800Ω CT	16Ω Tap @ 8Ω, 4Ω	T022	H411	A-3102		22S39	HSM-186 ①	① Drill new mounting holes.

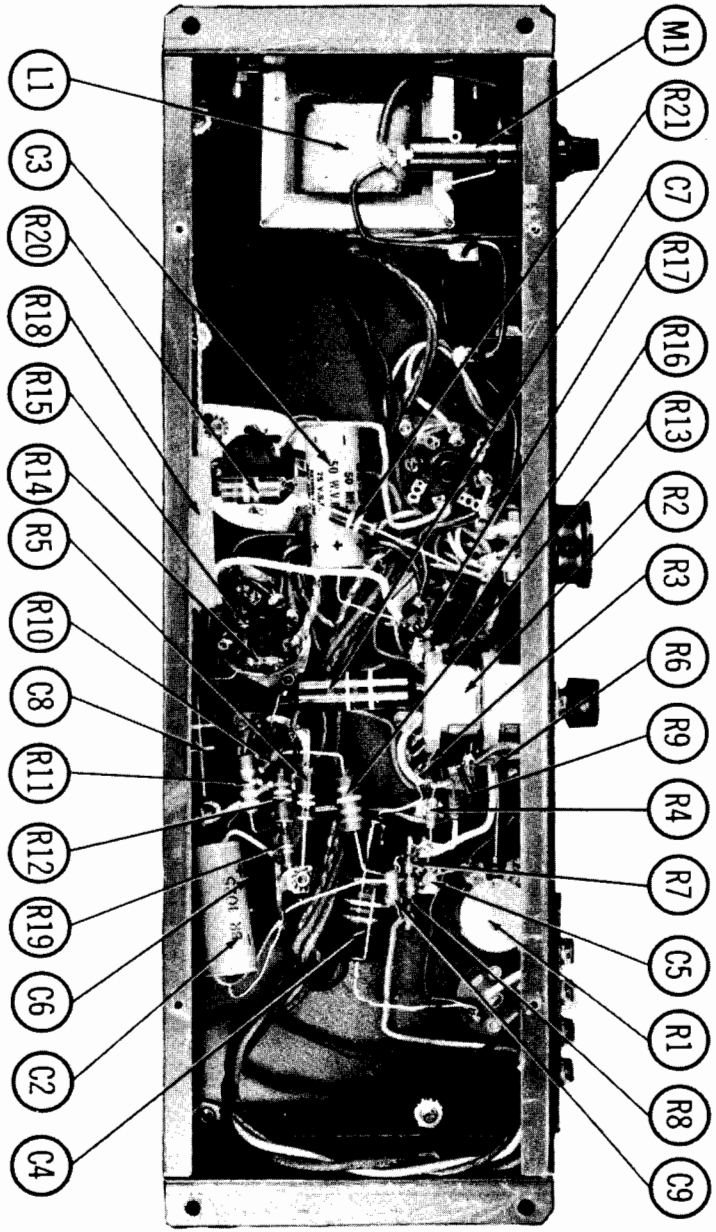
FILTER CHOKE

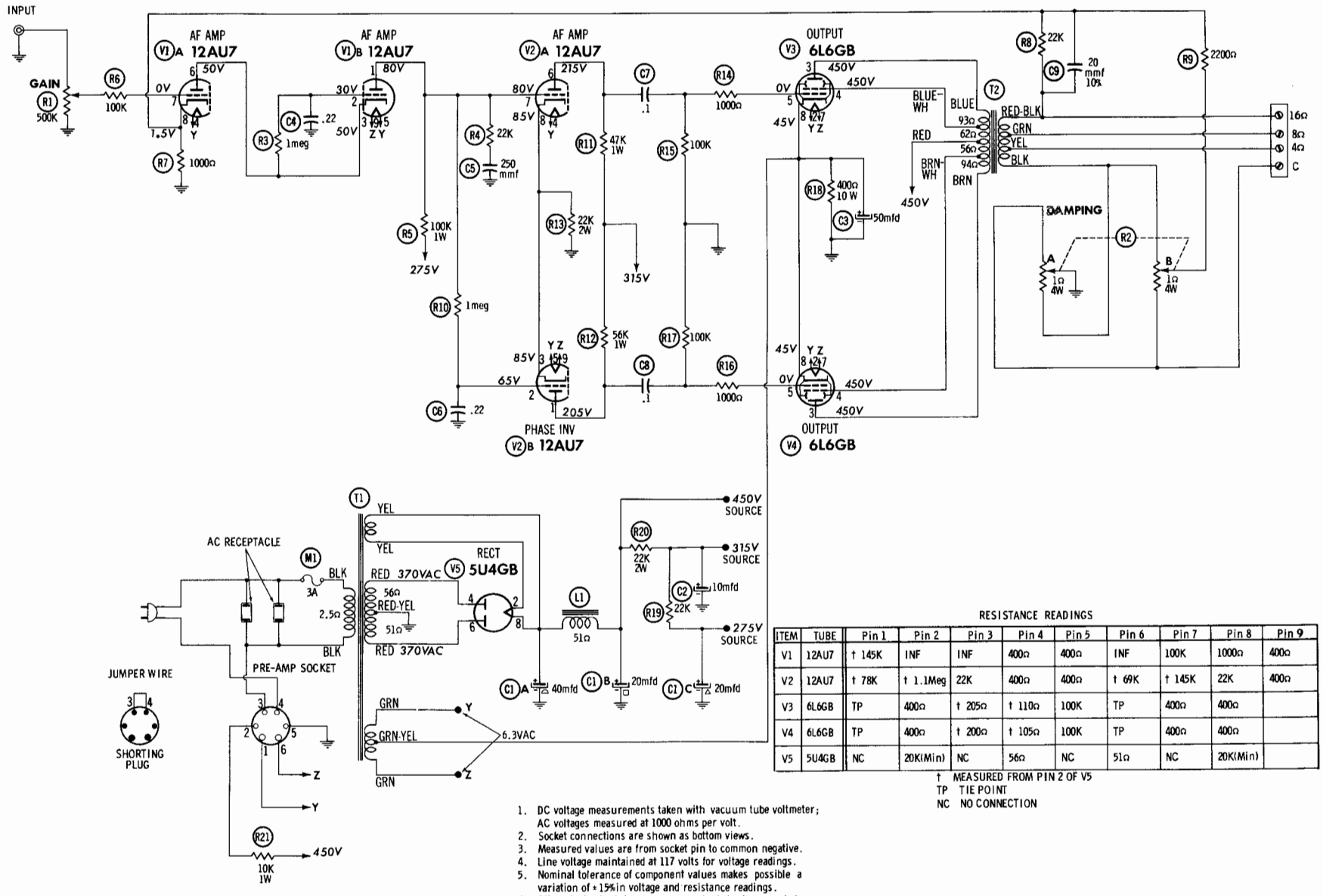
ITEM No.	RATINGS			REPLACEMENT DATA					
	TOTAL DIRECT CURRENT	D. C. RESISTANCE	INDUCTANCE (0 CURRENT 1000 ∿)	GROMMES PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
L1	.110A	51Ω	2Hy	CH2	C5026	C-2974	C-2304	28C43	C-23X

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			GROMMES PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M1	3AG	3A			312003. (3AG-3A)	342001	AGC3	HCM

CHASSIS—BOTTOM VIEW





RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AU7	† 145K	INF	INF	400Ω	400Ω	INF	100K	1000Ω	400Ω
V2	12AU7	† 78K	† 1.1Meg	22K	400Ω	400Ω	† 69K	† 145K	22K	400Ω
V3	6L6GB	TP	400Ω	† 205Ω	† 110Ω	100K	TP	400Ω	400Ω	
V4	6L6GB	TP	400Ω	† 200Ω	† 105Ω	100K	TP	400Ω	400Ω	
V5	5U4GB	NC	20K(Min)	NC	56Ω	NC	51Ω	NC	20K(Min)	

† MEASURED FROM PIN 2 OF V5
TP TIE POINT
NC NO CONNECTION

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

A PHOTOFACT STANDARD NOTATION SCHEMATIC
Howard W. Sams & Co., Inc. 1957

HAMILTON
MODEL PMX-6

TRADE NAME	Hamilton Model PMX-6
MANUFACTURER	Hamilton Electronics Corp., 2726 W. Pratt Ave., Chicago 45, Ill.
TYPE SET	AC Operated 6 Channel Preamplifier Mixer
TUBES (Three)	Types 12AX7 Channels 1-2 Preamplifier, 12AX7 Channels 3-4 Preamplifier, 12AX7 Channels 5-6 Preamplifier
POWER SUPPLY	110-120 Volts AC - 60 Cycles RATING .04 Amp. @ 117 Volts AC (5 Watts)

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Channel 1-2 Preamp.	12AX7	
V2	Channel 3-4 Preamp.	12AX7	

ITEM No.	USE	TYPE	NOTES
V3	Channel 5-6 Preamp.	12AX7	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA						
	CAP.	VOLT.	HAMILTON PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▲40	150	(Note 1)	AFH3-09	CO080	FP311.4	TMT-8	T-040	TVL-3438
B	■30	150							
C	20	150							

Note 1: Some versions may use 20-20-20MFD unit in this application.

FIXED CAPACITORS

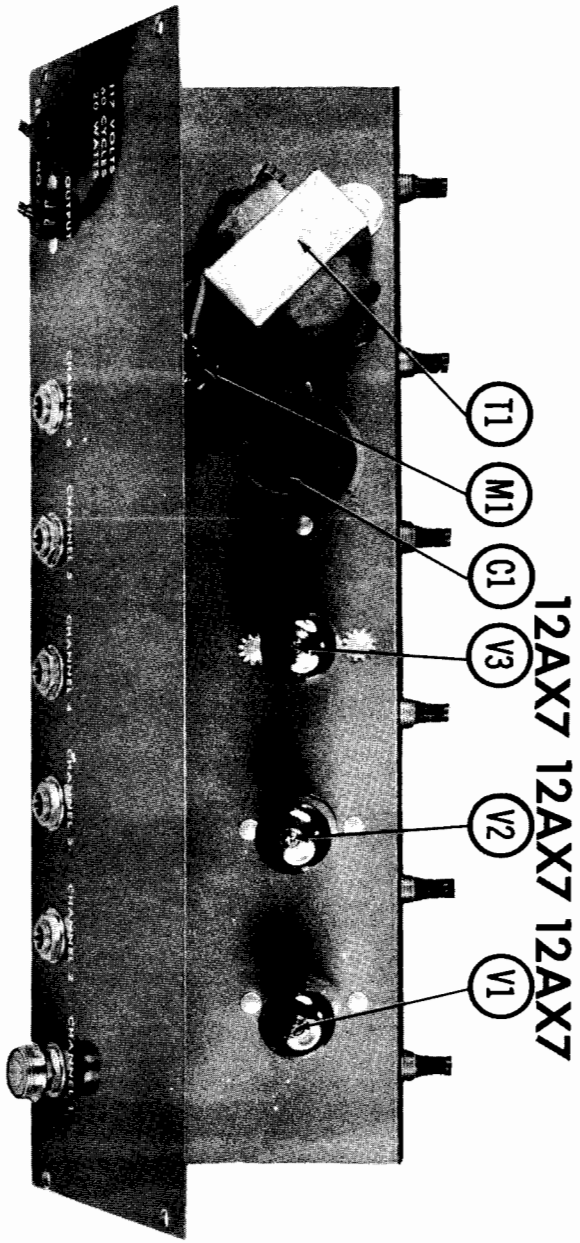
Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA							NOTES
	CAP.	VOLT	HAMILTON PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C2	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C3	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C4	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C5	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C6	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C7	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	HAMILTON PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	
R1A	500K	½		B-60	A47-500K-Z	Q13-133	U48	Channel 1 Volume
B	Shaft			Not Req.	KSS-3	Not Req.	Not Req.	
R2A	500K	½		B-60	A47-500K-Z	Q13-133	U48	Channel 2 Volume
B	Shaft			Not Req.	KSS-3	Not Req.	Not Req.	
R3A	500K	½		B-60	A47-500K-Z	Q13-133	U48	Channel 3 Volume
B	Shaft			Not Req.	KSS-3	Not Req.	Not Req.	
R4A	500K	½		B-60	A47-500K-Z	Q13-133	U48	Channel 4 Volume
B	Shaft			Not Req.	KSS-3	Not Req.	Not Req.	
R5A	500K	½		B-60	A47-500K-Z	Q13-133	U48	Channel 5 Volume
B	Shaft			Not Req.	KSS-3	Not Req.	Not Req.	
R6A	500K	½		B-60	A47-500K-Z	Q13-133	U48	Channel 6 Volume
B	Shaft			Not Req.	KSS-3	Not Req.	Not Req.	
C	Switch			KB-1	SWE-12	78-1	US-26	

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	HAMILTON PART No.	IRC PART No.	
R7	470K			BTS-470K	
R8	100K			BTS-100K	
R9	150K			BTS-150K	
R10	470K			BTS-470K	
R11	100K			BTS-100K	
R12	150K			BTS-150K	
R13	470K			BTS-470K	
R14	100K			BTS-100K	
R15	150K			BTS-150K	
R16	470K			BTS-470K	
R17	100K			BTS-100K	

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	HAMILTON PART No.	IRC PART No.	
R18	150K			BTS-150K	
R19	470K			BTS-470K	
R20	100K			BTS-100K	
R21	150K			BTS-150K	
R22	470K			BTS-470K	
R23	100K			BTS-100K	
R24	150K			BTS-150K	
R25	33K			BTS-33K	
R26	33K			BTS-33K	
R27	10K			BTS-10K	

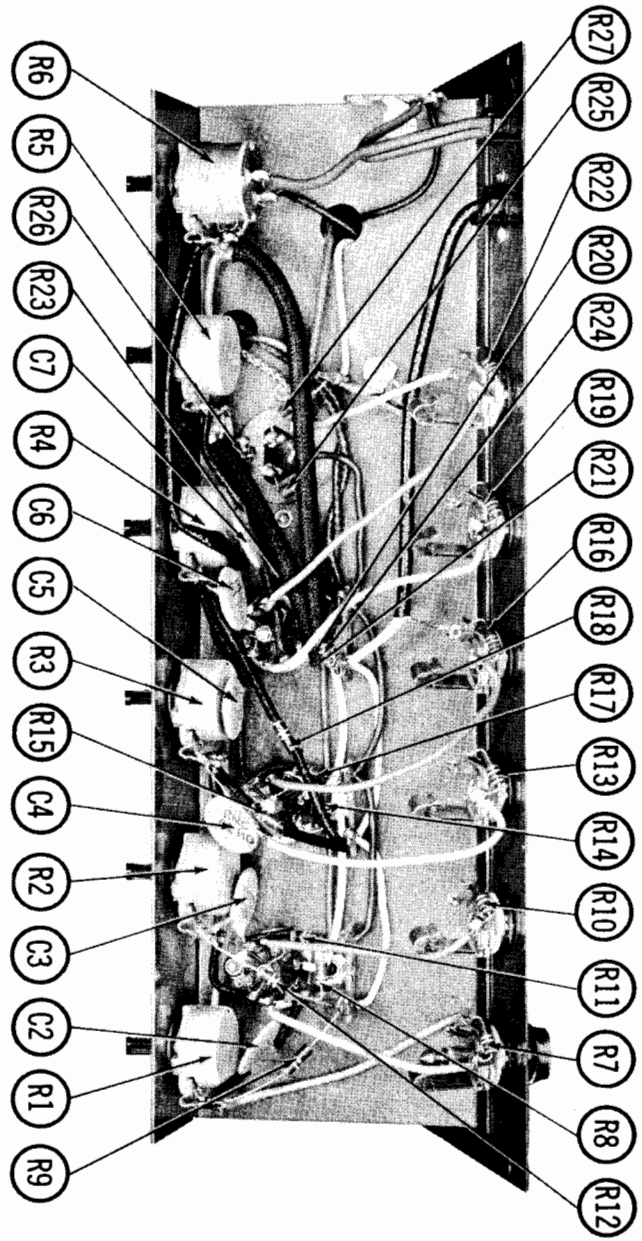
TRANSFORMER (POWER)

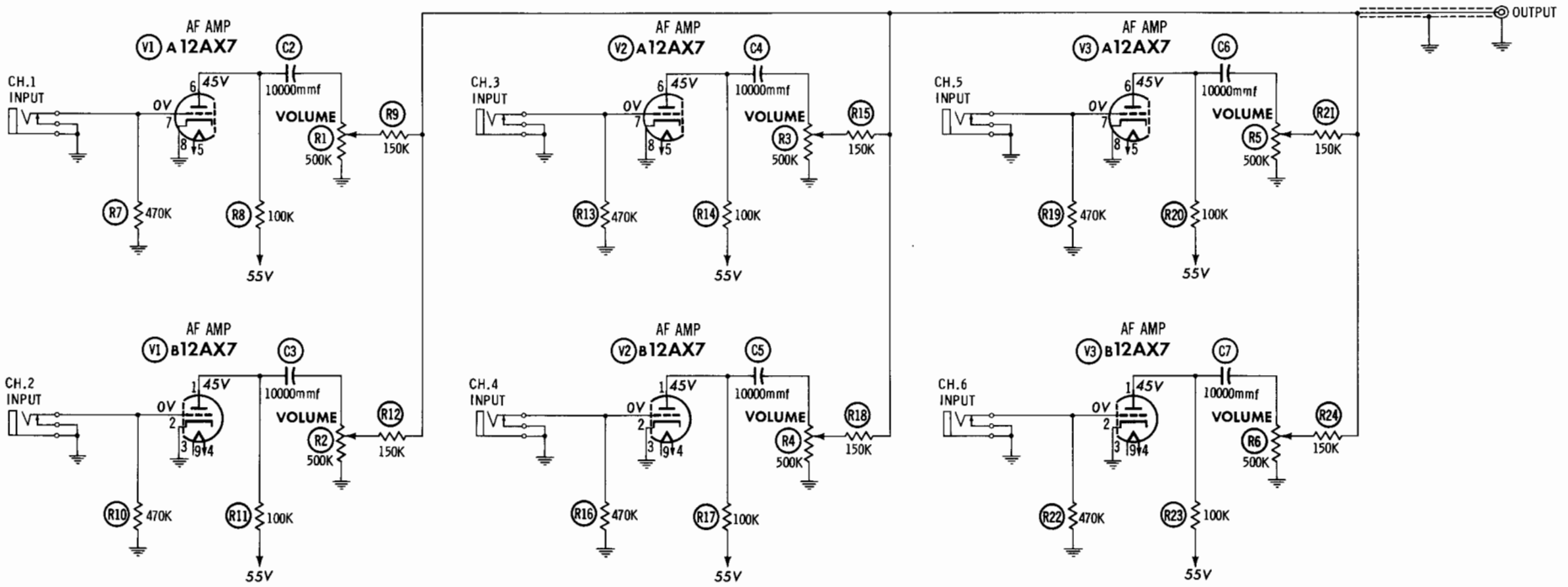
ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	HAMILTON PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117VAC @ .04A	150VAC @ .0012A	8VCT @ .34A		33GA07		P-3046		26R32	

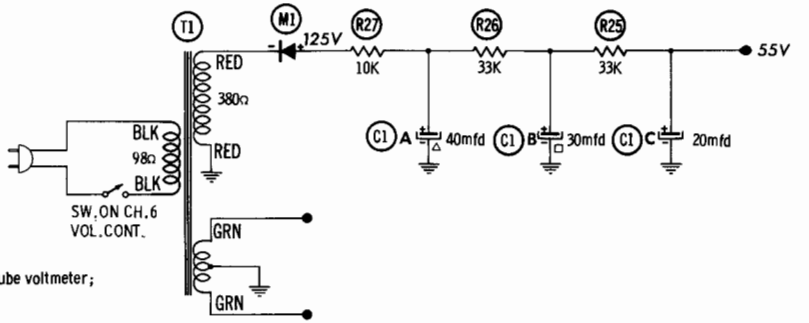
SELENIUM RECTIFIER

ITEM No.	RATING	REPLACEMENT DATA						NOTES
	CURRENT (Measured)	HAMILTON PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	MALLORY PART No.	RADIO RECEPTOR PART No.	SARKES TARZIAN PART No.	
M1	.0012A		1386	RS050	8S75	8J1	50	

CHASSIS—BOTTOM VIEW







RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7	†175K	0Ω	0Ω	.9Ω	.9Ω	†175K	0Ω	0Ω	.5Ω
V2	12AX7	†175K	0Ω	0Ω	.9Ω	.9Ω	†175K	0Ω	0Ω	.5Ω
V3	12AX7	†175K	0Ω	0Ω	.9Ω	.9Ω	†175K	0Ω	0Ω	.5Ω

† MEASURED FROM OUTPUT OF M1.

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ± 15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

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HARMAN-KARDON
MODEL A-1040 "Trend II"

HARMAN-KARDON
MODEL A-1040 "Trend II"

TRADE NAME	Harman-Kardon Model A-1040 "Trend II"
MANUFACTURER	Harman-Kardon, Inc., 520 Main St., Westbury, L.I., N.Y.
TYPE SET	AC Operated 6 Channel 40 Watt Audio Amplifier
TUBES (Ten)	Types 12AX7 Phono Preamplifier, 12AX7 Cath. Follower-AF Amp., 12AV6 AF Amplifier, 12AT7 AF Amp-Phase Inv., (4) 12AB5 Output, (2) EZ81 Rectifier
POWER SUPPLY	105-125 Volts AC-60 Cycles RATING .83 Amp. @117 Volts AC (84 Watts)

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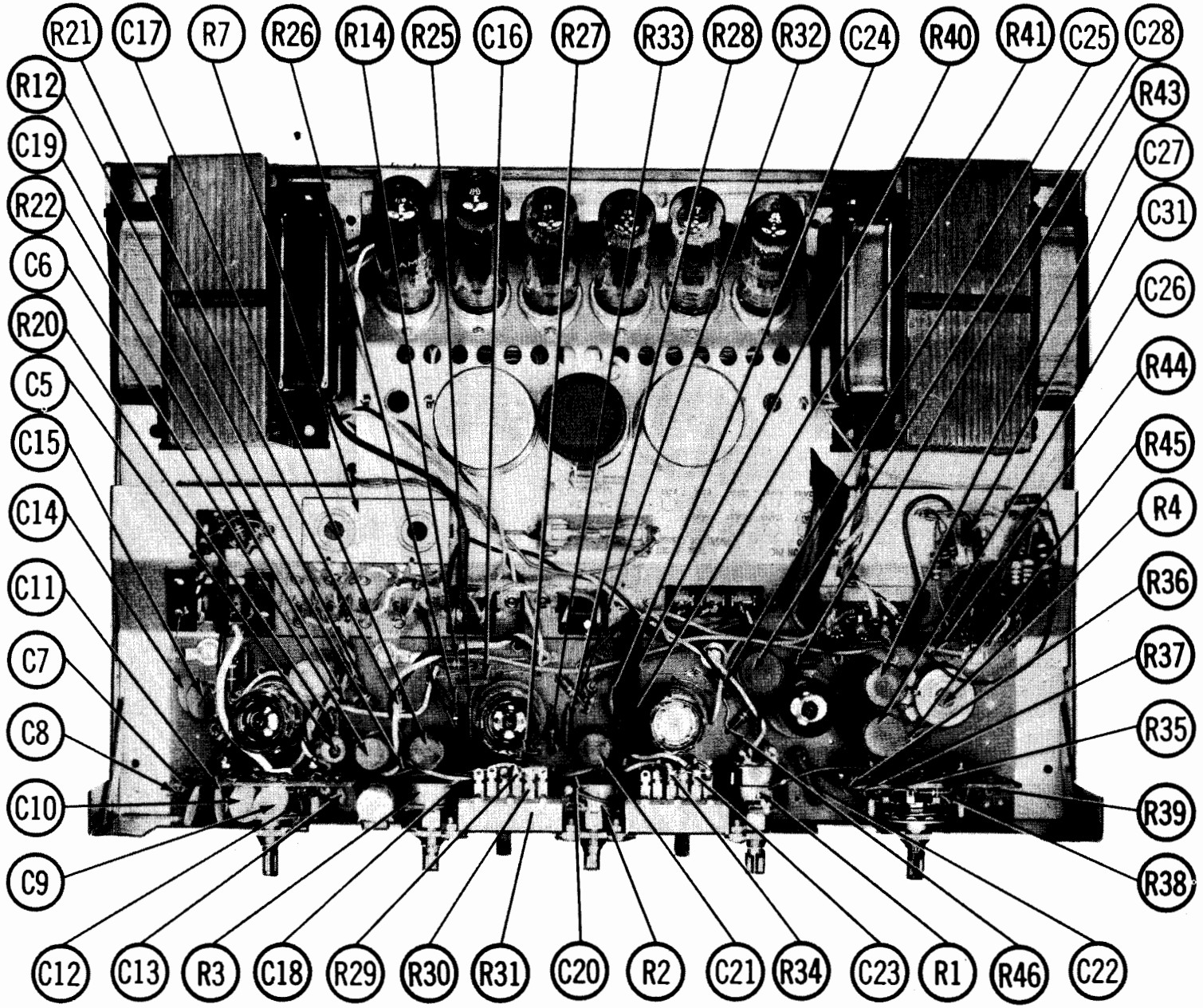
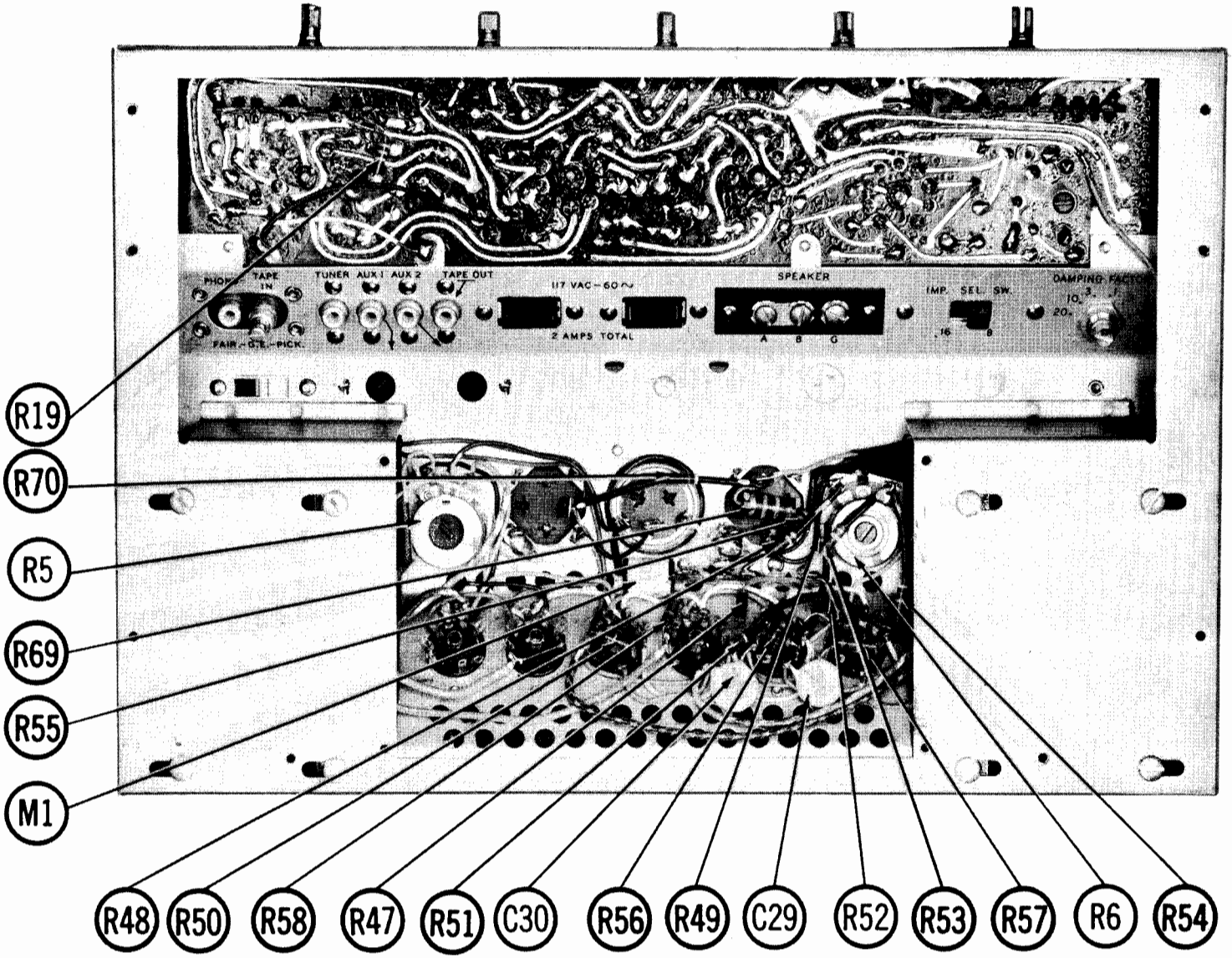
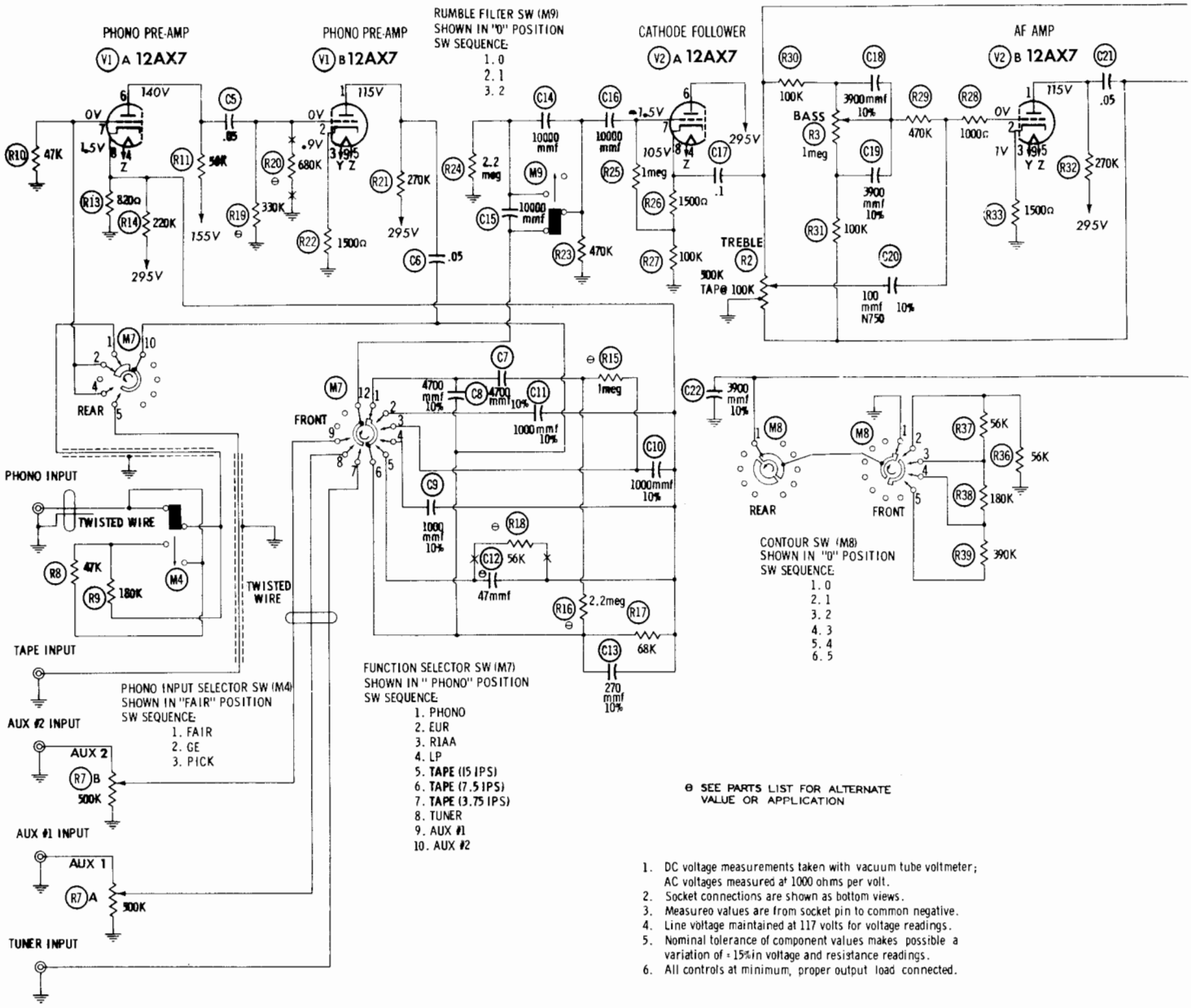


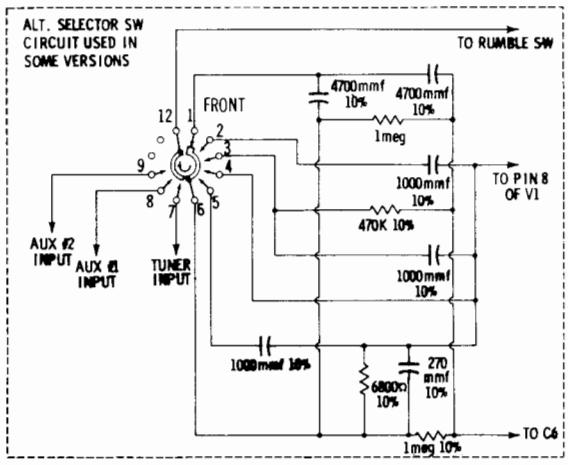
CHASSIS TOP VIEW



CHASSIS BOTTOM VIEW



1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measureo values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

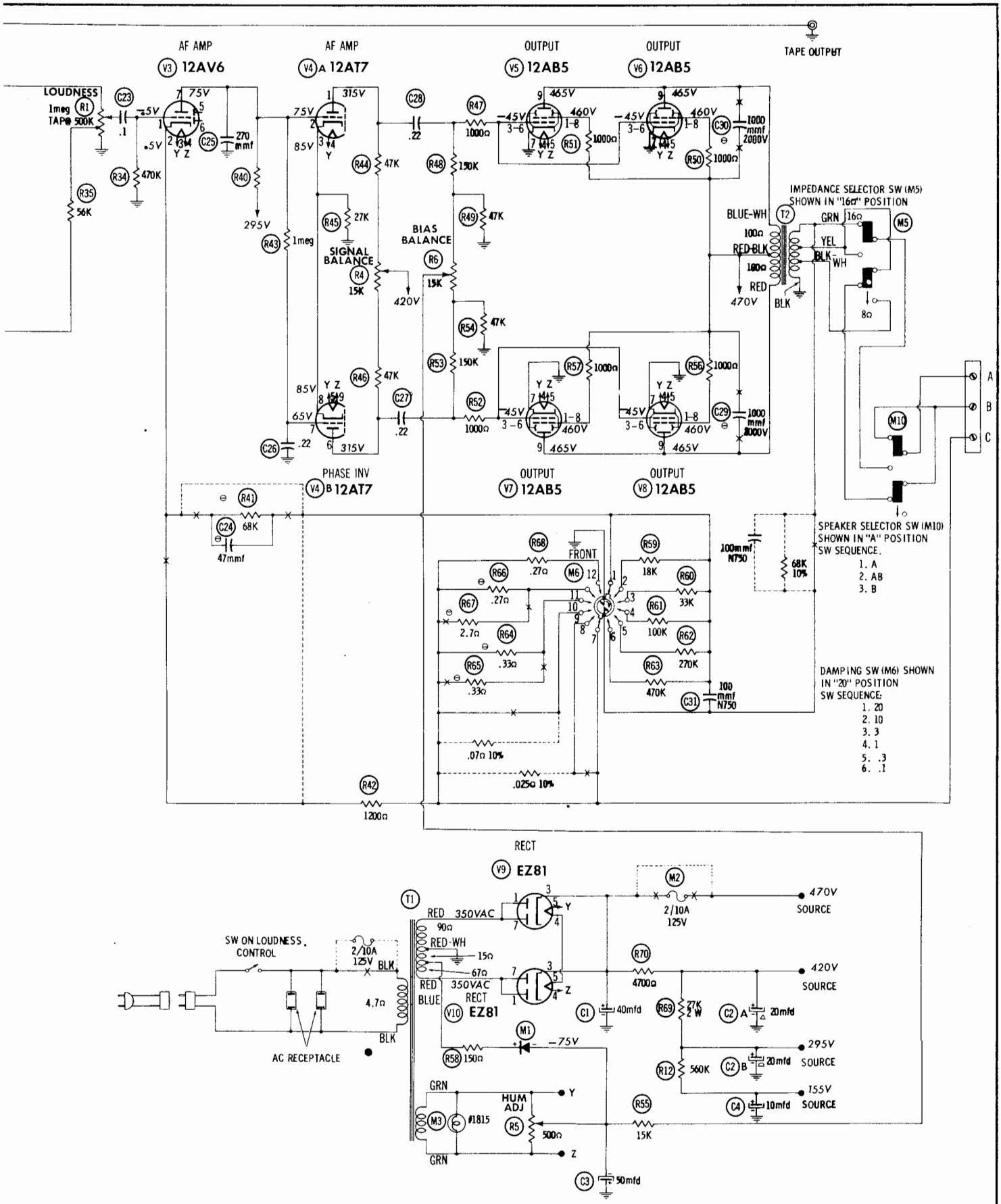


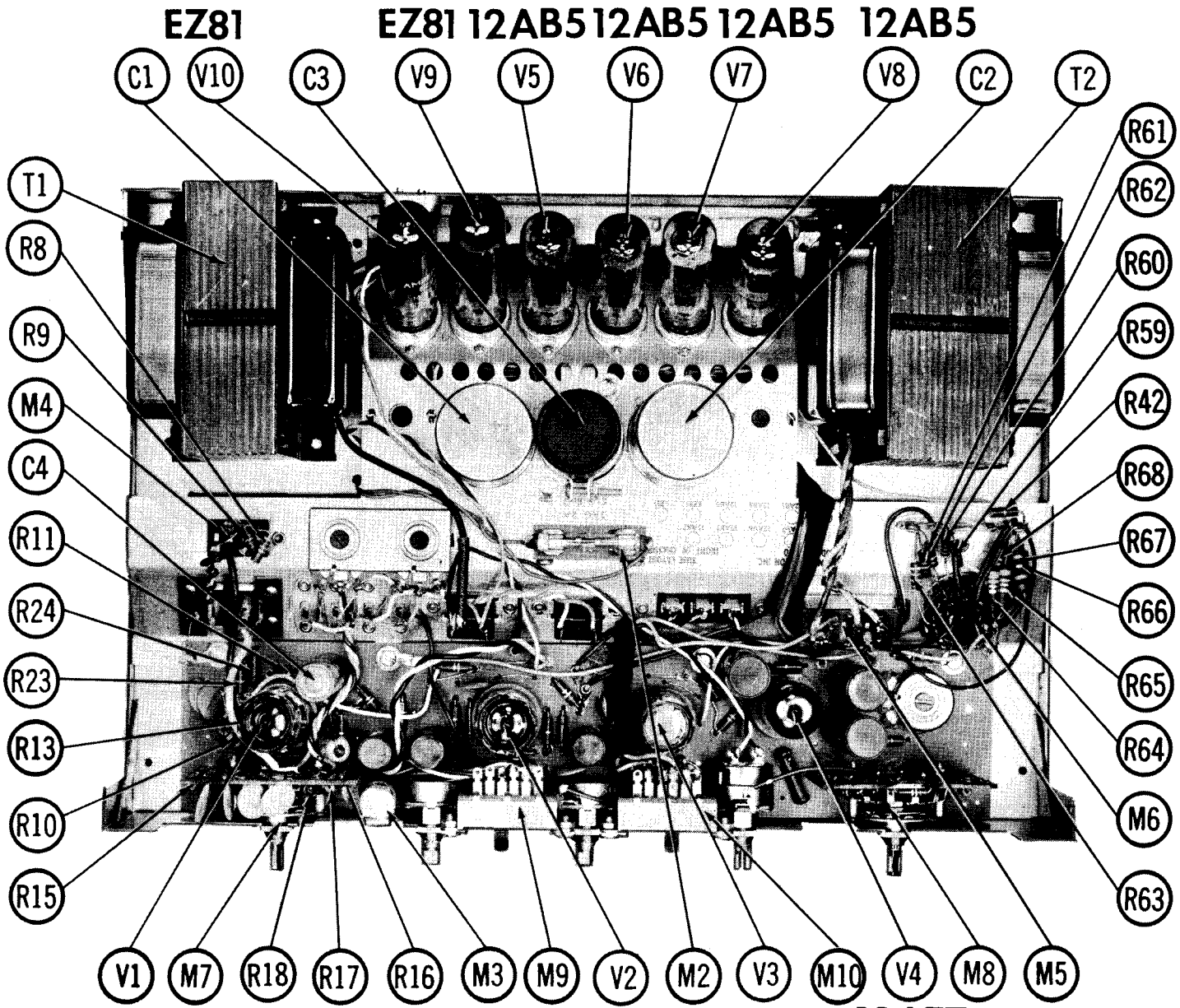
RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7	†300K	220K	1500Ω	37K	37K	†270K	47K	820Ω	37K
V2	12AX7	†300K	600K	1500Ω	37K	37K	†32K	1.1meg	100K	37K
V3	12AV6	470K	1100Ω	37K	37K	NC	NC	†500K		
V4	12AT7	†60K	†500K	27K	37K	37K	†60K	†1.5meg	27K	37K
V5	12AB5	† 1000Ω	TP	165K	37K	37K	165K	0Ω	†1000Ω	†100Ω
V6	12AB5	† 1000Ω	TP	165K	37K	37K	165K	0Ω	†1000Ω	†100Ω
V7	12AB5	† 1000Ω	TP	165K	37K	37K	165K	0Ω	†1000Ω	†100Ω
V8	12AB5	† 1000Ω	TP	165K	37K	37K	165K	0Ω	†1000Ω	†100Ω
V9	EZ81	90Ω	NC	20K(min)	37K	37K	NC	90Ω	NC	NC
V10	EZ81	81Ω	NC	20K(min)	37K	37K	NC	81Ω	NC	NC

† MEASURED FROM PIN 3 OF V10
▲ MEASURED FROM PIN 8 OF V 2
NC NO CONNECTION
*TP TIE POINT

A PHOTOFACT STANDARD NOTATION SCHEMATIC
Howard W. Sams & Co., Inc. 1958


AF AMP
V3 12AV6
AF AMP
V4A 12AT7
OUTPUT
V5 12AB5
OUTPUT
V6 12AB5
TAPE OUTPUT
LOUDNESS
1meg TAP@ 500K
R1
C23
.1
R34 470K
R35 56K
C25 270 mmf
R40
295V
R43 1meg
R44 47K
R45 27K
SIGNAL BALANCE
R4 15K
420V
BIAS BALANCE
R6 15K
R47 1000Ω
R48 150K
R49 47K
R54 47K
R53 150K
R46 47K
C27 .22
R52 1000Ω
C26 .22
C28 .22
R51 1000Ω
R50 1000Ω
R57 1000Ω
R56 1000Ω
C30 1000 mmf 2000V
C29 1000 mmf 2000V
IMPEDANCE SELECTOR SW (M5)
SHOWN IN "16Ω" POSITION
T2
BLUE-WH
100Ω
RED-BLK
180Ω
RED
470V
BLK
GRN
YEL
BLK-WH
16Ω
8Ω
M5
M10
A
B
C
PHASE INV
V4B 12AT7
R41
C24 68K
47mmf
OUTPUT
V7 12AB5
OUTPUT
V8 12AB5
R68 .27Ω
R66 .27Ω
R67 2.7Ω
R64
R65 .33Ω
.33Ω
.07Ω 10%
.025Ω 10%
FRONT
M6
R59 18K
R60 33K
R61 100K
R62 270K
R63 470K
C31 100 mmf N750
100mmf N750
68K 10%
SPEAKER SELECTOR SW (M10)
SHOWN IN "A" POSITION
SW SEQUENCE.
1. A
2. AB
3. B
DAMPING SW (M6) SHOWN
IN "20" POSITION
SW SEQUENCE:
1. 20
2. 10
3. 3
4. 1
5. .3
6. .1
R42 1200Ω
RECT
V9 EZ81
T1
RED 350VAC
90Ω
RED-WH
15Ω
67Ω
RED
BLUE
350VAC
RECT
V10 EZ81
4.7Ω
SW ON LOUDNESS CONTROL
2/10A 125V
BLK
AC RECEPTACLE
M2
2/10A 125V
470V SOURCE
R70 4700Ω
420V SOURCE
C1 40mfd
R69 27K 2W
C2A 20mfd
295V SOURCE
R12 560K
C2B 20mfd
155V SOURCE
C4 10mfd
R55 15K
M1
−75V
R58 150Ω
GRN
HUM ADJ
R5 500Ω
M3 #1815
C3 50mfd



CHASSIS-TOP VIEW

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Phono Preamplifier	12AX7	
V2	Cath. Follower-AF Amp.	12AX7	
V3	AF Amplifier	12AV6	
V4	AF Amplifier-Phase Inv.	12AT7	
V5	Output	12AB5	
V6	Output	12AB5	
V7	Output	12AB5	
V8	Output	12AB5	
V9	Rectifier	EZ81	
V10	Rectifier	EZ81	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING CAP.	RATING VOLT.	Harman-Kardon PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1	40	475	JE1071739	AFH1-56-10	A0516	FP284	TMD-61	S-300	TVL-1820
C2A	▲ 20	475	JE1071740	AFH2-69	B0500		TMD-61	D-270	TVL-2935
B	▲ 20	475							
C3	50	150	JE1021711	AFH1-18	A0200	FP115	TMS-20	S-080	TVL-1415
C4	10	150		PRS150V10	BBR10-150	TC42	TD-10-150	MT-1510	TVA-1406

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING CAP.	RATING VOLT	Harman-Kardon PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C5	.05	200		P288N-05	DF-503	CUB2S5		GEM-415	2TM-S5	
C6	.05	400				BC6S47J		ACE615	4SE-S47	
C7	4700					1R5D47			MS-247	10%
C8	4700					1R5D47			MS-247	10%
C9	1000					1R5D1	ED-1000	MCB255	MS-21	10%
C10	1000					1R5D1	ED-1000	MCB255	MS-21	10%
C11	1000					1R5D1	ED-1000	MCB255	MS-21	10%
C12	47			BPD-000047	DD-470	L10Q47	ED-47	UC-5447	5GA-Q47	①
C13	270			NPO-S1270	D6-271	5R5T27	ED-270		MS-327	10%
C14	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C15	10000			BPD-01	DD-103	BYA8S1	ED-01	DC511	5HK-S1	
C16	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C17	.1	200				BC2P1J		ACE401	2SE-P10	
C18	3900					1R5D39			MS-239	10%
C19	3900					1R5D39			MS-239	10%
C20	100			N750-D1100	TCN-100	C10T1U	TC7-100	NT-531	5TCU-T1	N750 10%
C21	.05	400				BC6S47J		ACE615	4SE-S47	
C22	3900					1R5D39			MS-239	10%
C23	.1	200				BC2P1J		ACE401	2SE-P10	
C24	47			BPD-000047	DD-470	L10Q47	ED-47	UC-5447	5GA-Q47	①
C25	270			S1270	D6-271	LT6T27	GP-270	UC-5327	5GA-T27	
C26	.22	400				BC6P22J		ACE6022	4SE-P22	
C27	.22	400				BC6P22J		ACE6022	4SE-P22	
C28	.22	400				BC6P22J		ACE6022	4SE-P22	
C29	1000	2000		HVD-30-1000	DD30-102	HVB20D1	HD3-1000	DC3021	20HKB-D1	①
C30	1000	2000		HVD-30-1000	DD30-102	HVB20D1	HD3-1000	DC3021	20HKB-D1	①
C31	100			N750-D1100	TCN-100	C10T1U	TC7-100	NT-531	5TCU-T1	N750

① Not Used in Some Versions

CONTROLS

ITEM No.	RATING RESISTANCE	RATING WATTS	Harman-Kardon PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	1meg	½	RV1021636					Loudness, Tap ⓐ 500K
B	Switch							Power On-Off
R2	500K	½	RV1021634					Treble, Tap ⓐ 100K
R3	1meg	½	RV1021635					Bass
R4	15K	½	RV1021725					Signal Balance
R5A	500Ω	½	RV1021709	AB-4	A47-500-S	B11-103	TA52L	Hum Adjustment
B	Shaft			AK-1	FKS-1/4	TM1-Kit	Not Req.	
R6A	15K	½	RV1021708	AB-22	A47-15K-S	B11-118	TA153L	Bias Balance
B	Shaft			AK-1	FKS-1/4	TM1-Kit	Not Req.	
R7A	500K	½	RV1071756	BX-59	A47-500K-S	B11-133	TA55L	Aux. 1
B	500K	½		BX-59	A47-500K-S	B11-133	TA55L	Aux. 2
C	Shaft			Not Req.	FKS-1/4 *	TM1-Kit *	Not Req.	* Two Required

PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING OHMS	RATING WATT	Harman-Kardon PART No.	NOTES
R8	47K			
R9	180K			
R10	47K			
R11	56K			
R12	560K			
R13	820Ω			
R14	220K			
R15	1meg			Note 1
R16	2.2meg			Note 2
R17	68K			
R18	56K			Note 3
R19	330K			Note 4
R20	680K			Note 3
R21	270K			*
R22	1500Ω			
R23	470K			
R24	2.2meg			
R25	1meg			
R26	1500Ω			
R27	100K			
R28	1000Ω			
R29	470K			
R30	100K			
R31	100K			
R32	270K			
R33	1500Ω			
R34	470K			
R35	56K			
R36	56K			
R37	56K			
R38	180K			
R39	390K			
R40	470K			
R41	68K			Note 3
R42	1200Ω			
R43	1meg			
R44	47K			
R45	27K			
R46	47K			
R47	1000Ω			
R48	150K			
R49	47K			
R50	1000Ω			
R51	1000Ω			
R52	1000Ω			
R53	150K			
R54	47K			
R55	15K			
R56	1000Ω			
R57	1000Ω			
R58	150Ω			
R59	18K			
R60	33K			
R61	100K			
R62	270K			
R63	470K			
R64	0.33Ω			Note 5
R65	0.33Ω			Note 3
R66	0.27Ω			Note 6
R67	2.7Ω			Note 3
R68	0.27Ω			
R69	27K	2		
R70	4700Ω			

Note 1. Some versions may use 470K in this application
Note 2. Some versions may use 1meg in this application
Note 3. Not used in some versions
Note 4. Some versions may use 220K in this application
Note 5. Some versions may use 0.16Ω in this application
Note 6. Some versions may use 0.24Ω in this application

TRANSFORMER (POWER)

ITEM No.	RATING PRI.	RATING SEC. 1	RATING SEC. 2	RATING SEC. 3	Harman-Kardon PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117V ⓐ .83A	720VCT ⓐ .074A Tap ⓐ 65V ⓐ .002A	12V ⓐ 2.6A		FT1071729					

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE PRI.	IMPEDANCE SEC.	Harman-Kardon PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	NOTES
T2	4400Ω CT	16Ω Tap ⓐ 8Ω, 4Ω	FT1071730				22S78 ①		① Use Orig. Shields Do Not Use 250Ω, 500Ω Taps

PARTS LIST AND DESCRIPTIONS (Continued)

RECTIFIERS

ITEM No.	RATING	REPLACEMENT DATA				NOTES
	CURRENT (Measured)	Harman-Kardon PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	SARKES TARZIAN PART No.	
M1	.002A	Z1021726	1159	CR20	10	

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			Harman-Kardon PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M2	3AG	2/10A 125V S/B			313.200 (3AG 2/10A 125V S/B)	357001	MDL 2/10	4405

MISCELLANEOUS

ITEM No.	PART NAME	Harman-Kardon PART No.	NOTES
M3	Pilot Lamp	KB1071741	#1815
M4	Switch		Fair.-GE-Pick (Slide Type SPDT)
M5	Switch		Impedance Selector (Slide Type SPST)
M6	Switch	ER371057	Damping Factor (Rotary Wafer Type)
M7	Switch	ER1021633	Function (Rotary Wafer Type)
M8	Switch	ER1021632	Contour (Rotary Wafer Type)
M9	Switch		Rumble Filter (Slide Type DPST)
M10	Switch	ES1021717	Speaker (Slide Type DPST)

WIRING DATA

General-use Unshielded Hook-up Wire ..... Use BELDEN No. 8530 (Solid) Available in Ten Colors
8524 (Stranded) Available in Ten Colors
Power Cord ..... Use BELDEN No. 1765-B (6 Ft. Length)
1725-K (7½ Ft. Length)
Low-Loss Shielded Lead (Interconnecting)..... Use BELDEN No. 8401
Phono Pick-up Arm Cable ..... Use BELDEN No. 8430 (Two Conductor - Twisted)

CABINETS & CABINET PARTS

(When Ordering Cabinets & Cabinet Parts, Specify Model, Chassis & Color)

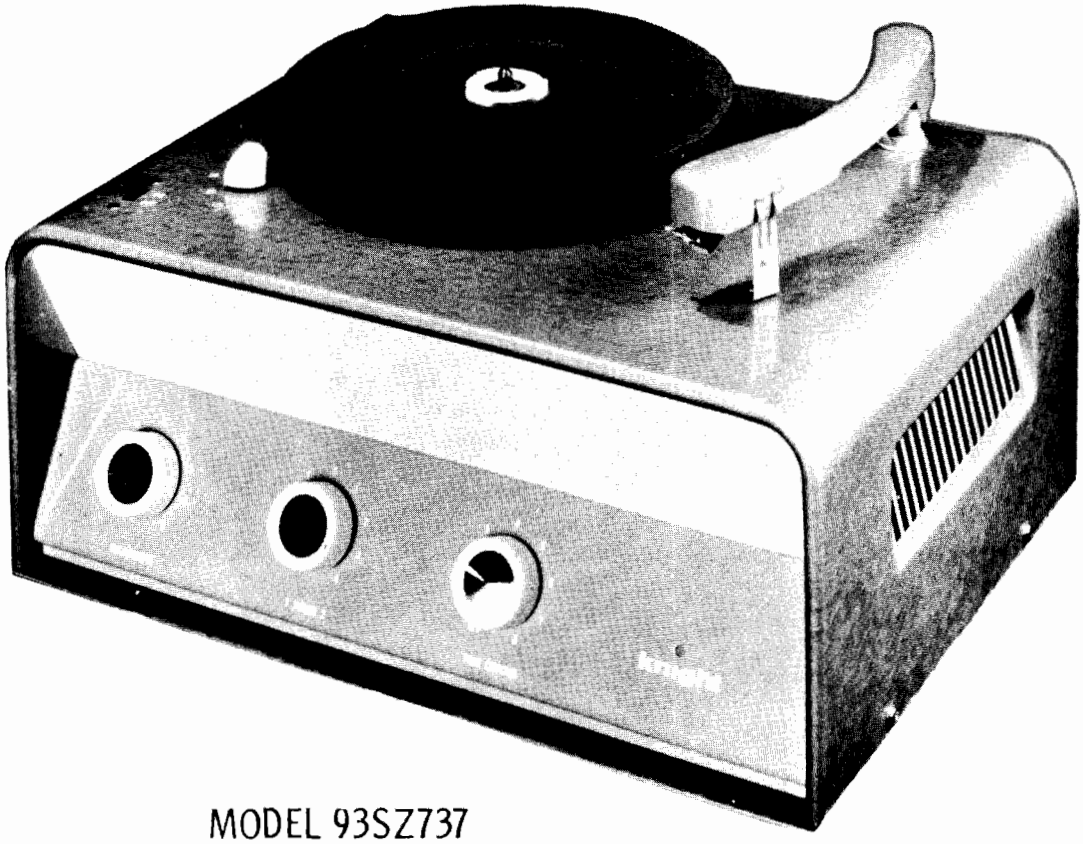
ADJUSTMENTS

BIAS BALANCE ADJUSTMENT (R6)

This control should be adjusted if an output tube (V5, V6, V7, or V8) is replaced. Connect a suitable load (speaker or resistor) across the speaker terminals and allow the amplifier to warm-up. Connect an oscilloscope across the speaker terminals. With volume control at minimum, adjust R6 for a straight line on the screen of the scope. If an oscilloscope is not available, an AC VTVM may be connected across the speaker terminals and R6 adjusted for a minimum reading on the meter.
(This should be approximately 1-5 millivolt).

SIGNAL BALANCE ADJUSTMENT (R4)

This control should be adjusted if new tubes are installed in the amplifier. The "Bias Balance" control (R6) should be adjusted prior to adjusting R4. Connect an IM analizer, with a signal ratio of 4:1, to the amplifier. Set volume control for maximum output.
Adjust the "Signal Balance" control (R4) for minimum IM.



MODEL 93SZ737

KNIGHT
MODELS 93SZ505, 93SZ737

TRADE NAME	Knight Models 93SZ505, 93SZ737
SUPPLIER	Allied Radio Corp., 100 N. Western Ave., Chicago 80, Illinois
TYPE SET	AC Operated 16 Watt 3 Channel Audio Amplifier (Model 93SZ737 Has 4 Speed Manual Record Player)
TUBES (Five)	Types 6AV6 Mic. Preamplifier, ECC83 (or) 12AD7 (or) 12AX7 AF Amplifier, (2) 6V6GT Output, 5Y3GT Rectifier
POWER SUPPLY	110-120 Volts AC - 60 Cycles RATING .6 Amp. @ 117 Volts AC, 62 Watts

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co., Inc., as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co., Inc., by the manufacturers of the particular type of replacement part listed. Reproduction or use, without express permission, of editorial or pictorial content, in any manner, is prohibited. No patent liability is assumed with respect to the use of the information contained herein. © 1957 Howard W. Sams & Co., Inc., Indianapolis 5, Indiana. Printed in U.S. of America

H170

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Mic. Preamplifier	6AV6	
V2	AF Amplifier	ECC83/ 12AX7	Note 1
V3	Output	6V6GT	
V4	Output	6V6GT	
V5	Rectifier	5Y3GT	

Note 1. Some versions use a 12AD7 in this application.

ELECTROLYTIC CAPACITORS

ITEM No.	RATING CAP.	RATING VOLT.	REPLACEMENT DATA KNIGHT PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▲40	450		AFH3-41	C0320	FP396.2	TMT-36	Q-055	TVL-3783
B	■10	450							
C	▲10	450							
C2	8	450		PRS450V8	BR845	TC71	TD-8-450	MT-4508	TVA-1704
C3	35	50		PRS150V40	BR505	TC48	TD-40-150	MT-1540	TVA-1308

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING CAP.	RATING VOLT	REPLACEMENT DATA KNIGHT PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C4	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C5	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C6	500				DD-501		ED-500			10%
C7	150				DD-151	L10T15	ED-150			10%
C8	2200									10%
C9	.047	600		P688N-047	DF-503	CUB6S47		GEM-6147	6TM-S47	
C10	.047	600		P688N-047	DF-503	CUB6S47		GEM-6147	6TM-S47	
C11	.047	600		P688N-047	DF-503	CUB6S47		GEM-6147	6TM-S47	
C12	.047	600		P688N-047	DF-503	CUB6S57		GEM-6147	6TM-S47	
C13	.02	600		P688N-02	DD-203	CUB6S2		GEM-612	6TM-S2	

CONTROLS

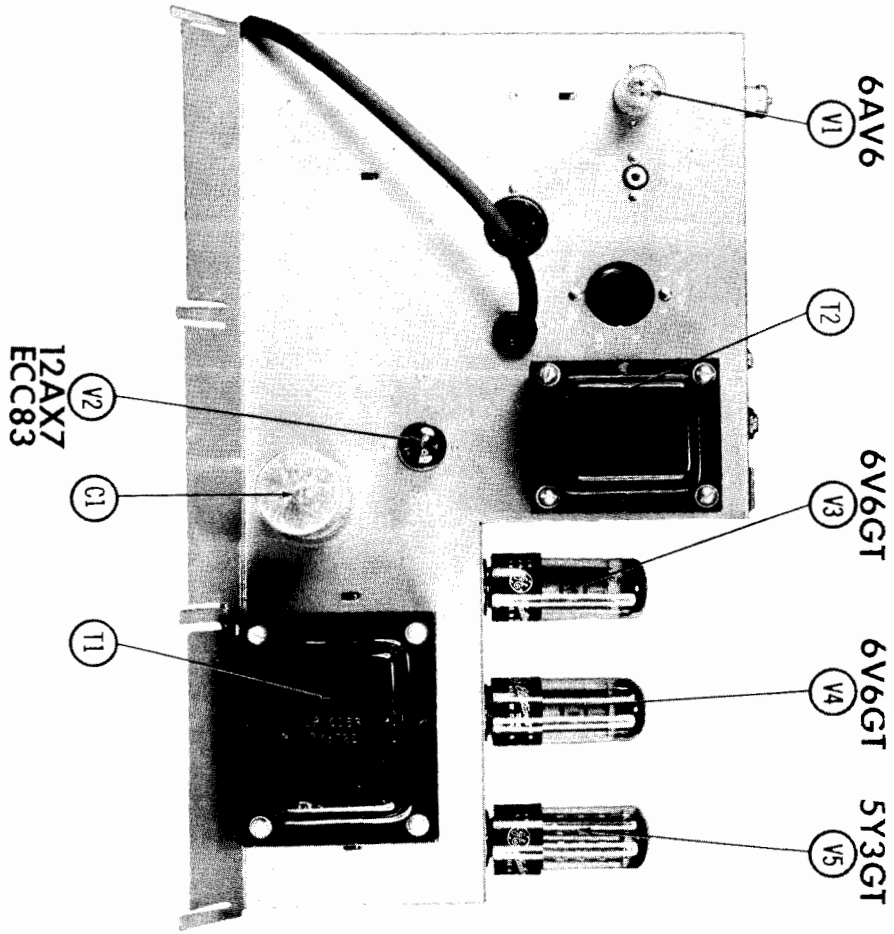
ITEM No.	RATING RESISTANCE	RATING WATTS	REPLACEMENT DATA KNIGHT PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	1Meg	½	RP-105AC-C	B-70	A47-1Meg-Z	Q13-137	U53	Tone
B	Shaft			Not Req.	KSS-3	Not Req.	Not Req.	
C	Switch			KB-1	SWE-12	76-1	US-26	
R2	4Meg	½	RP-405A					Phono #1 & #2, Tap @ 2Meg
R3A	1Meg	½	RP-105A	B-70	A47-1Meg-Z	Q13-137	U53	Mic. Input
B	Shaft			Not Req.	KSS-3	Not Req.	Not Req.	

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA KNIGHT PART No.	REPLACEMENT DATA IRC PART No.	NOTES
R4	10Meg			BTS-10Meg	
R5	470K			BTS-470K	
R6	220K			BTS-220K	
R7	470K			BTS-470K	
R8	470K			BTS-470K	
R9	2700Ω			BTS-2700	
R10	330K			BTS-330K	
R11	470K			BTS-470K	
R12	470K			BTS-470K	
R13	100K			BTS-100K	
R14	1000Ω			BTS-1000	
R15	100K			BTS-100K	
R16	470K			BTS-470K	
R17	250Ω	4		PW4-250	
R18	470K			BTS-470K	
R19	3300Ω	1		BTA-3300	
R20	10K			BTS-10K	
R21	22K			BTS-22K	

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	KNIGHT PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordorson PART No.	Triad PART No.
T1	117VAC @ .6A	640VCT @ .076A	5VAC @ 2A	6.3VCT @ 1.5A	LP-0258	P9315	P-2953	PM8410	22R05	R-148

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	KNIGHT PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordorson PART No.	Triad PART No.	
T2	6900Ω CT	500Ω Tap @ 70V, 250Ω, 16Ω, 8Ω, 4Ω	L0-0150						

PHONO CARTRIDGE

ITEM No.	REPLACEMENT DATA					REMARKS
	KNIGHT PART No.	ASTATIC PART No.		ELECTRO-VOICE PART No.		
		CARTRIDGE	NEEDLE	CARTRIDGE	MOUNT	
M1		55T * P-55-T	GD	56 * 2756	PT-2	* Tone Arm Complete With Cartridge.

ASTATIC NEEDLE LISTING SHOWN ABOVE IS SPECIFIED FOR THE RESPECTIVE REPLACEMENT CARTRIDGE LISTED. FOR ORIGINAL CARTRIDGE NEEDLE REPLACEMENTS SEE BELOW.

PHONO NEEDLE

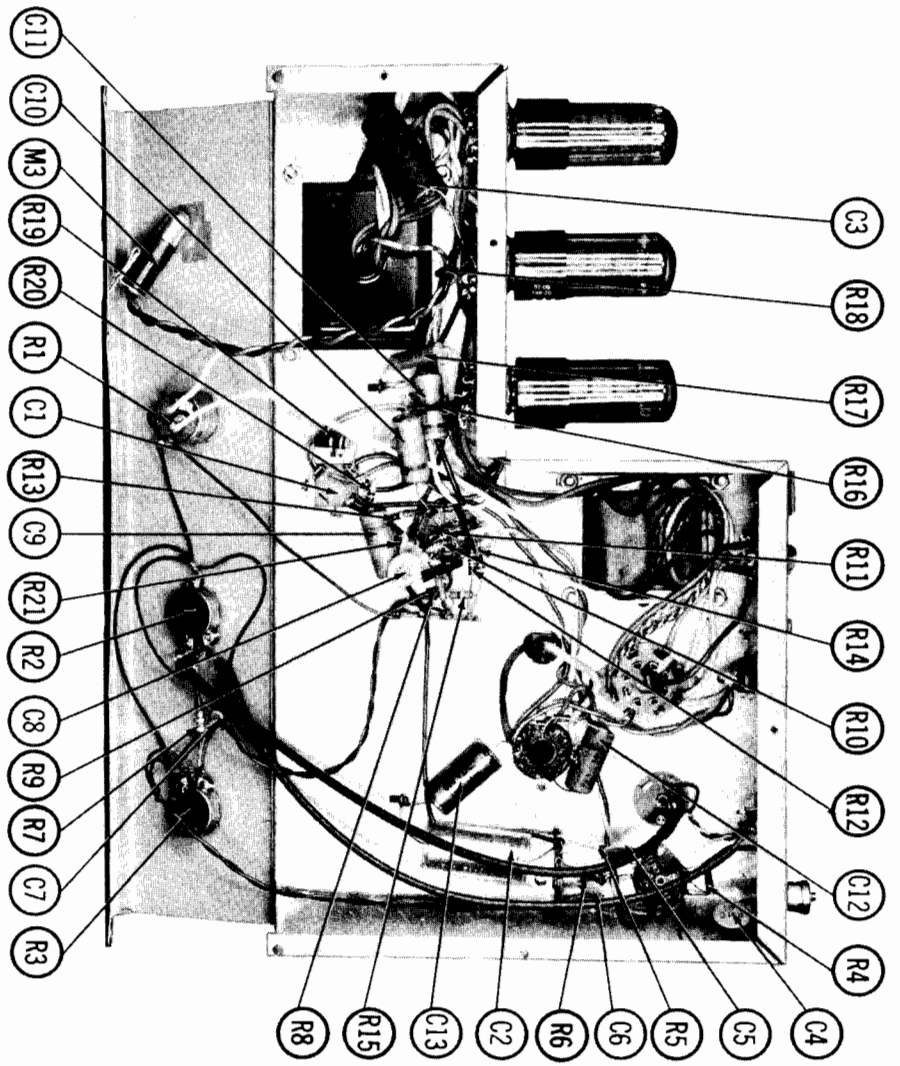
(FOR REPLACEMENT IN ORIGINAL EQUIPMENT CARTRIDGE)

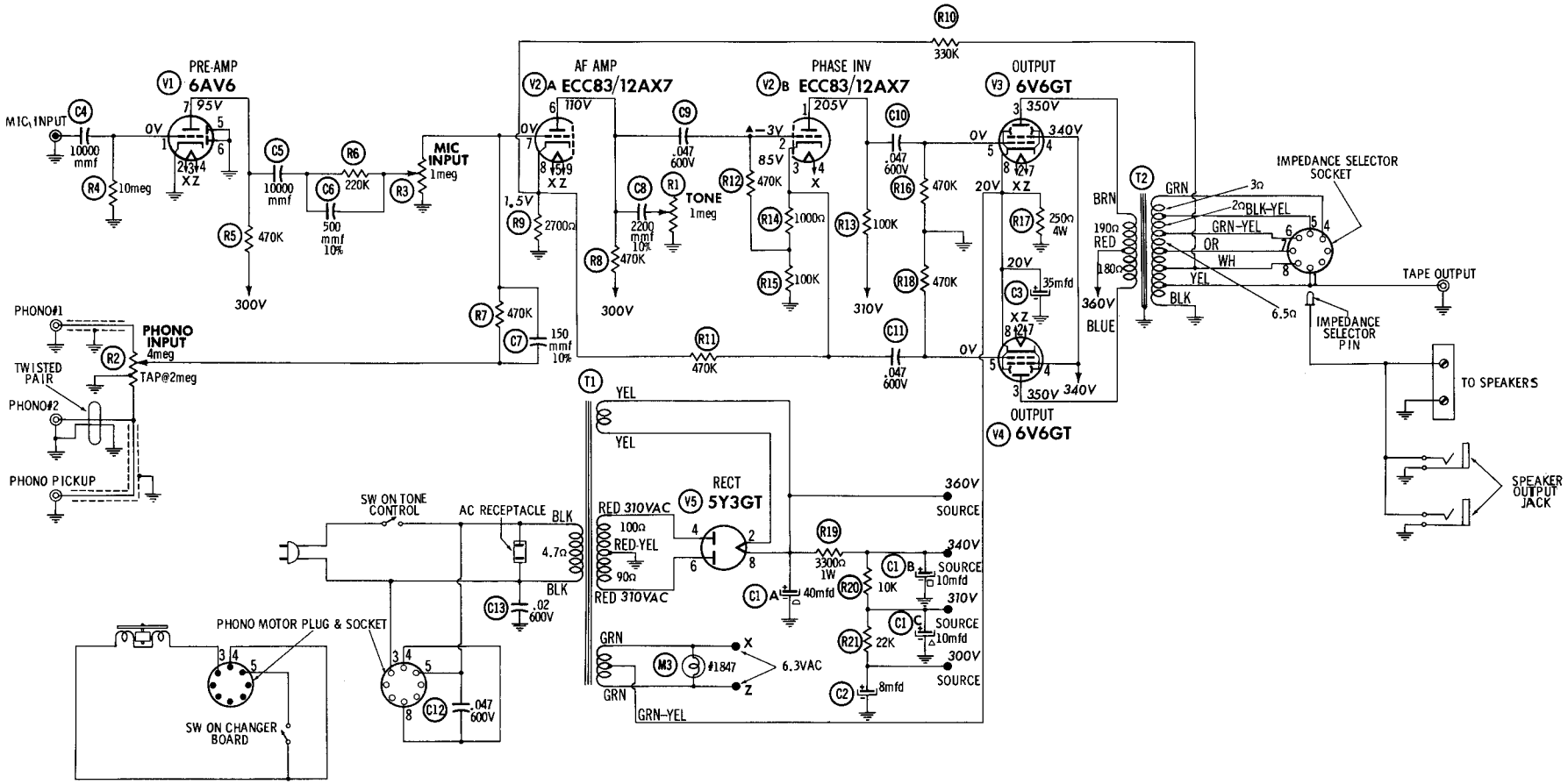
ITEM No.	REPLACEMENT DATA			REMARKS
	KNIGHT PART No.	JENSEN PART No.	WALCO PART No.	
M2		† A-71 or †♦ A-71SD or ♦ A-71D	* W-8TPA or † W-8TPS or †♦ W-8DS or ♦ W-8TPD	* Metal † Jewel ♦ Diamond

MISCELLANEOUS

ITEM No.	PART NAME	KNIGHT PART No.	NOTES
M3	Panel Lamp		#1847

CHASSIS—BOTTOM VIEW





RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	6AV6	10Meg	0Ω	250Ω	250Ω	0Ω	0Ω	† 500K		
V2	ECC83/ 12AX7	† 110K	570K	100K	250Ω	250Ω	† 500K	650K	2500Ω	250Ω
V3	6V6GT	0Ω	250Ω	† 190Ω	† 3300Ω	470K	NC	250Ω	250Ω	
V4	6V6GT	0Ω	250Ω	† 180Ω	† 3300Ω	470K	NC	250Ω	250Ω	
V5	5Y3GT	NC	20K(Min)	TP	100Ω	TP	90Ω	NC	20K(Min)	

† MEASURED FROM PIN 2 OF V5
▲ MEASURED FROM PIN 3 OF V2
TP TIE POINT
NC NO CONNECTION

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

A PHOTOFACT STANDARD NOTATION SCHEMATIC
Howard W. Sams & Co., Inc. 1957

KNIGHT
MODEL 93SZ645

TRADE NAME	Knight Model 93SZ645		
SUPPLIER	Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.		
TYPE SET	AC (or) Battery Operated 4 Channel 25 Watt Mobile Audio Amplifier		
TUBES (Seven)	Types 12AX7 Mic. 1-Mic, 2-Mag. Preamp., 12AX7 Mic. 1-Mic. 2-Mag. Preamp. 12AX7 AF Amp. -Phase Inv., (2) 6L6G Output, (2) 6X5GT Rectifier		
POWER SUPPLY	110-130 Volts AC - 60 Cycles (or) 6 Volt Storage Battery (or) 12 Volt Storage Battery	RATING	. 92 Amp. @ 117 Volts AC (100 Watts) (or) 15. 5 Amp. @ 6. 3 Volts DC (or) 8. 75 Amp. @ 12. 6 Volts DC

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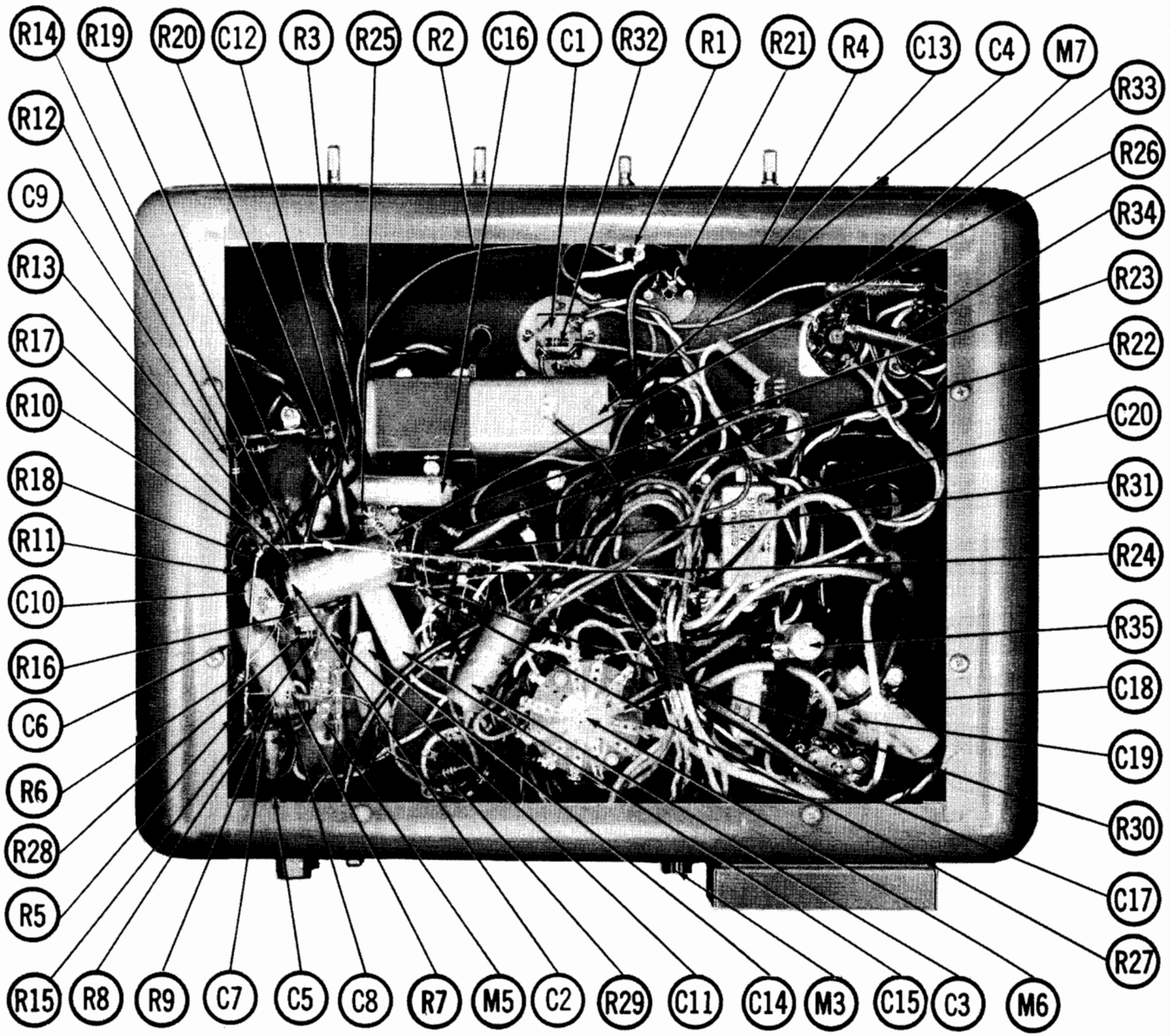


CHASSIS BOTTOM VIEW

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Mic. 1-Mic. 2-Mag. Preamp.	12AX7	
V2	Mic. 1-Mic. 2-Mag. Preamp.	12AX7	
V3	AF Amp. -Phase Inverter	12AX7	
V4	Output	6L6G	

ITEM No.	USE	TYPE	NOTES
V5	Output	6L6G	
V6	Rectifier	6X5GT	
V7	Rectifier	6X5GT	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA						
	CAP.	VOLT.	KNIGHT PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▲40	450		AFH3-41	CO320	FP396. 2	TMT-36	Q-055	TVL-3783
B	■10	450							
C	▲10	450							
C2	6	450		PRS450V8	BR845	TC71	TD-8-450	FM-4508	TVA-1704
C3	35	50		PRS150V40	BR505	TC39	TD-50-50	FM-0550	TVA-1308
C4	4. 0	600		JP09MR600V4	TJU6040	TX803	PLM6-4	7106-4	CR46

FIXED CAPACITORS

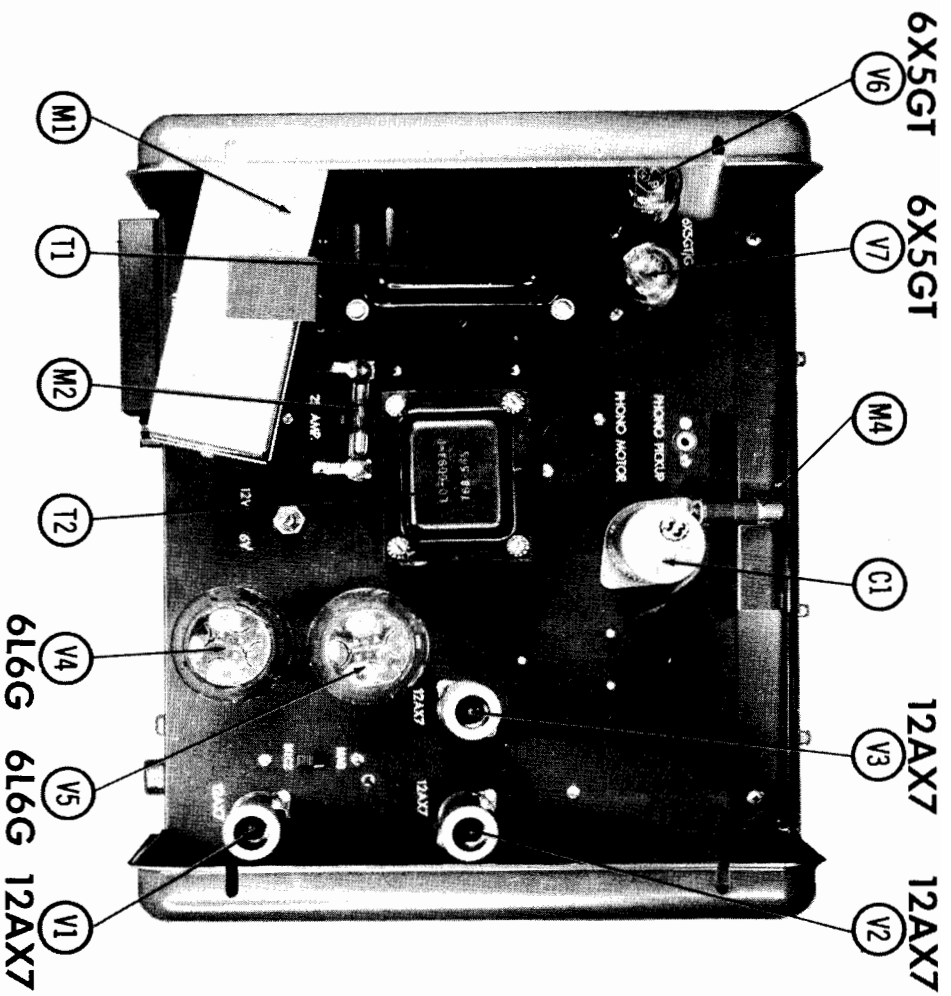
Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

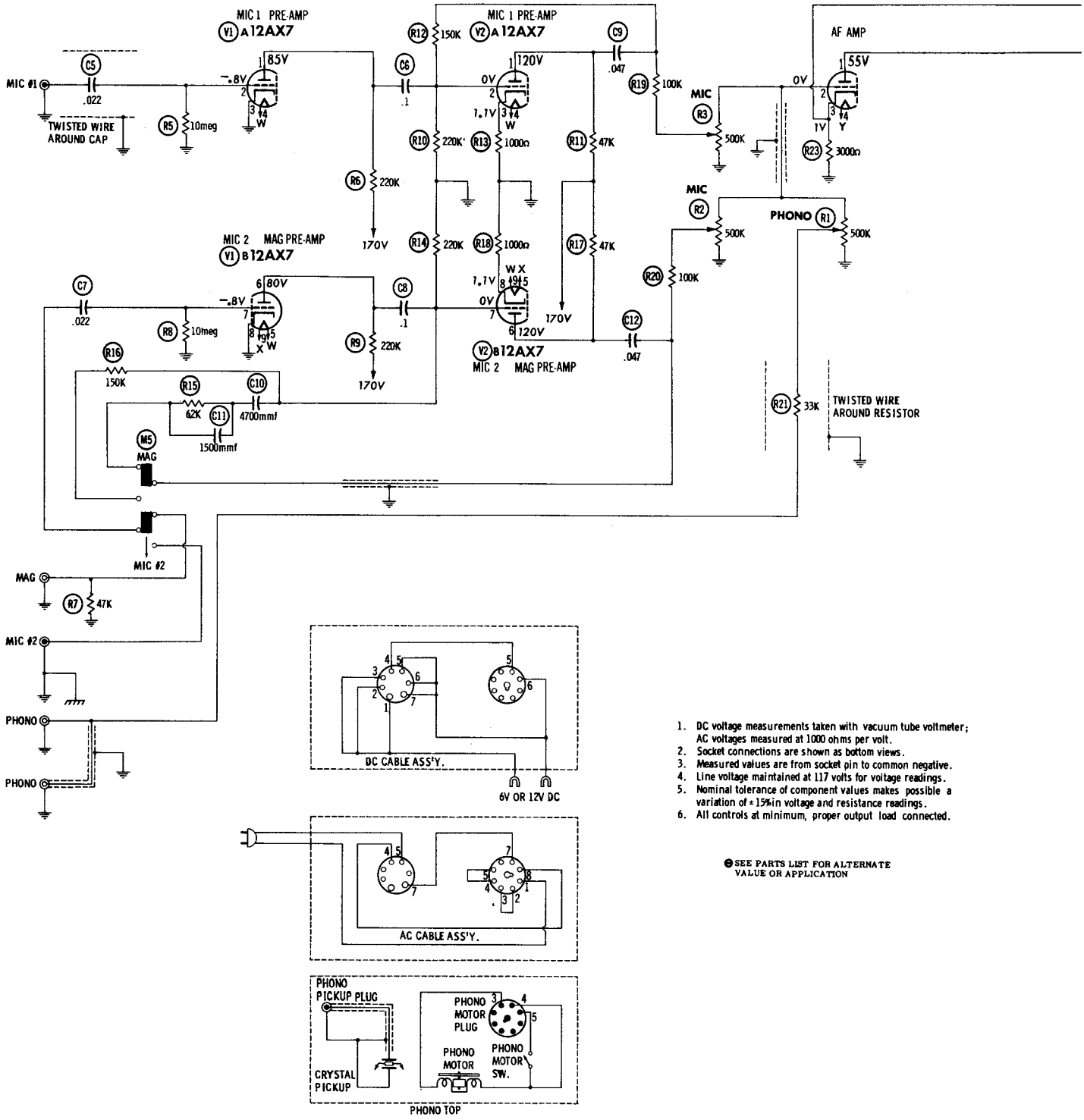
ITEM No.	RATING		REPLACEMENT DATA							NOTES
	CAP.	VOLT	KNIGHT PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C5	. 022	200		BPD-02	DD-203	CUB4S22	ED-02	GEM-4122	4TM-S22	
C6	. 1	600		P668N-1	DF-104	CUB6P1		GEM-601	6TM-P1	
C7	. 022	200		BPD-02	DD-203	CUB4S22	ED-02	GEM-4122	4TM-S22	
C8	. 1	600		P668N-1	DF-104	CUB6P1		GEM-601	6TM-P1	
C9	. 047	600		BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	
C10	4700			BPD-0047	DD-472	K079	ED-0047	UC-5247	5HK-D47	
C11	1500			BPD-0015	DD-152	K071	ED-0015	UC-5215	5GA-D15	
C12	. 047	600		BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	
C13	. 047	600		BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	
C14	. 047	600		BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	
C15	. 047	600		BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	
C16	. 047	600		BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	
C17	. 47	200		P268N-47		CUB2P47		GEM-4047	2TM-P47	
C18	. 47	200		P268N-47		CUB2P47		GEM-4047	2TM-P47	
C19	. 47	200		P288N-47		CUB2P47		GEM-4047	2TM-P47	
C20	. 5	400								

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	KNIGHT PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	
R1A	500K	½		AB-59	A47-500K-S	Q11-133	U50	Phono Volume
B	Shaft			AK-4	KSS-3	Not Req.	Not Req.	
C	Switch			KB-1	SWE-12	76-1	US-26	
R2A	500K	½		AB-60	A47-500K-Z	Q13-133	U46	Mic. 2-Mag. Volume
B	Shaft			AK-4	KSS-3	Not Req.	Not Req.	
R3A	500K	½		AB-60	A47-500K-Z	Q13-133	U46	Mic. 1 Volume
B	Shaft			AK-4	KSS-3	Not Req.	Not Req.	
R4A	500K	½		AB-60	A47-500K-Z	Q13-133	U48	Tone
B	Shaft			AK-4	KSS-3	Not Req.	Not Req.	

CHASSIS—TOP VIEW





1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

⊖ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7	†245K	10Meg	0Ω	200Ω	200Ω	†245K	10Meg	0Ω	200Ω
V2	12AX7	†75K	100K	1000Ω	200Ω	200Ω	†75K	220K	1000Ω	200Ω
V3	12AX7	†485K	125K	3000Ω	200Ω	200Ω	†65K	550K	48K	200Ω
V4	6L6G	TP	200Ω	†100Ω	†7500Ω	470K	TP	200Ω	200Ω	
V5	6L6G	TP	200Ω	†100Ω	†7500Ω	470K	TP	200Ω	200Ω	
V6	6X5GT	NC	200Ω	110Ω	NC	110Ω	TP	200Ω	30K	
V7	6X5GT	NC	200Ω	120Ω	TP	120Ω	NC	200Ω	30K	

† MEASURED FROM PIN 8 OF V6
NC NO CONNECTION
TP TIE POINT

A PHOTOFACT STANDARD NOTATION SCHEMATIC

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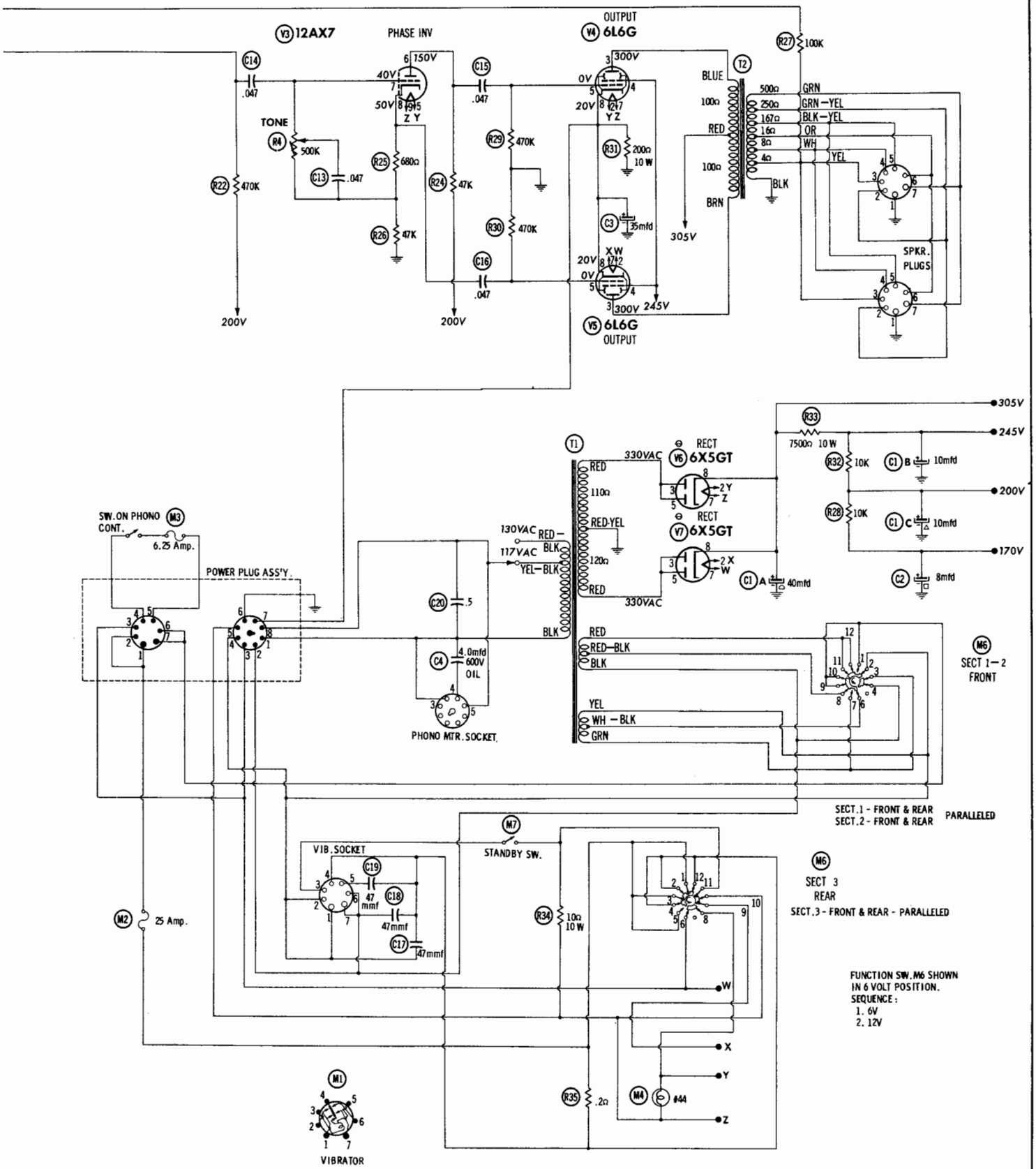

V3 12AX7
PHASE INV
V4 6L6G
OUTPUT
V5 6L6G
OUTPUT
V6 6X5GT
RECT
V7 6X5GT
RECT
T1
T2
TONE
R4 500K
R22 470K
R24 47K
R25 680Ω
R26 47K
R27 100K
R29 470K
R30 470K
R31 200Ω 10 W
R32 10K
R33 7500Ω 10 W
R34 10Ω 10 W
R35 .2Ω
R28 10K
C1 A 40mfd
C1 B 10mfd
C1 C 10mfd
C2 8mfd
C3 35mfd
C4 4.0mfd 600V OIL
C13 .047
C14 .047
C15 .047
C16 .047
C17 47mmf
C18 47mmf
C19 47 mmf
C20 .5
M1 VIBRATOR
M2 25 Amp.
M3 SW. ON PHONO CONT.
6.25 Amp.
POWER PLUG ASS'Y.
PHONO MTR. SOCKET
VIB. SOCKET
M4 #44
M6 SECT 1—2 FRONT
SECT 3 REAR
M7 STANDBY SW.
SECT. 1 - FRONT & REAR
SECT. 2 - FRONT & REAR
PARALLELED
SECT. 3 - FRONT & REAR - PARALLELED
FUNCTION SW. M6 SHOWN IN 6 VOLT POSITION.
SEQUENCE:
1. 6V
2. 12V
200V
245V
305V
170V
330VAC
130VAC
117VAC
RED
RED-YEL
RED-BLK
BLK
YEL
WH-BLK
GRN
YEL
BLUE
BRN
500Ω
250Ω
167Ω
16Ω
8Ω
4Ω
100Ω
GRN
GRN-YEL
BLK-YEL
OR
WH
YEL
BLK
SPKR. PLUGS
W
X
Y
Z

PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	KNIGHT PART No.	IRC PART No.	
R5	10Meg			BTS-10Meg	
R6	220K			BTS-220K	
R7	47K			BTS-47K	
R8	10Meg			BTS-10Meg	
R9	220K			BTS-220K	
R10	220K			BTS-220K	
R11	47K			BTS-47K	
R12	150K			BTS-150K	
R13	1000Ω			BTS-1000	
R14	220K			BTS-220K	
R15	62K 5%			BTS-62K 5%	
R16	150K			BTS-150K	
R17	47K			BTS-47K	
R18	1000Ω			BTS-1000	
R19	100K			BTS-100K	
R20	100K			BTS-100K	

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	KNIGHT PART No.	IRC PART No.	
R21	33K			BTS-33K	
R22	470K			BTS-470K	
R23	3000Ω 5%			BTS-3000 5%	
R24	47K			BTS-47K	
R25	680Ω			BTS-680	
R26	47K			BTS-47K	
R27	100K			BTS-100K	
R28	10K			BTS-10K	
R29	470K			BTS-470K	
R30	470K			BTS-470K	
R31	200Ω	10		PW10-200	
R32	10K			BTS-10K	
R33	7500Ω	10		PW10-7500	
R34	10Ω	10		PW10-10	
R35	.2Ω	20			

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	KNIGHT PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
	AC OPERATION									
T1	130VAC Tap ⓐ 117VAC ⓐ .92A	660VCT ⓐ .120A	6.3VCT ① ⓐ 1.5A 6.3VCT ② ⓐ 2.2A	6.3VCT ① ⓐ 1.5A 6.3VCT ② ⓐ 2.2A	LP-0239A					
	DC OPERATION									
	PRI. 1	660VCT ⓐ .120A								
	6.3VCT ⓐ 2.5A ③ 6.3VCT ⓐ 3A ④									
	PRI. 2									
	6.3VCT ⓐ 2.5A ③ 6.3VCT ⓐ 3A ④									

① 6V filament operation.
② 12V filament operation.
③ 6V input operation.
④ 12V input operation.

PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	KNIGHT PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordorson PART No.	Triad PART No.	
T2	8KCT	500Ω Tap ⓐ 250Ω, 167Ω (70V), 16Ω, 8Ω 4Ω	LO-0093-D						

VIBRATOR

ITEM No.	TYPE	INPUT VOLTS	FREQUENCY	REPLACEMENT DATA				NOTES
				KNIGHT PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	RADIART PART No.	
M1	Interrupter	6 or 12	60~	JV-0021	6VB6UL		6VB6UL	

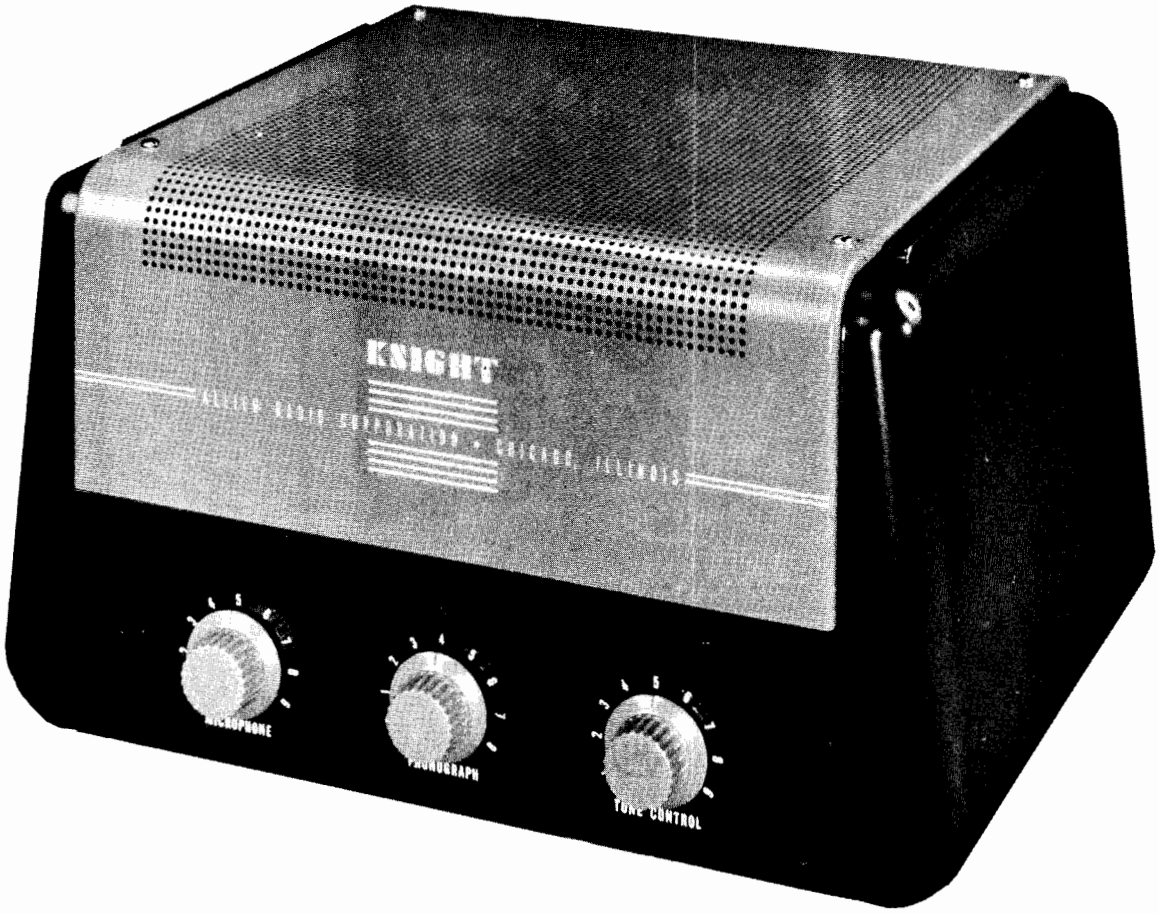
FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			KNIGHT PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M2	411 4AG 3AG	25A 32V			411025. (4AG 25A)	456001	MDM 25	4512
M3	313	6 1/4A 32V			3136.25 (3AG 6 1/4A)	341001	MDL 6 1/4	HKP

MISCELLANEOUS

ITEM No.	PART NAME	KNIGHT PART No.	NOTES
M4	Pilot Light		#44
M5	Switch		Mag-Mic. 2, Slide Type (DPDT)
M6	Switch		Power Changeover (Rotary, Wafer Type) 3 Gang.
M7	Switch		DC On-Stand By, Slide Type (SPST)

KNIGHT
MODEL 93SZ655



KNIGHT
MODEL 93SZ655

TRADE NAME	Knight Model 93SZ655
SUPPLIER	Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.
TYPE SET	AC Operated 3 Channel 15 Watt Audio Amplifier
TUBES (Five)	Types 6SJ7 Mic Preamplifier, 6SC7 AF Amp.-Phase Inv., (2) 6V6GT Output, 5Y3GT Rectifier
POWER SUPPLY	105-130 Volts AC 50/60 Cycles RATING .8 Amp. @ 117 Volts AC (75 Watts)

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Mic Preamplifier	6SJ7	
V2	AF Amp.-Phase Inv.	6SC7	
V3	Output	6V6GT	
V4	Output	6V6GT	
V5	Rectifier	5Y3GT	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA						
	CAP.	VOLT.	KNIGHT PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▲40	450		AFH3-41	CO320	FP396.2	TMT-36	Q-055	TVL-3783
B	■10	450							
C	▲10	450							
C2	8	450		PRS450V8	BR845	TC71	TD-8-450	FM-4508	TVA-1704
C3	35	50		PRS150V40	BR505	TC39	TD-50-50	FM-0550	TVA-1308

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA							NOTES
	CAP.	VOLT	KNIGHT PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C4	.047	600		BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	
C5	.047	600		BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	
C6	.047	600		BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	
C7	220			1468-00022	D6-221	5W5T22	GP-220	UC-5322	1FM-322	
C8	.0022	600		BPD-0022	D6-222	CUB6D22	ED-0022	GEM-6222	6TM-D22	
C9	.047	600		BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	
C10	.047	600		BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	
C11	.05	600		BPD-05	DF-503	CUB6S5		GEM-615	6TM-S5	
C12	.047	600		BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	KNIGHT PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	
R1A	500K	½		AB-59	A47-500K-S	Q11-133	U50	Phono
B	Shaft			AK-4	KSS-3	Not Req.	Not Req.	
C	Switch			KB-1	SWE-12	76-1	US-26	
R2A	500K	½		AB-60	A47-500K-Z	Q13-133	U48	Mic.
B	Shaft			AK-4	KSS-3	Not Req.	Not Req.	
R3A	500K	½		AB-60	A47-500K-Z	Q13-133	U48	Tone
B	Shaft			AK-4	KSS-3	Not Req.	Not Req.	

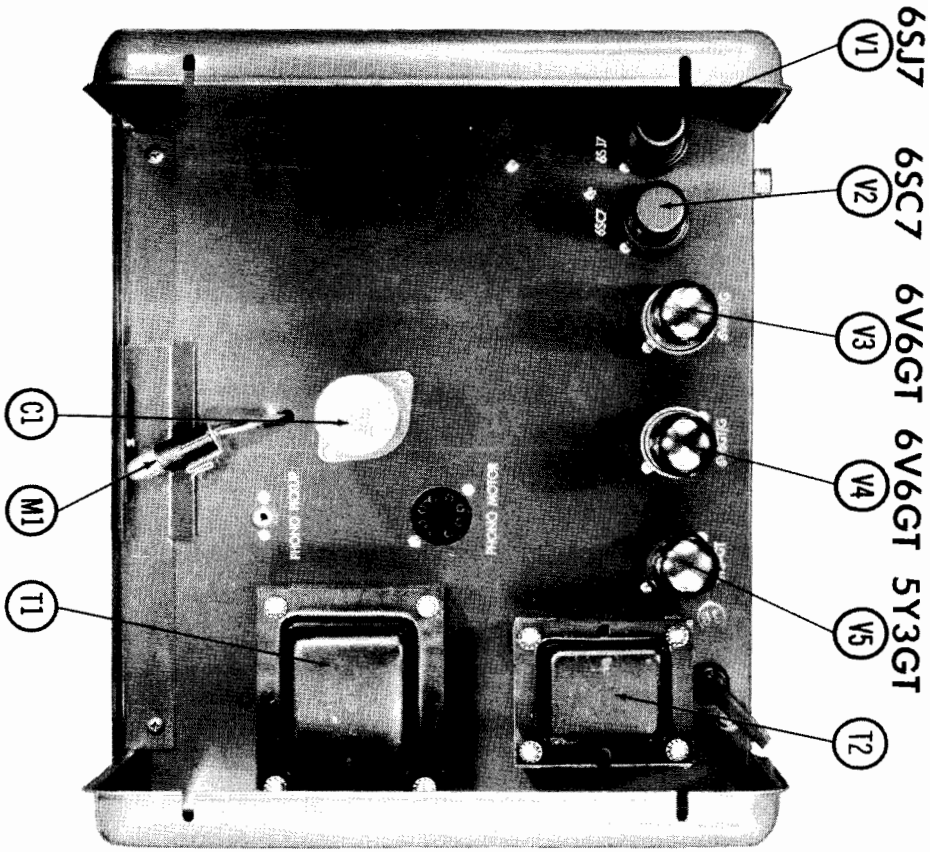
RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	KNIGHT PART No.	IRC PART No.	
R4	100K			BTS-100K	
R5	10Meg			BTS-10Meg	
R6	470K			BTS-470K	
R7	2.2Meg			BTS-2.2Meg	
R8	470K			BTS-470K	
R9	470K			BTS-470K	
R10	10K			BTS-10K	
R11	470K			BTS-470K	

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	KNIGHT PART No.	IRC PART No.	
R12	470K			BTS-470K	
R13	1500Ω			BTS-1500	
R14	10K			BTS-10K	
R15	10K			BTS-10K	
R16	470K			BTS-470K	
R17	250Ω	10		PW10-250	
R16	3300Ω	1		BTA-3300	

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	KNIGHT PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordorson PART No.	Triod PART No.
T1	130VAC tap @ 117VAC @ .8A	650VCT @ .085A	5VAC @ 3A	6.3VCT @ 1.85A	LP-0168				22R06 ①	

① This transformer does not provide a tap on primary winding for 130VAC input.

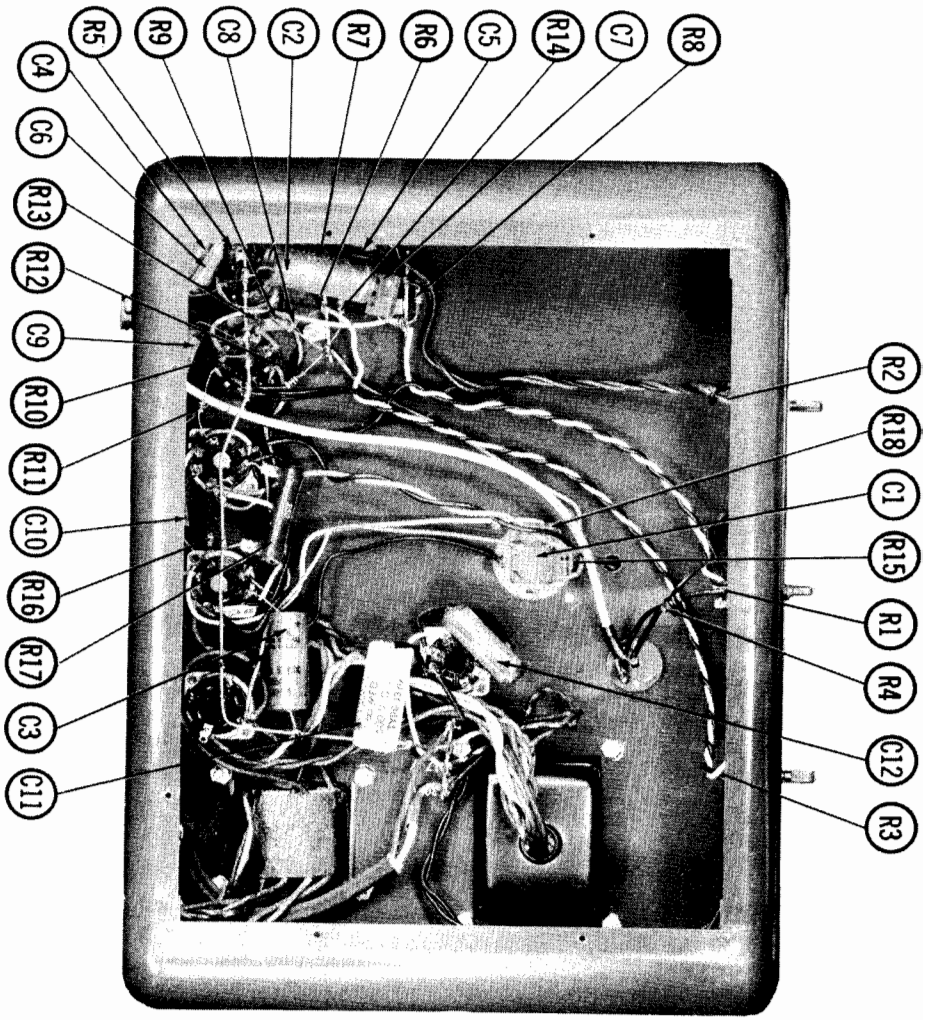
TRANSFORMER (AUDIO OUTPUT)

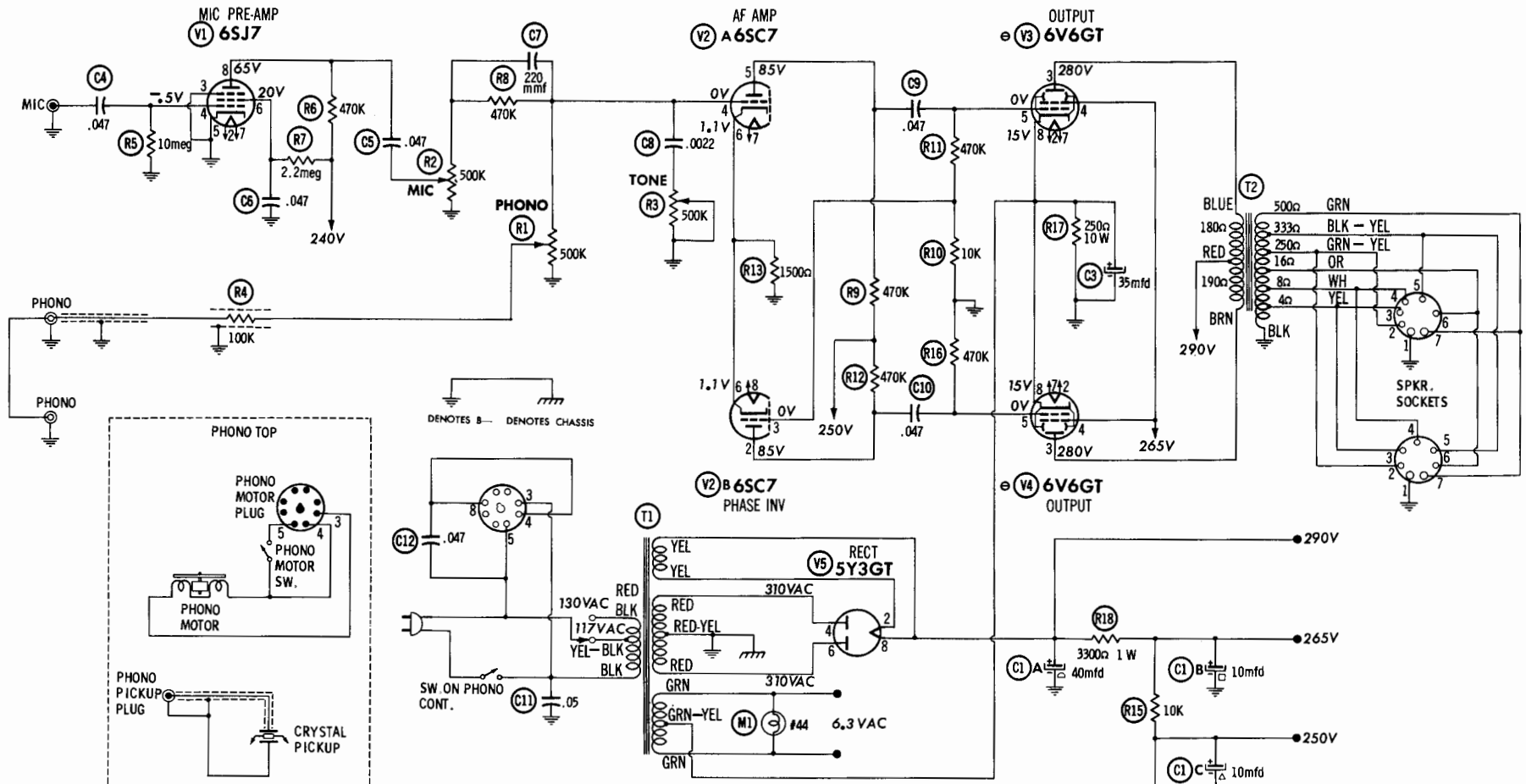
ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	KNIGHT PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordorson PART No.	Triad PART No.	
T2	10K CT	500Ω tap @ 333Ω (70V), 250Ω, 16Ω, 8Ω, 4Ω	LO-0092-B						

MISCELLANEOUS

ITEM No.	PART NAME	KNIGHT PART No.	NOTES
M1	Pilot Light		#44

CHASSIS—BOTTOM VIEW





RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1	6SJ7	0Ω	250Ω	0Ω	10Meg	0Ω	†2.2Meg	250Ω	†495K
V2	6SC7	0Ω	†485K	10K	340K	†485K	1500Ω	250Ω	250Ω
V3	6V6GT	0Ω	250Ω	†180Ω	†3300Ω	480K	NC	250Ω	250Ω
V4	6V6GT	NC	250Ω	†190Ω	†3300Ω	470K	NC	250Ω	250Ω
V5	5Y3GT	NC	50K	NC	76Ω	NC	72Ω	NC	50K

† MEASURED FROM PIN 8 OF V5.
NC NO CONNECTION

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

⊖ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

A PHOTOFACT STANDARD NOTATION SCHEMATIC

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KNIGHT
MODEL 93SZ682

KNIGHT
MODEL 93SZ682

TRADE NAME	Knight Model 93SZ682
SUPPLIER	Allied Radio Corp., 100 N. Western Ave., Chicago 80, Illinois
TYPE SET	AC Operated 5 Channel 30 Watt Audio Amplifier
TUBES (Six)	Types 6SC7 Preamplifier, 6SC7 Mixer, 6SC7 AF Amp.-Phase Inv., (2) 6L6G Output, 5U4G Rectifier
POWER SUPPLY	105-130 Volts AC-50/60 Cycles RATING 1.18 Amp. @ 117 Volts AC (125 Watts)

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

"The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co., Inc., as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co., Inc., by the manufacturers of the particular type of replacement part listed." "Reproduction or use, without express permission, of editorial or pictorial content, in any manner, is prohibited. No patent liability is assumed with respect to the use of the information contained herein. Copyright 1957 by Howard W. Sams & Co., Inc., Indianapolis 5, Indiana, U. S. of America. Copyright under international Copyright Union. All rights reserved under Inter-American Copyright Union (1910) by Howard W. Sams & Co., Inc." Printed in U. S. of America

G792

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	MIC 1 Preamplifier — MIC 2 — Mag Preamplifier	6SC7	
V2	Mixer	6SC7	
V3	AF Amp. - Phase Inv.	6SC7	
V4	Output	6L6G	
V5	Output	6L6G	
V6	Rectifier	5U4G	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING CAP.	RATING VOLT.	REPLACEMENT DATA KNIGHT PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▲40	450		AFH3-41	C0320	FP396-2	TMT-36	Q-055	TVL-3783
B	▲10	450							
C	■10	450							
C2	8	450		PRS450V8	BR845	TC71	TD-8-450	FM-4508	TVA-1704
C3	35	50		PRS150V40	BR505	TC39	TD-50-50	FM-0550	TVA-1308

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

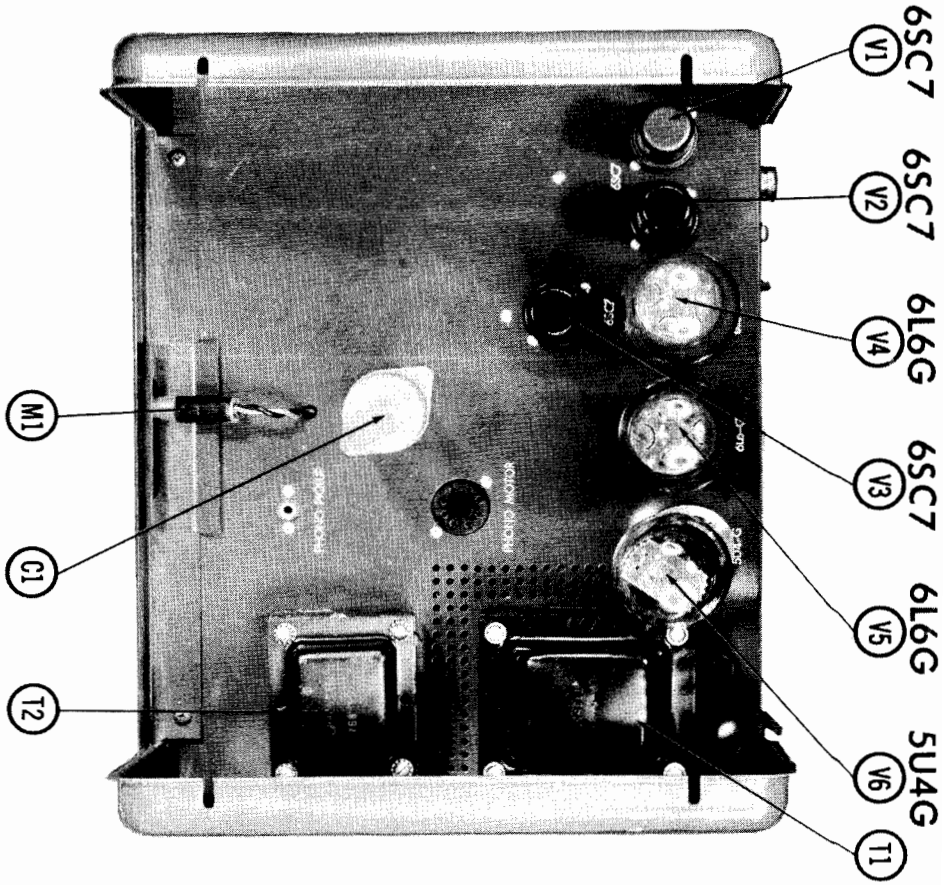
ITEM No.	RATING CAP.	RATING VOLT	REPLACEMENT DATA KNIGHT PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C4	.047	600		BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	
C5	.047	600		BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	
C6	.047	600		BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	
C7	4700			BPD-0047	DD-472	K079	ED-0047	UC-5247	5HK-D47	
C8	.01	600		BPD-01	DD-103	CUB6S1	ED-01	GEM-611	6TM-S1	
C9	.047	600		BPD-05	DD-503	CUB6S47		GEM-6147	6TM-S47	
C10	.047	600		BPD-05	DD-503	CUB6S47		GEM-6147	6TM-S47	
C11	39			1469-000039		5R5Q39			MS-439	
C12	.0033	600		BPD-0033	D6-332	CUB6D33	ED-0033	GEM-6233	6TM-D33	
C13	220			1469-00022		5R5T22			MS-322	Note #1
C14	.047	600		BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	
C15	.047	600		BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	
C16	.05	600		BPD-05	DF-503	CUB6S5		GEM-615	8TM-S5	
C17	.047	600		BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	

Note #1. Some Versions Use 330MMF In This Application.

CONTROLS

ITEM No.	RATING RESISTANCE	RATING WATTS	REPLACEMENT DATA KNIGHT PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	500K	½		AB-59	A47-500K-S	Q11-133	U50	Phono
B	Shaft			AK-4	KSS-3	Not Req.	Not Req.	
C	Switch			KB-1	SWE-12	76-1	US-26	
R2A	500K	½		AB-59	A47-500K-S	Q11-133	U50	MIC 2-Mag
B	Shaft			AK-4	KSS-3	Not Req.	Not Req.	
C	Switch			KB-1	SWE-12	76-1	US-26	
R3A	500K	½		AB-60	A47-500K-Z	Q13-133	U48	MIC 1
B	Shaft			AK-4	KSS-3	Not Req.	Not Req.	
R4A	500K	½		AB-60	A47-500K-Z	Q13-133	U48	Tone
B	Shaft			AK-4	KSS-3	Not Req.	Not Req.	

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	KNIGHT PART No.	IRC PART No.	
R5	10Meg			BTS-10Meg	
R6	220K			BTS-220K	
R7	10Meg			BTS-10Meg	
R8	100K			BTS-100K	
R9	220K			BTS-220K	
R10	47K			BTS-47K	
R11	100K			BTS-100K	
R12	22K			BTS-22K	
R13	180K			BTS-180K	
R14	1800Ω			BTS-1800	
R15	1.5Meg			BTS-1.5Meg	

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	KNIGHT PART No.	IRC PART No.	
R16	470K			BTS-470K	
R17	10K			BTS-10K	
R18	470K			BTS-470K	
R19	470K			BTS-470K	
R20	1500Ω			BTS-1500	
R21	10K			BTS-10K	
R22	10K			BTS-10K	
R23	470K			BTS-470K	
R24	200Ω	10		PW10-200	
R25	7500Ω	10		PW10-7500	

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	KNIGHT PART No.	Halldorson PART No.	Merit PART No.	Stoncor PART No.	Thordorson PART No.	Triad PART No.
T1	130VAC Tap @ 117VAC @ 1.18A	725VCT @ .135A	5VAC @ 3A	6.3VCT @ 2.9A	LP-0198-B				24R05 ①	

① This Transformer Does Not Provide A Tap On Primary Winding For 130VAC Input.

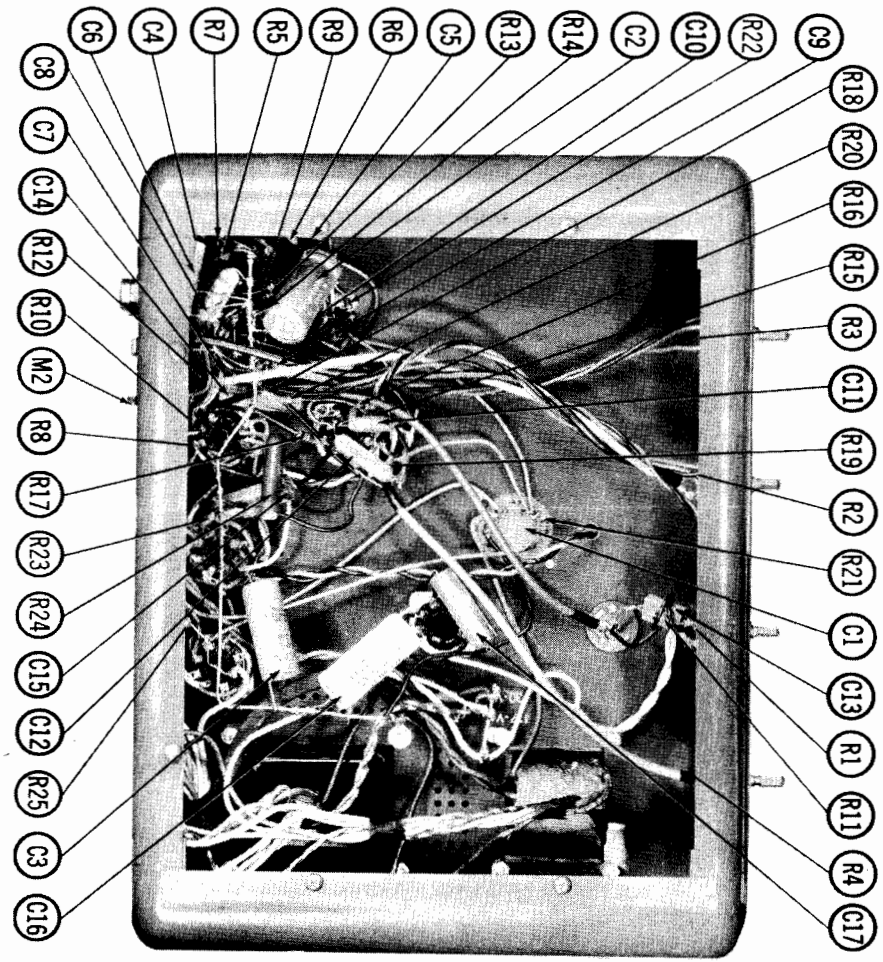
TRANSFORMER (AUDIO OUTPUT)

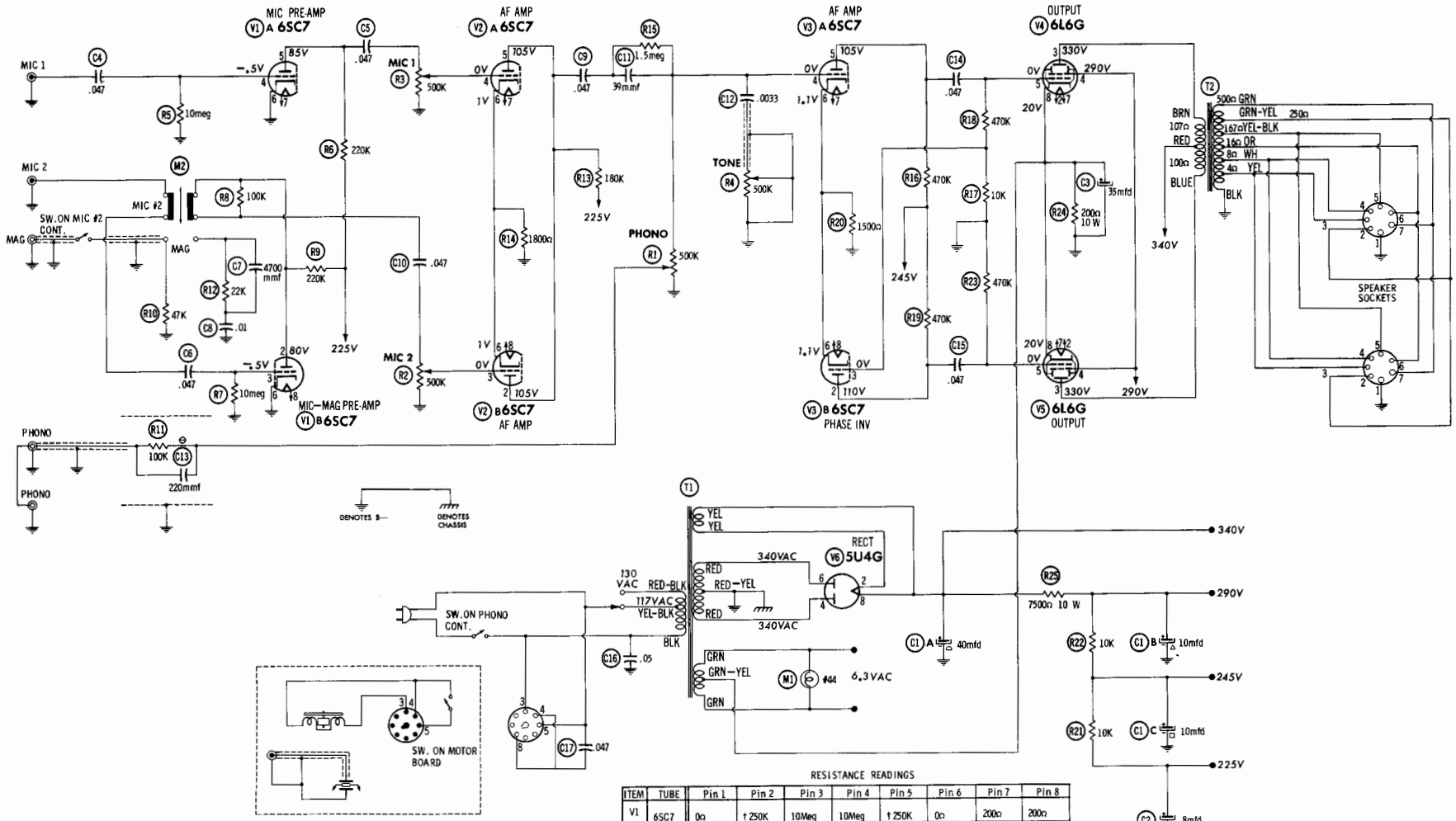
ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	KNIGHT PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	
T2	8000Ω	500Ω Taps @ 250Ω 167Ω (70V), 16Ω, 8Ω, 4Ω	LO-0093-D						

MISCELLANEOUS

ITEM No.	PART NAME	KNIGHT PART No.	NOTES
M1	Pilot Light		#44
M2	Switch		Mag. - MIC 2, Slide Type (D. P. D. T.)

CHASSIS—BOTTOM VIEW





ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V1	6SC7	0Ω	†250K	10Meg	10Meg	†250K	0Ω	200Ω	200Ω
V2	6SC7	0Ω	†210K	0Ω	0Ω	†210K	1800Ω	200Ω	200Ω
V3	6SC7	0Ω	†490K	10K	500K	†490K	1500Ω	200Ω	200Ω
V4	6L6G	0Ω	200Ω	†107Ω	†7500Ω	480K	NC	200Ω	200Ω
V5	6L6G	0Ω	200Ω	†100Ω	†7500Ω	470K	NC	200Ω	200Ω
V6	5U4G	NC	50K	NC	75Ω	TP	65Ω	NC	50K

† MEASURED FROM PIN 8 OF V6.
NC NO CONNECTION
TP TIE POINT

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

⊕ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

A PHOTOFACT STANDARD NOTATION SCHEMATIC

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KNIGHT
MODEL 94SX706

KNIGHT
MODEL 94SX706

TRADE NAME	Knight Model 94SX706
SUPPLIER	Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.
TYPE SET	AC Operated Equalizer Preamplifier
TUBES (Three)	Types 12AX7 Preamplifier, 12AX7 Cath. Follower - 1st AF Amp., 6C4 2nd AF Amplifier
POWER SUPPLY	110-120 Volts AC-50/60 Cycles RATING .15 Amp. @ 117 Volts AC (7 Watts)

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Phono – Mic Preamplifier	12AX7	
V2	Cathode Follower-1st AF Amplifier	12AX7	

ITEM No.	USE	TYPE	NOTES
V3	2nd AF Amplifier	6C4	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING CAP.	RATING VOLT.	KNIGHT PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	■30	150		AFH3-08	C0070	FP225 [TC47	TMD-7 [TD-16-150	T-025	TVL-3535
B	▲15	150							
C	15	150							
C2A	10	150		AFH3-22	C0210	FP330.5	TMT-22	T-095	TVL-3432.8
B	▲10	150							
C	■10	150							
C3	35	50		PRS150V40	BR505	TC39	TD-50-50	FM-0550	TVA-1308

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

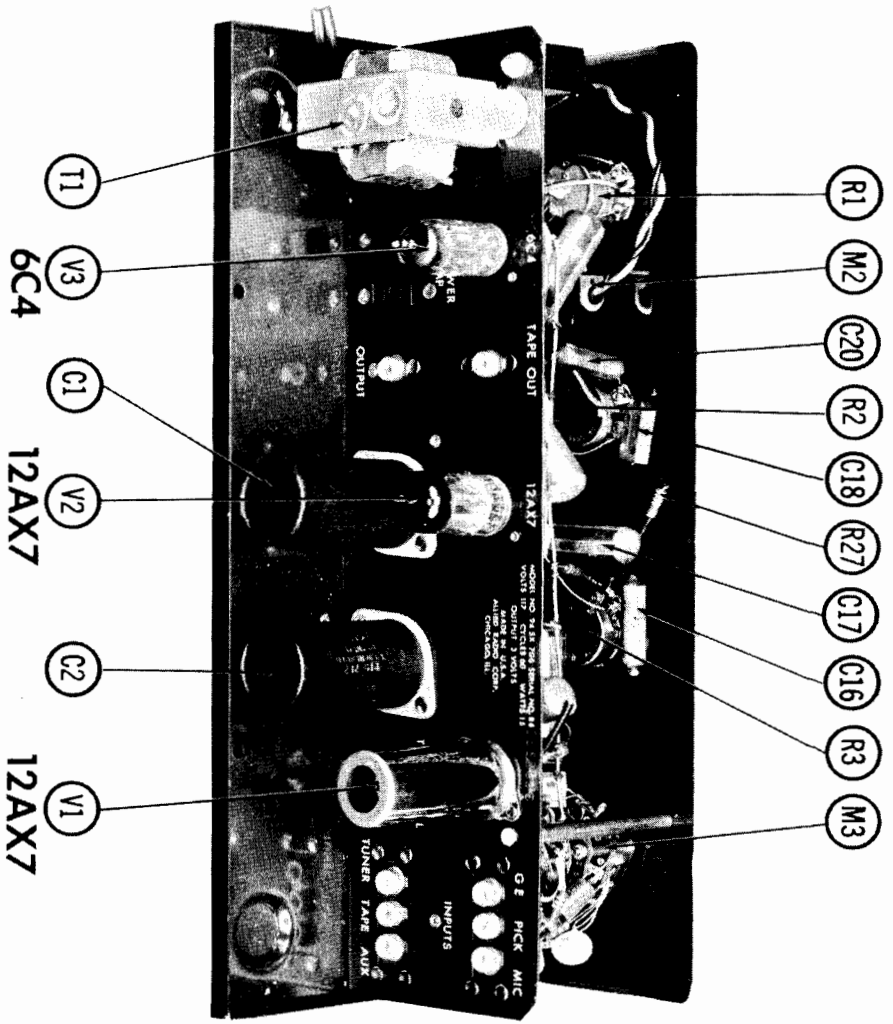
ITEM No.	RATING CAP.	RATING VOLT	KNIGHT PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C4	.1	600		P688N-1	DF-104	CUB6P1		GEM-601	6TM-P1	Note 1
C5	39	1000								
C6	.0068	600		BPD-0068	D6-682	CUB6D68	GP-6800	GEM-6268	6TM-D68	
C7	2200			BPD-0022	D6-222	K073	ED-0022	UC-5222	5GA-D22	
C8	1000			BPD-001	DD-102	K069	ED-001	DC-521	5HK-S1	
C9	560			S1560	DD-561	G063	ED-560	UC-5356	5GA-T56	
C10	4700			BPD-0047	DD-472	K079	ED-0047	UC-5247	5HK-D47	
C11	270			BPD-00027	DD-271	G054	ED-270	UC-5327	5GA-T27	
C12	.01	600		BPD-01	DD-103	CUB6S1	ED-01	GEM-611	6TM-S1	
C13	.022	200		BPD-02	DD-203	CUB4S22	ED-02	GEM-4122	4TM-S22	
C14	.022	200		BPD-02	DD-203	CUB4S22	ED-02	GEM-4122	4TM-S22	
C15	.1	600		P688N-1	DF-104	CUB6P1		GEM-601	6TM-P1	
C16	.0056	600								
C17	.056	600								
C18	15	500		1468-000015	DD-150		ED-15	UC-5415	1FM-415	
C19	330			BPD-00033	DD-331	G056	ED-330	UC-5333	5GA-T33	
C20	.0033	600		BPD-0033	D6-332	CUB6D33	ED-0033	GEM-6233	6TM-D33	
C21	.1	600		P688N-1	DF-104	CUB6P1		GEM-601	6TM-P1	
C22	.1	600		P688N-1	DF-104	CUB6P1		GEM-601	6TM-P1	
C23	.1	600		P688N-1	DF-104	CUB6P1		GEM-601	6TM-P1	
C24	.02	600		BPD-02	DD-203	CUB6S2	ED-02	GEM-612	6TM-S2	

Note #1. Not used in some versions.

CONTROLS

ITEM No.	RATING RESISTANCE	RATING WATTS	KNIGHT PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	500K	½		AB-59	A47-500K-S	Q11-133	U50	Volume
B	Shaft			AK-4	KSS-3	Not Req.	Not Req.	
C	Switch			KB-1	SWE-12	76-1	US-26	
R2A	500K	½		AB-60	A47-500K-Z	Q13-133	U48	Treble
B	Shaft			AK-4	KSS-3	Not Req.	Not Req.	
R3A	500K	½		AB-60	A47-500K-Z	Q13-133	U48	Bass
B	Shaft			AK-4	KSS-3	Not Req.	Not Req.	
R4A	500K	½		AB-60	A47-500K-Z	Q13-133	U48	Tuner Level
B	Shaft			AK-4	KSS-3	Not Req.	Not Req.	

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	KNIGHT PART No.	IRC PART No.	
R5	27K			BTS-27K	
R6	22K			BTS-22K	
R7	470K			BTS-470K	
R8	68K			BTS-68K	
R9	68K			BTS-68K	
R10	68K			BTS-68K	
R11	68K			BTS-68K	
R12	100K			BTS-100K	
R13	150K			BTS-150K	
R14	100K			BTS-100K	
R15	220K 1%			DCC-220K1%	
R16	4700Ω 5%			BTS-4700 5%	
R17	4700Ω			BTS-4700	
R18	470K			BTS-470K	
R19	47K 5%			BTS-47K 5%	
R20	1500Ω 5%			BTS-1500 5%	

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	KNIGHT PART No.	IRC PART No.	
R21	3.3Meg			BTS-3.3Meg	
R22	4700Ω			BTS-4700	
R23	22K			BTS-22K	
R24	4700Ω			BTS-4700	
R25	47K			BTS-47K	
R26	4700Ω			BTS-4700	
R27	47K			BTS-47K	
R28	68K			BTS-68K	
R29	3000Ω 5%			BTS-3000 5%	
R30	22K			BTS-22K	
R31	3300Ω			BTS-3300Ω	
R32	4700Ω			BTS-4700	
R33	4700Ω			BTS-4700	
R34	4700Ω			BTS-4700	
R35	2200Ω			BTS-2200	
R36	4.7Ω			BW $\frac{1}{2}$-4.7	

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	KNIGHT PART No.	Halldarson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triod PART No.
T1	117VAC @ .15A	120VAC @ .002A	6.3VCT @ .72A		LP-0243		P-3046 ①		26R32 ①	

① Drill New Mtg. Hole.

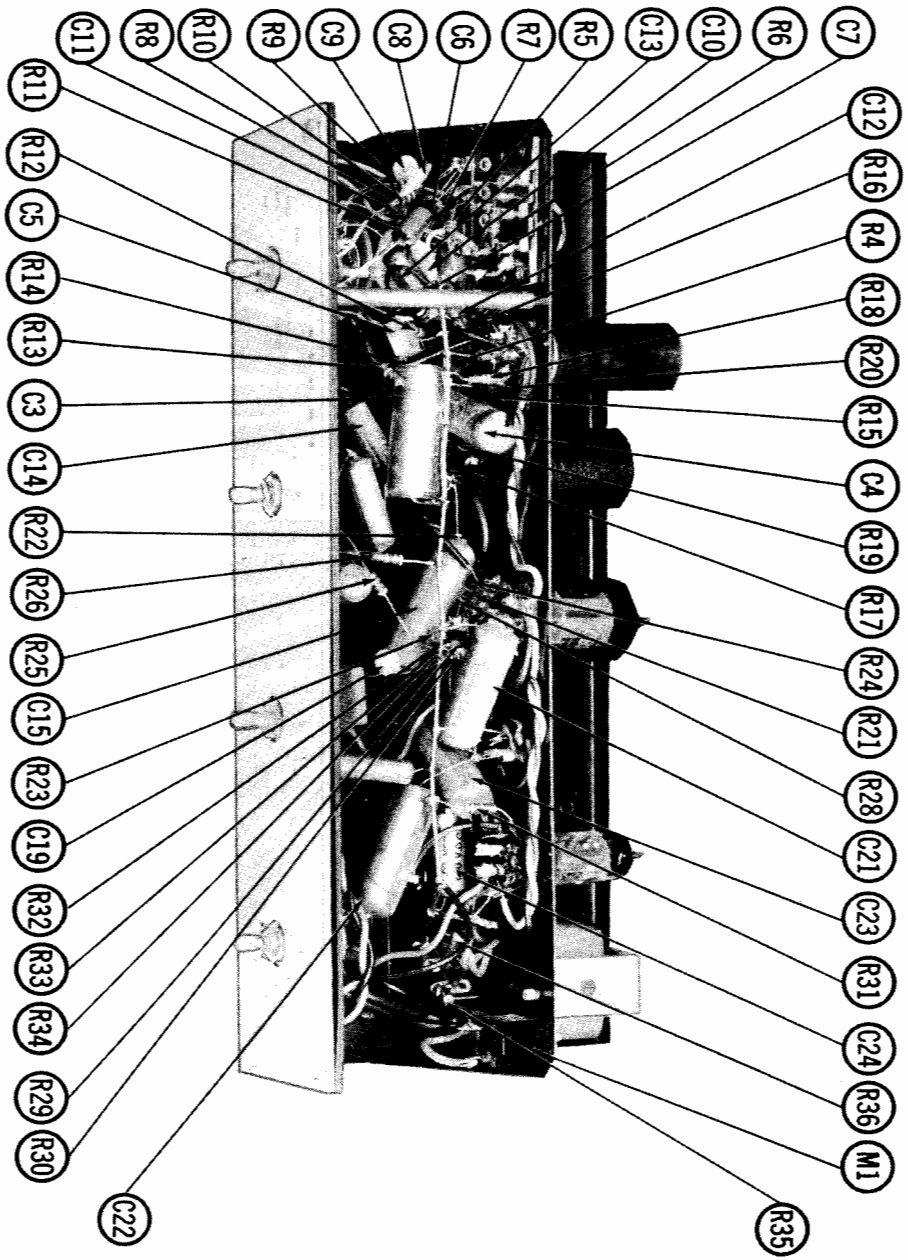
SELENIUM RECTIFIER

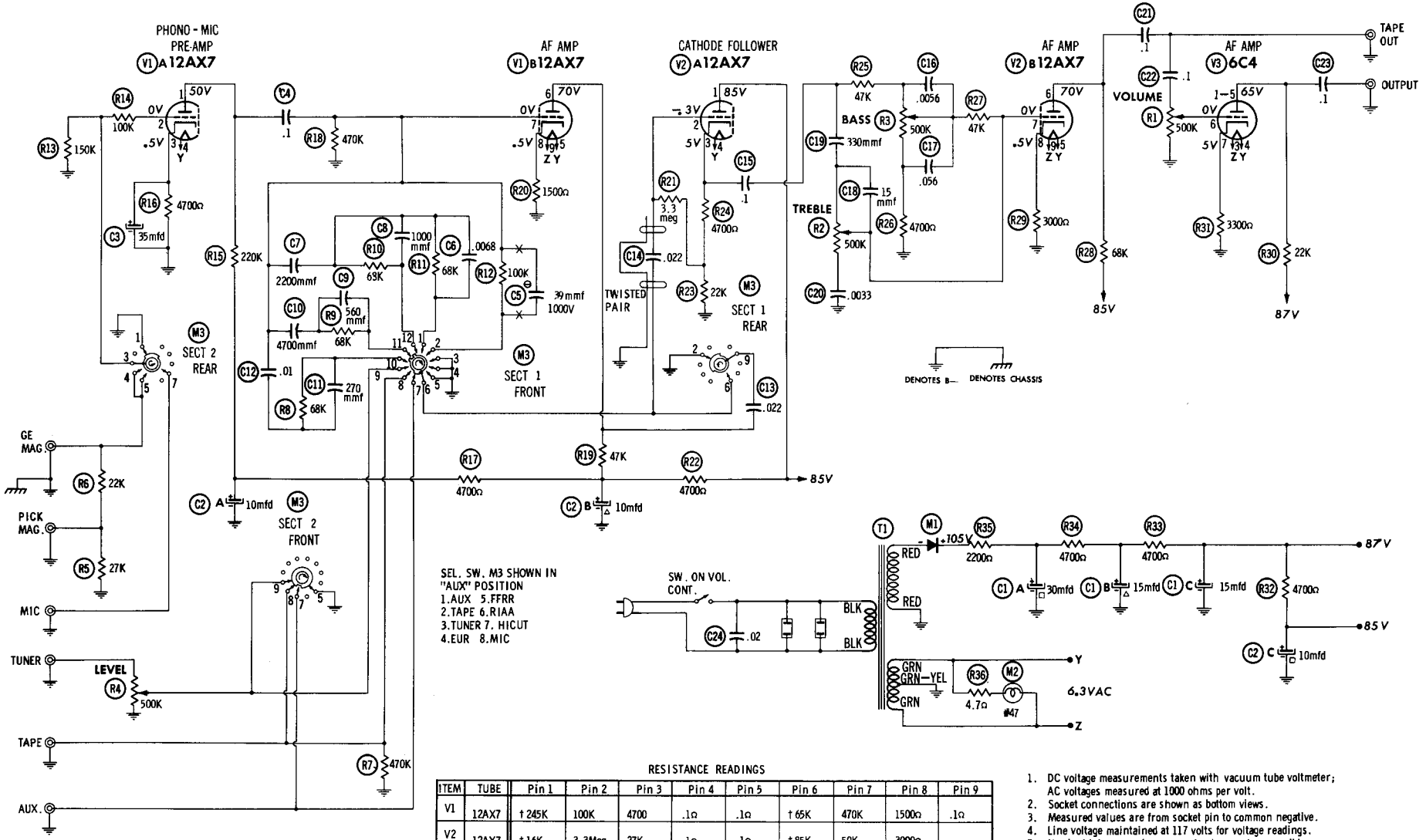
ITEM No.	RATING	REPLACEMENT DATA						NOTES
	CURRENT	KNIGHT PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	MALLORY PART No.	RADIO RECEPTOR PART No.	SARKES TARZIAN PART No.	
M1	.002A	JR-0022	1386	RS-050	8S20	8Y1	50	

MISCELLANEOUS

ITEM No.	PART NAME	KNIGHT PART No.	NOTES
M2	Dial Lamp		#47
M3	Switch		Function Selector, 2 Gang, Wafer Type

CHASSIS—BOTTOM VIEW





RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7	†245K	100K	4700	.1Ω	.1Ω	†65K	470K	1500Ω	.1Ω
V2	12AX7	†16K	3.3Meg	27K	.1Ω	.1Ω	†85K	50K	3000Ω	
V3	6C4	†33K	NC	.1Ω	.1Ω	†33K	0Ω	3300Ω		

ALL MEASUREMENTS TAKEN IN "AUX" POSITION.
† MEASURED FROM OUTPUT OF M1.
NC NO CONNECTION.

⊖ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

A PHOTOFACT STANDARD NOTATION SCHEMATIC

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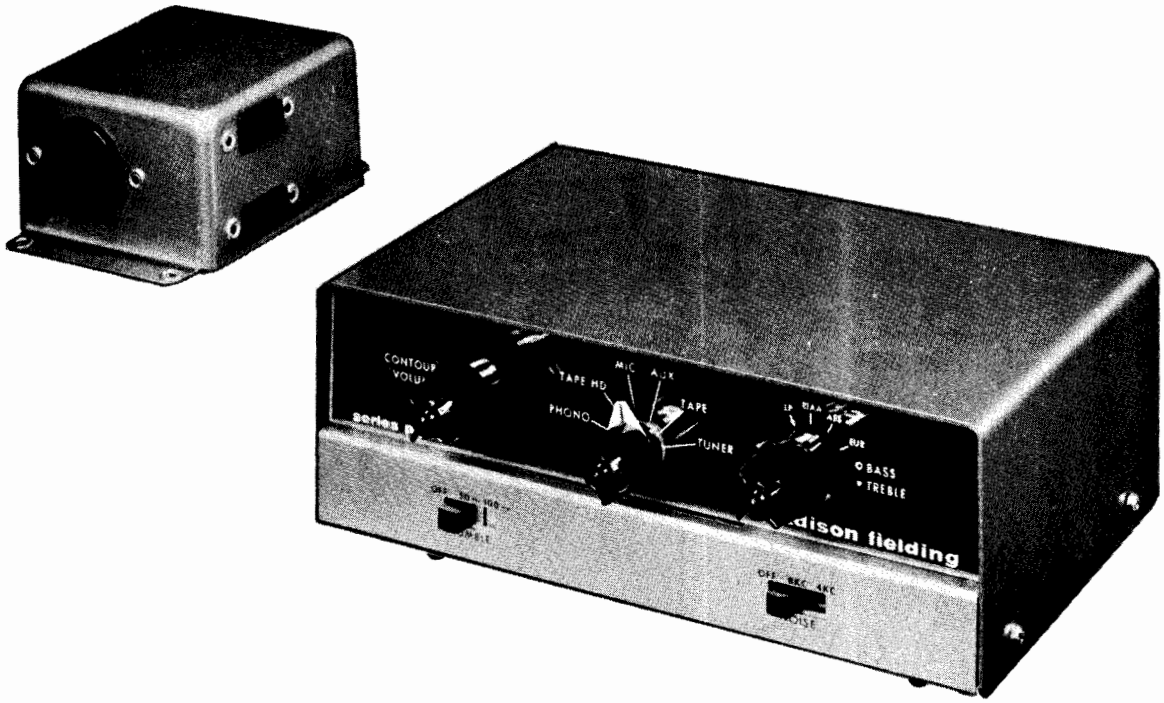
MADISON FIELDING
MODEL PR-45 "Transamp"



MADISON FIELDING
MODEL PR-45 "Transamp"

TRADE NAME	Madison Fielding Model PR-45 "Transamp"		
MANUFACTURER	Madison Fielding Corp., 863 Madison St., Brooklyn 21, N. Y.		
TYPE SET	AC Operated 6 Channel Preamplifier With Transistorized Input		
TUBES (One)	Type 12AX7/ECC83 AF Amplifier		
POWER SUPPLY	105-125 Volts AC-50/60 Cycles	RATING	.10 Amp. @ 117 Volts AC (6 Watts)

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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H277

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE
V1	AF Amplifier	12AX7/ECC83

ITEM No.	USE	TYPE

TRANSISTORS

ITEM No.	ORIG. TYPE	USE	REPLACEMENT DATA			NOTES
			C8S PART No.	RAYTHEON PART No.	SYLVANIA PART No.	
X1	2N35	AF Amplifier	2N439		2N35	
X2	2N35	AF Amplifier	2N439		2N35	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA						
	CAP.	VOLT.	Madison Fielding PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	20	200	CE202010						R2472 *
B	20	200							
C	20	150							
C2	2	15		PWE25002			ML2-15		R2473 *
C3	2	15		PWE25002			ML2-15		R2473 *
C4	150	2		PWE3200					R2474 *
C5	150	15							R2475 *
C6	150	20		PRS50V150	BR2502				R2476 *
C7	2	25		PRS50V2	BBR2-50	TC302	TD-2-25	MT-0502	R2477 *
C8	25	3		SRE3V25	BBR25-3	TT3X25	ML25-3	MMT-325	TE-1055
C9	25	3		SRE3V25	BBR25-3	TT3X25	ML25-3	MMT-325	TE-1055

* Non Catalog Item

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA							NOTES
	CAP.	VOLT	Madison Fielding PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C10	3500					1R5D36			MS-235	10%
C11	8700									10%
C12	3500					1R5D36			MS-235	10%
C13	20000			BPD-02	DD-203	BYB6S2	ED-02		5HK-S2	
C14	20000			BPD-02	DD-203	BYB6S2	ED-02		5HK-S2	
C15	.1	200		P288N-1	DF-104	CUB2P1		GEM-201	2TM-P1	
C16	2200			BPD-0022	DD-222	BYA10D22	ED-0022	UC-5222	5GA-D22	
C17	4700			BPD-0047	DD-472	BYA10D47	ED-0047	UC-5247	5GA-D47	
C18	9					C10V9C				NPO
C19	18			SI 18	D6-180	LT6Q18	GP-18	UC-5418	5GA-Q18	
C20	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5GA-S1	
C21	10000			BPD-01	DD-103	BYA6S1	ED-01	DC511	5GA-S1	
C22	47			SI 47	D6-470	LT6Q47	GP047	UC-5447	5GA-Q47	
C23	.22	200		P288N-22		CUB2P22		GEM-2022	2TM-P22	

CONTROLS

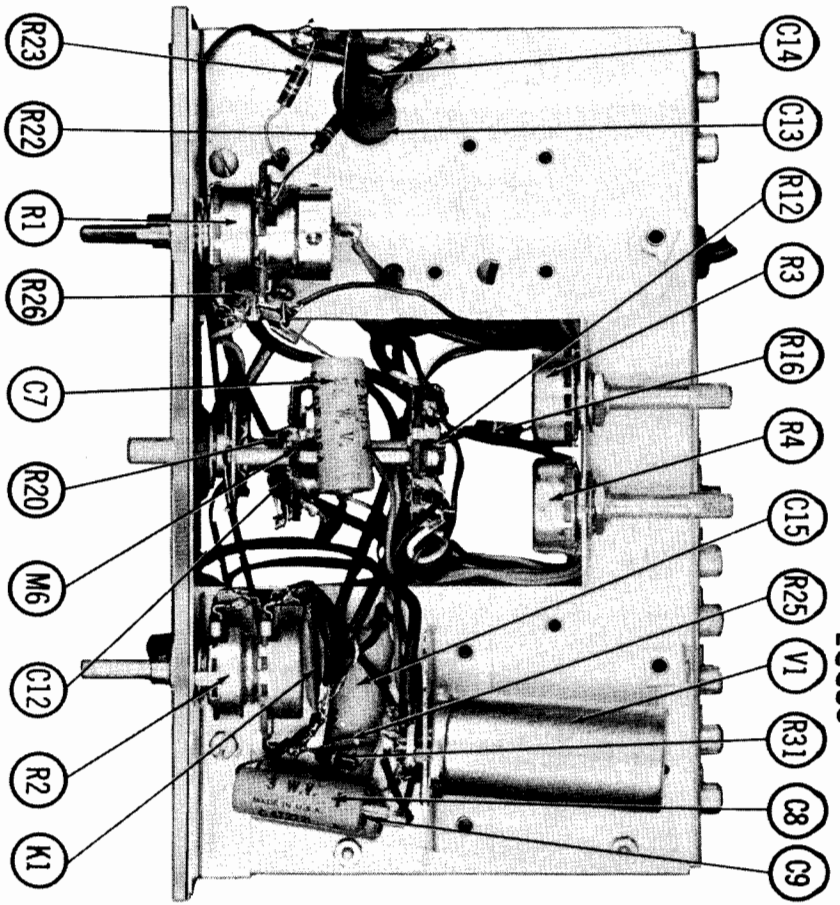
ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	Madison Fielding PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	
R1A	500K	½	RV10502				▲ UE3761S	Volume
B	100K	½						Contour, Tap ② 25K & 50K
C	Switch							
R2A	1meg	½	RV1002	F1-52		♦	■ UE3762	Bass
B	500K	½		R4-42				Treble, Tap ② 250K
R3A	470K	½	RV5043	B-59	A47-500K-S	Q11-133	U50	Tuner Adjust
B	Shaft			Not Req.	KSS-3	Not Req.	Not Req.	
R4A	25K	½	RV2530	B-26	A47-25K-S	Q11-120	U29	Phono & Low Level Adjust
B	Shaft			Not Req.	KSS-3	Not Req.	Not Req.	
R5	500Ω	2	RW5001					Hum Adjust (Wirewound)

♦ Concentrikit Equivalent; K-2 Kit, Base Elements and Shafts: B11-137, P1-200 (Panel) B19-137X, R1-205 (Rear)

▲ STA-LOC Equivalent FB55A, OS500, RU15DT54, IS1125, US-41

■ STA-LOC Equivalent FB16L, OS500, RU55T254, IS1125

CHASSIS—TOP VIEW



12AX7
ECC83

PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING OHMS	RATING WATT	Madison Fielding PART No.	NOTES
R6	270K			
R7	150K			
R8	6800Ω			
R9	100K			
R10	120K			
R11	560Ω			
R12	390K			
R13	18K			
R14	100K			
R15	18K			
R16	100K			
R17	18K			
R18	18K			
R19	22K			
R20	22K			

ITEM No.	RATING OHMS	RATING WATT	Madison Fielding PART No.	NOTES
R21	33K			
R22	10K			
R23	10K			
R24	100K			
R25	2700Ω			
R26	470K			
R27	820K			
R28	220K			
R29	1.8meg			
R30	220K			
R31	1500Ω			
R32	150K			
R33	22K			
R34	10K			

TRANSFORMER (POWER)

ITEM No.	RATING PRI.	RATING SEC. 1	RATING SEC. 2	RATING SEC. 3	REPLACEMENT DATA Madison Fielding PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117V @ .100A	155V @ .002A	6.3V @ .300A		TP1003					

COMPONENT COMBINATIONS

ITEM No.	USE	DESCRIPTION	Madison Fielding PART No.	REPLACEMENT DATA
K1	Tone Comp.	4700mmf, 4700mmf, 100mmf, 100K, 470K, 1000Ω		

RECTIFIERS

ITEM No.	RATING CURRENT (Measured)	REPLACEMENT DATA Madison Fielding PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	SARKES TARZIAN PART No.	NOTES
M1	.0018A	SR1001		CR28		

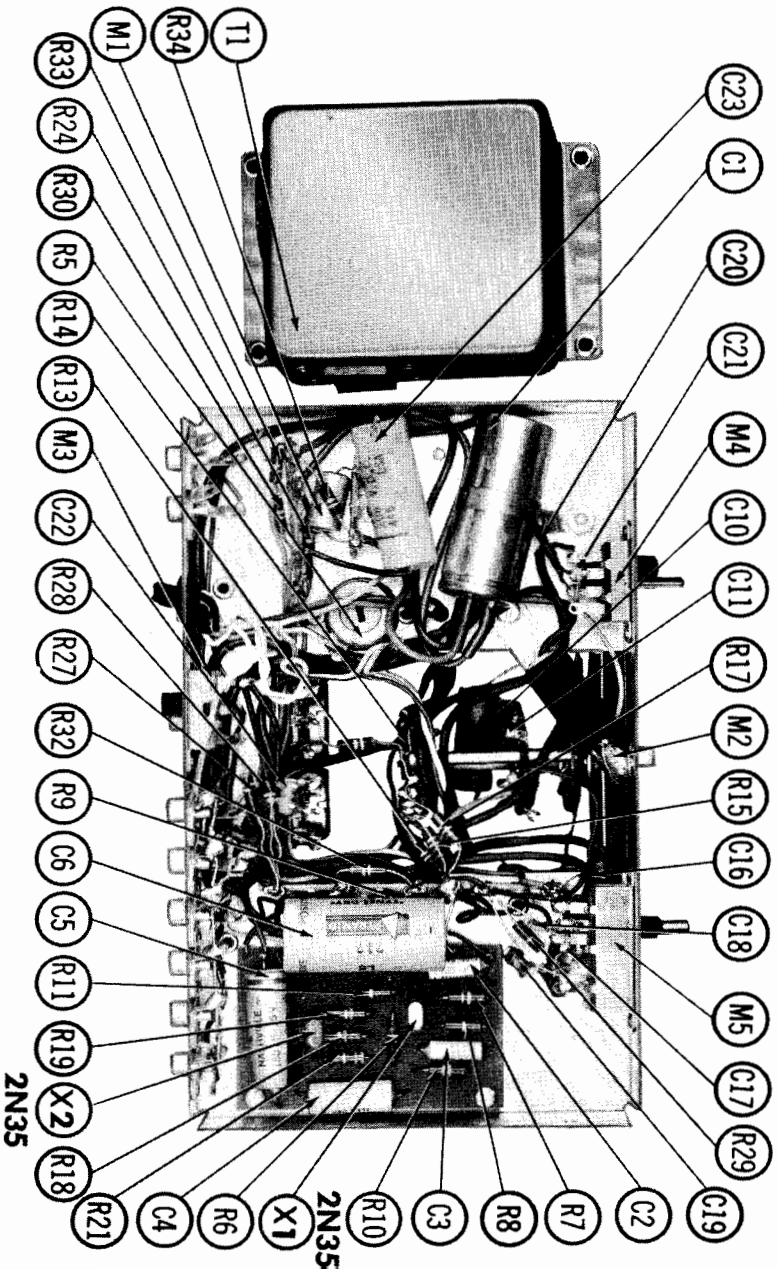
MISCELLANEOUS

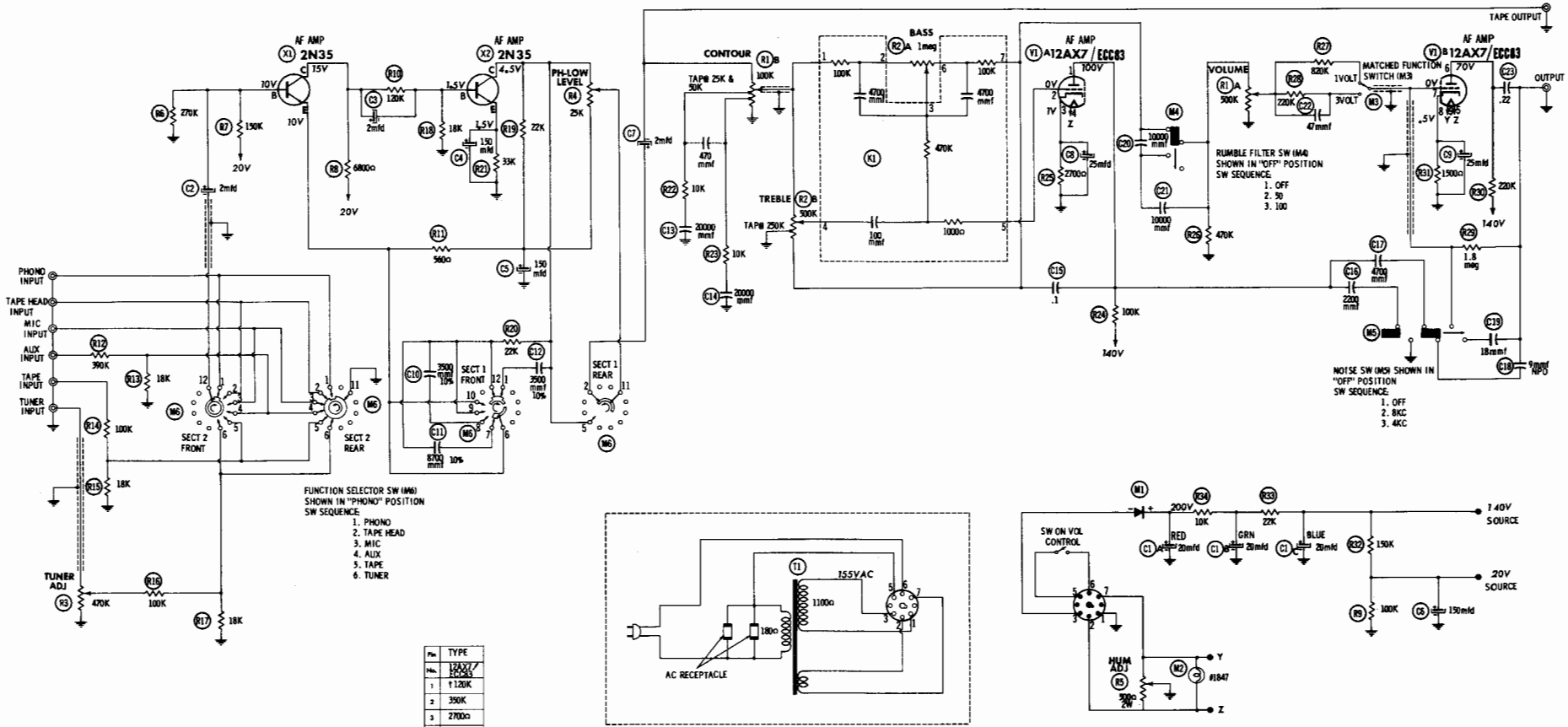
ITEM No.	PART NAME	Madison Fielding PART No.	NOTES
M2	Pilot Lamp		#1847
M3	Switch	SS1007	Matched Function (Slide Type SPDT)
M4	Switch	SS1002	Rumble Filter (Slide Type DPDT)
M5	Switch	SS1006	Noise Filter (Slide Type DPDT)
M6	Switch	SF1002	Selector (Rotary Wafer Type)

WIRING DATA

General-use Unshielded Hook-up Wire	Use BELDEN No. 8530 (Solid) Available in Ten Colors 8524 (Stranded) Available in Ten Colors
Power Cord	Use BELDEN No. 1765-B (6 Ft. Length) 1725-K (7½ Ft. Length)
Low-Loss Shielded Lead (Interconnecting)	Use BELDEN No. 8401
Phono Pick-up Arm Cable	Use BELDEN No. 8430 (Two Conductor - Twisted)

CHASSIS—BOTTOM VIEW





Pin No.	TYPE 12AX7/ ECC83
1	†120K
2	350K
3	2700Ω
4	75Ω
5	75Ω
6	†230K
7	220K
8	1500Ω
9	75Ω

ALL MEASUREMENTS TAKEN IN "PHONO" POSITION
† MEASURED FROM OUTPUT OF M1

TRANSISTOR CIRCUIT RESISTANCE NOT GIVEN BECAUSE OF THE WIDE VARIATION IN INTERNAL TRANSISTOR RESISTANCE

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

A PHOTOFACT STANDARD NOTATION SCHEMATIC
Howard W. Sams & Co., Inc. 1958

NEWCOMB
MODEL CO-1010

NEWCOMB
MODEL CO-1010

TRADE NAME	Newcomb Model CO-1010
MANUFACTURER	Newcomb Audio Products Co., 6824 Lexington Ave., Hollywood 38, Calif.
TYPE SET	AC Operated 6 Channel 10 Watt Audio Amplifier
TUBES (Five)	Types 12AX7 Preamp. - AF Amp., 12AX7 AF Amp. - Phase Inv. (2) 6V6GT Output 6AX5GT Rectifier
POWER SUPPLY	110-120 Volts AC-60 Cycles RATING .55 Amp. @ 117 Volts AC (60 Watts)

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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G982

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Preamplifier-AF Amplifier	12AX7	
V2	AF Amplifier-Phase Inv.	12AX7	
V3	Output	6V6GT	

ITEM No.	USE	TYPE	NOTES
V4	Output	6V6GT	
V5	Rectifier	6AX5GT	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING CAP.	RATING VOLT.	REPLACEMENT DATA NEWCOMB PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▲40	475	CE-36						R2410*
B	■10	475							
C	▲10	475							
D	25	50							
C2	4	450	CE-1	PRS450V4	BR445	TC70	TD-4-450	FM-4504	TVA-1702

*Non Catalog Item

FIXED CAPACITORS

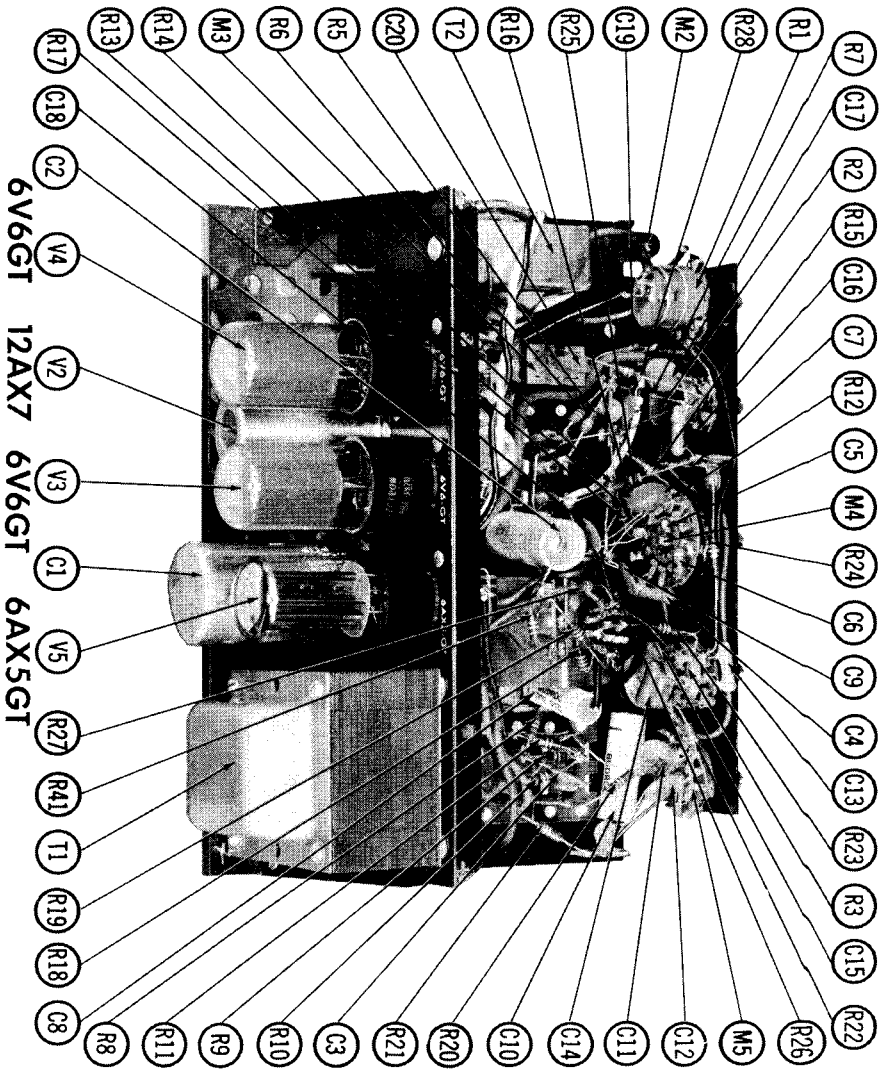
Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING CAP.	RATING VOLT	REPLACEMENT DATA NEWCOMB PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C3	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2	
C4	350		CM-26	SI350	D6-351	LT6T35	GP-350	UC-5335	5GA-T35	
C5	100		CM-14	SI100	D6-101	LT6T1	GP-100	UC-531	5GA-T1	
C6	300		CM-15	SI300	D6-301	LT6T3	GP-300	UC-533	5GA-T3	
C7	1600		CM-52	BPD-0015	DD-152	BYA10D15	ED-0015	UC-5215	5HK-D15	
C8	.022	600	CP-47	BPD-02	DD-203	CUB6S22	ED-02	GEM-6122	6TM-S22	
C9	10000		CM-32	BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C10	.1	600	CP-51	P688N-1	DF-104	CUB6P1		GEM-601	6TM-P1	
C11	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2	
C12	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2	
C13	470		CM-25	SI470	D6-471	LT6T47	GP-470	UC-5347	5GA-T47	
C14	1500		CM-27	SI1500	D6-152	LT6D15	GP-1500	UC-5215	5HK-D15	
C15	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2	
C16	470		CM-25	SI470	D6-471	LT6T47	GP-470	UC-5347	5GA-T47	
C17	10000		CM-32	BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C18	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2	
C19	250		CM-22	BPD-00025	DD-251	LI0T25	ED-250	UC-5325	5GA-T25	
C20	10000		CM-32	BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C21	10000		CM-32	BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C22	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2	
C23	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2	
C24	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2	
C25	100		CM-14	SI100	D6-101	LT6T1	GP-100	UC-531	5GA-T1	
C26	.022	600	CP-47-1	BPD-02	DD-203	CUB6S22	ED-02	GEM-6122	6TM-S2	

CONTROLS

ITEM No.	RATING RESISTANCE	RATING WATTS	REPLACEMENT DATA NEWCOMB PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	250K	½	RV-87-K	BT-53	A47F1-250K	Q13-130X		Loudness, Tap @ 100K
B	Shaft			Not Req.	KSS-3	Not Req.		
C	Switch			KB-1	SWE-12	76-1		
R2A	2Meg	½	RV-59-K		A47F3-2Meg	Q18-139X	UT-451	Treble, Tap @ 1.2Meg
B	Shaft				KSS-3	Not Req.	Not Req.	
R3A	5Meg	½	RV-57-K					Bass
B	5Meg	½						Bass
R4	100Ω	2	RV-75					Hum Balance (Wire Wound)

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	NEWCOMB PART No.	IRC PART No.	
R5	560K		RR-34	BTS-560K	
R6	560K		RR-34	BTS-560K	
R7	100K		RR-27	BTS-100K	
R8	56K		RR-25	BTS-56K	
R9	68K		RR-26	BTS-68K	
R10	100K		RR-27	BTS-100K	
R11	22K		RR-21	BTS-22K	
R12	330K		RR-32	BTS-330K	
R13	1.5Meg		RR-39	BTS-1.5Meg	
R14	270K		RR-31	BTS-270K	
R15	560K		RR-34	BTS-560K	
R16	470K		RR-33	BTS-470K	
R17	820K		RR-36	BTS-820K	
R18	18Meg		RR-140	BTS-18Meg	
R19	270K		RR-31	BTS-270K	
R20	560K		RR-34	BTS-560K	
R21	560K		RR-34	BTS-560K	
R22	82K		RR-133	BTS-82K	
R23	560K		RR-34	BTS-560K	
R24	560K		RR-34	BTS-560K	

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	NEWCOMB PART No.	IRC PART No.	
R25	470K		RR-33	BTS-470K	
R26	18Meg		RR-140	BTS-18Meg	
R27	270K		RR-31	BTS-270K	
R28	10K		RR-18	BTS-10K	
R29	56K		RR-25	BTS-56K	
R30	18Meg		RR-140	BTS-18Meg	
R31	270K		RR-31	BTS-270K	Note 1
R32	100Ω		RR-1	BTS-100	
R33	560K		RR-34	BTS-560K	
R34	100K 5%		RR-50	BTS-100K 5%	
R35	10K		RR-18	BTS-10K	
R36	100K 5%		RR-50	BTS-100K 5%	
R37	560K		RR-34	BTS-560K	
R38	560K		RR-34	BTS-560K	
R39	1200Ω	2	RR-146	BTB-1200	
R40	300Ω 5%	2	RR-130	BTB-300 5%	
R41	56K		RR-25	BTS-56K	
R42	27K		RR-22	BTS-27K	
R43	3900Ω		RR-13	BTS-3900Ω	
R44	6.8Ω 5%	1	RR-149		

Note 1. Some Versions May Use 560K In This Application (Part #RR-34).

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	NEWCOMB PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117VAC @.55A	660VCT @.072A	6.3VAC @2.74A		TR-175		P-2951 ①		22R02 ①	

① Tape 5V Winding & Center Tap On 6.3V Winding.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	NEWCOMB PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	
T2	800Ω CT	16Ω Tap @ 8Ω	TR-185	Z1404					

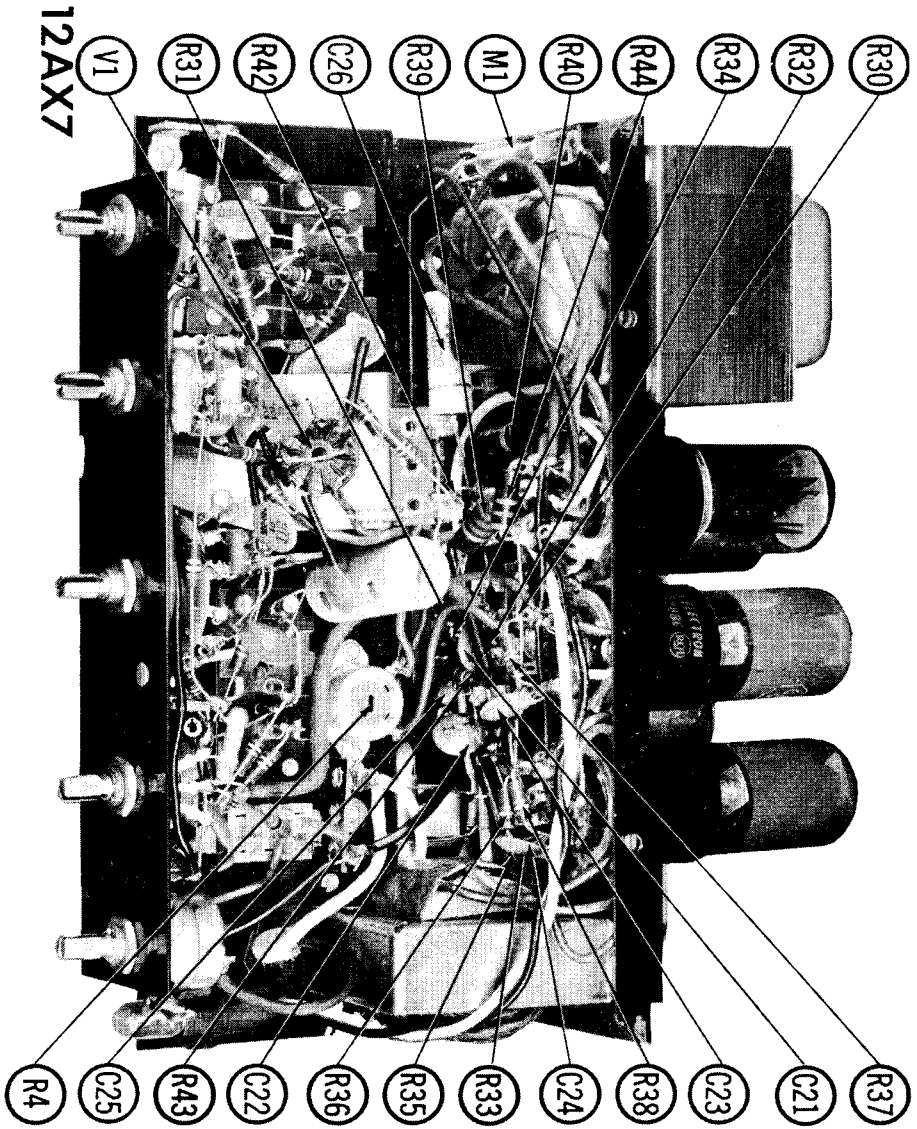
FUSES

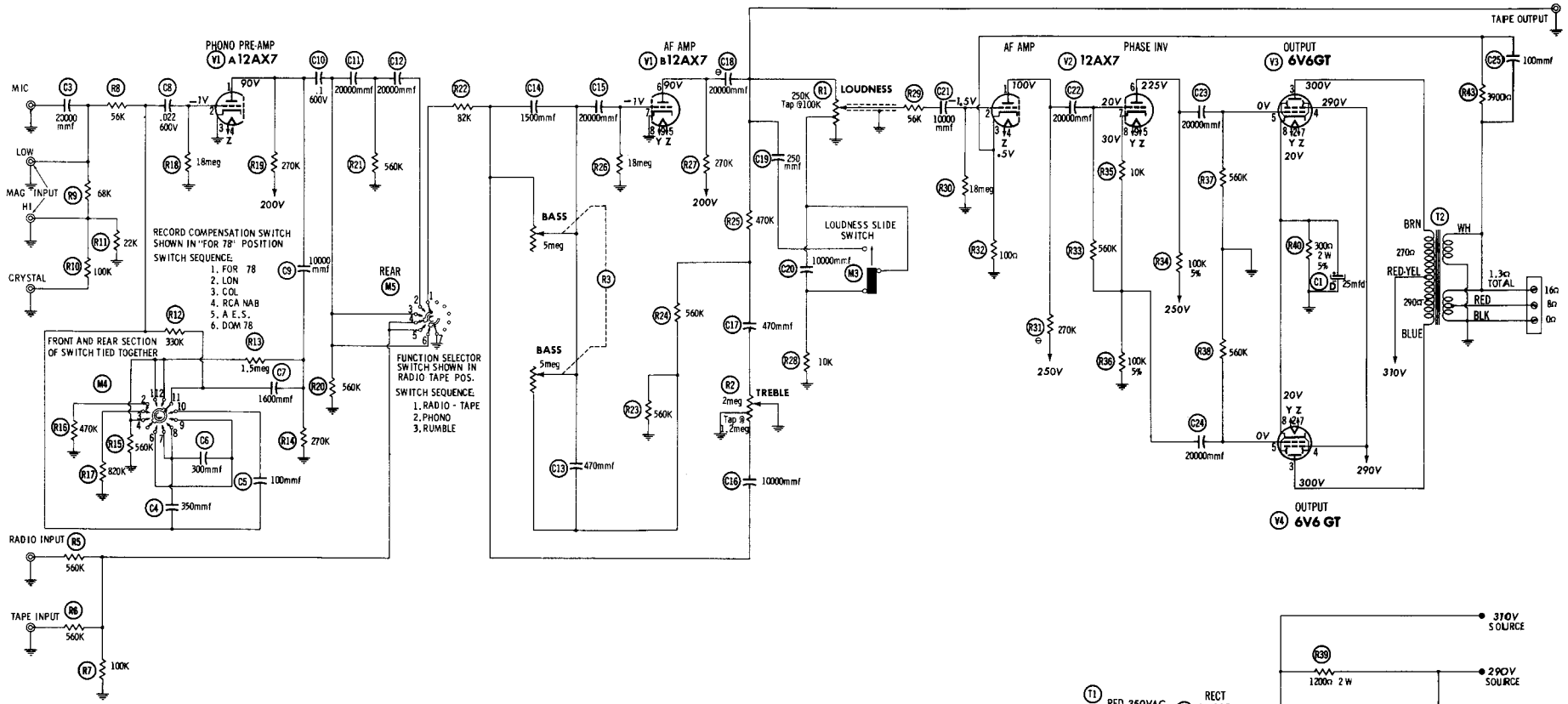
ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			NEWCOMB PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M1	3AG	1A 250V S/B	FA-18		313001. (3AG 1A) S/B	357001	MDL1	4405

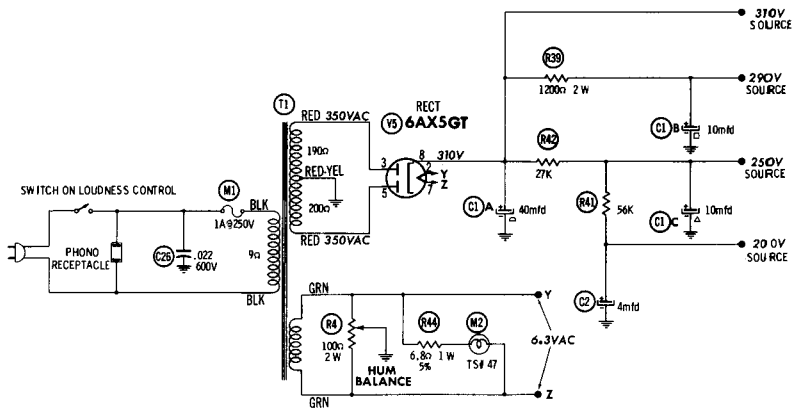
MISCELLANEOUS

ITEM No.	PART NAME	NEWCOMB PART No.	NOTES
M2	Pilot Light		#47
M3	Switch	SY-5	Loudness, Slide Type (SPDT)
M4	Switch	SY-88	Record Compensation, Rotary, Wafer Type
M5	Switch	SY-90	Function Selector, Rotary Wafer Type

CHASSIS—BOTTOM VIEW







RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7	† 325K	18Meg	0Ω	14Ω	14Ω	† 325K	18Meg	0Ω	14Ω
V2	12AX7	† 300K	18Meg	100Ω	14Ω	14Ω	† 130K	660K	110K	14Ω
V3	6V6GT	TP	14Ω	† 270Ω	† 1200Ω	560K	NC	14Ω	300Ω	
V4	6V6GT	TP	14Ω	† 290Ω	† 1200Ω	560K	TP	14Ω	300Ω	
V5	6AX5GT	TP	14Ω	190Ω	TP	200Ω	TP	14Ω	20K (MIN)	

† MEASURED FROM PIN 8 OF V5.
NC NO CONNECTION.
TP TIE POINT.

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

A PHOTOFACT STANDARD NOTATION SCHEMATIC

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NEWCOMB
MODEL CO-1012

TRADE NAME	Newcomb Model CO-1012
MANUFACTURER	Newcomb Audio Products Co., 6824 Lexington Ave., Hollywood 38, California
TYPE SET	AC Operated 7 Channel 12 Watt Audio Amplifier
TUBES (Six)	Types 12AX7 Mic-Phono Preamplifier, 6AV6 AF Amplifier, 12AX7 AF Amp.-Phase Inv. (2) 6V6GT Output, 5Y3GT Rectifier
POWER SUPPLY	110-120 Volts AC-60 Cycles RATING .64 Amp. @ 117 Volts AC (68 Watts)

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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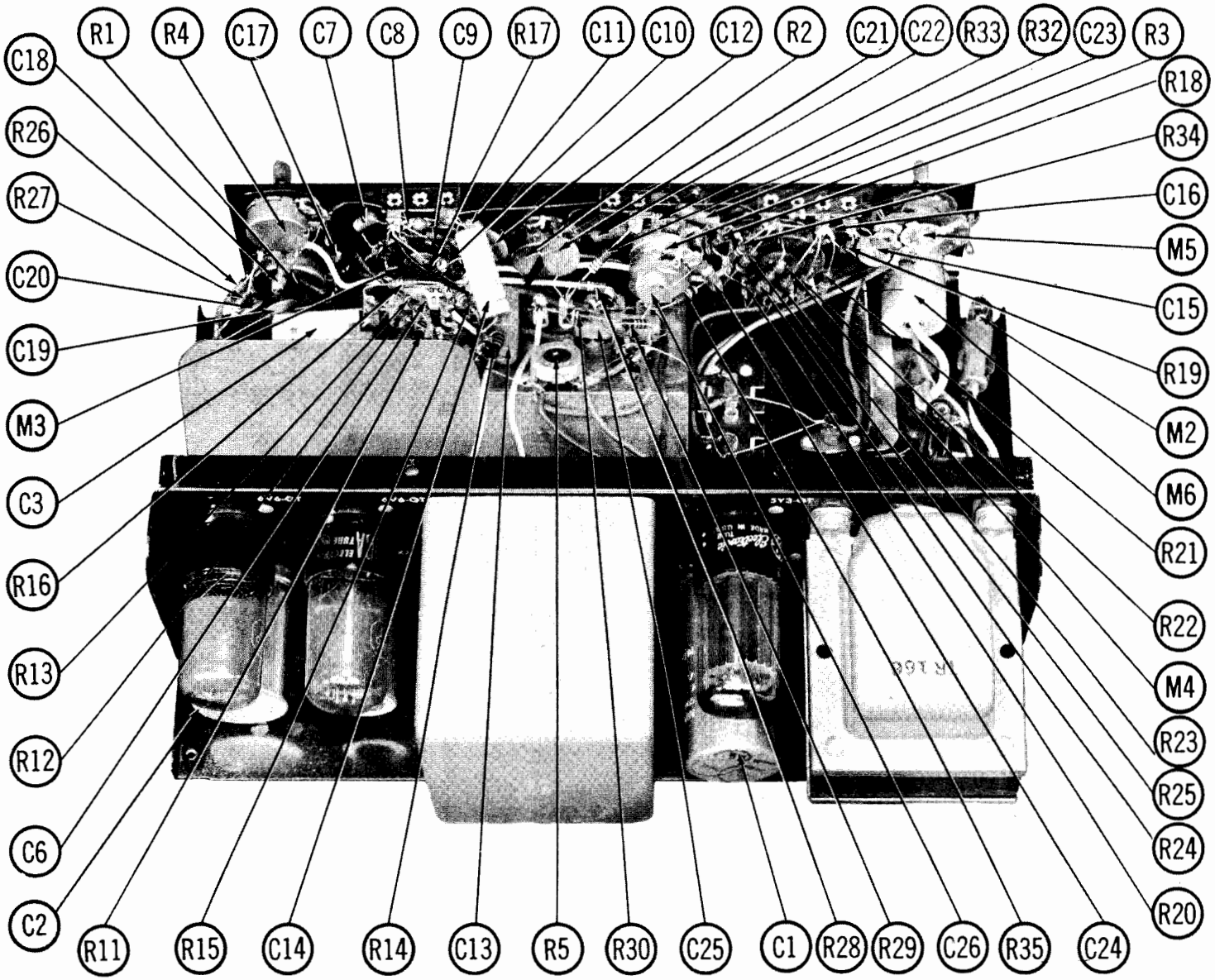


CHASSIS TOP VIEW

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Mic-Phono Preamplifier	12AX7	
V2	AF Amplifier	6AV6	
V3	AF Amplifier-Phase Inv.	12AX7	

ITEM No.	USE	TYPE	NOTES
V4	Output	6V6GT	
V5	Output	6V6GT	
V6	Rectifier	5Y3GT	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA						
	CAP.	VOLT.	NEWCOMB PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▲60	500	CE-33	AFH3-49	BO520 BR3050	FP284 TC82	TMD-92 TD-20-500	Q-075	TVL-3839
B	▲10	475							
C2A	▲20	475	CE-30			FP474 TC36	TMQ-19 TD-25-50	Q-070 FM-0525	R2405 *
B	▲10	475							
C	■10	475							
D	25	50							
C3	4	450	CE-1	PRS450V4	BR445	TC70	TD-4-450	FM-4504	TVA-1702

* Non Catalog Item.

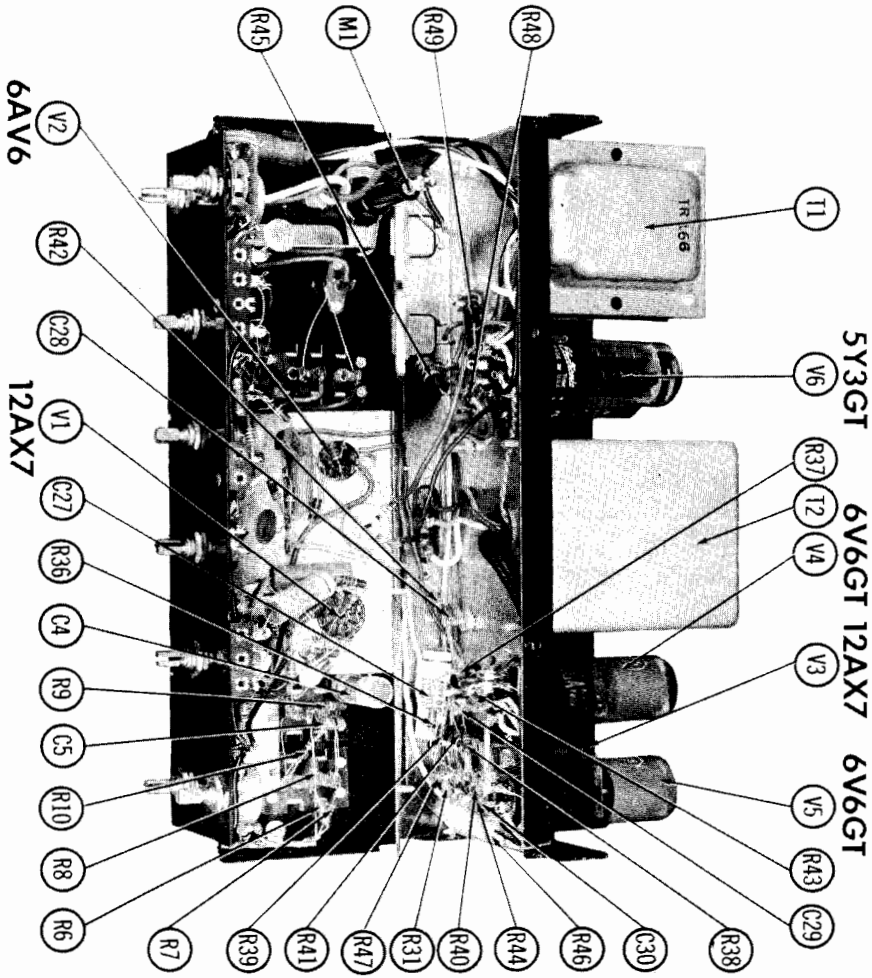
FIXED CAPACITORS

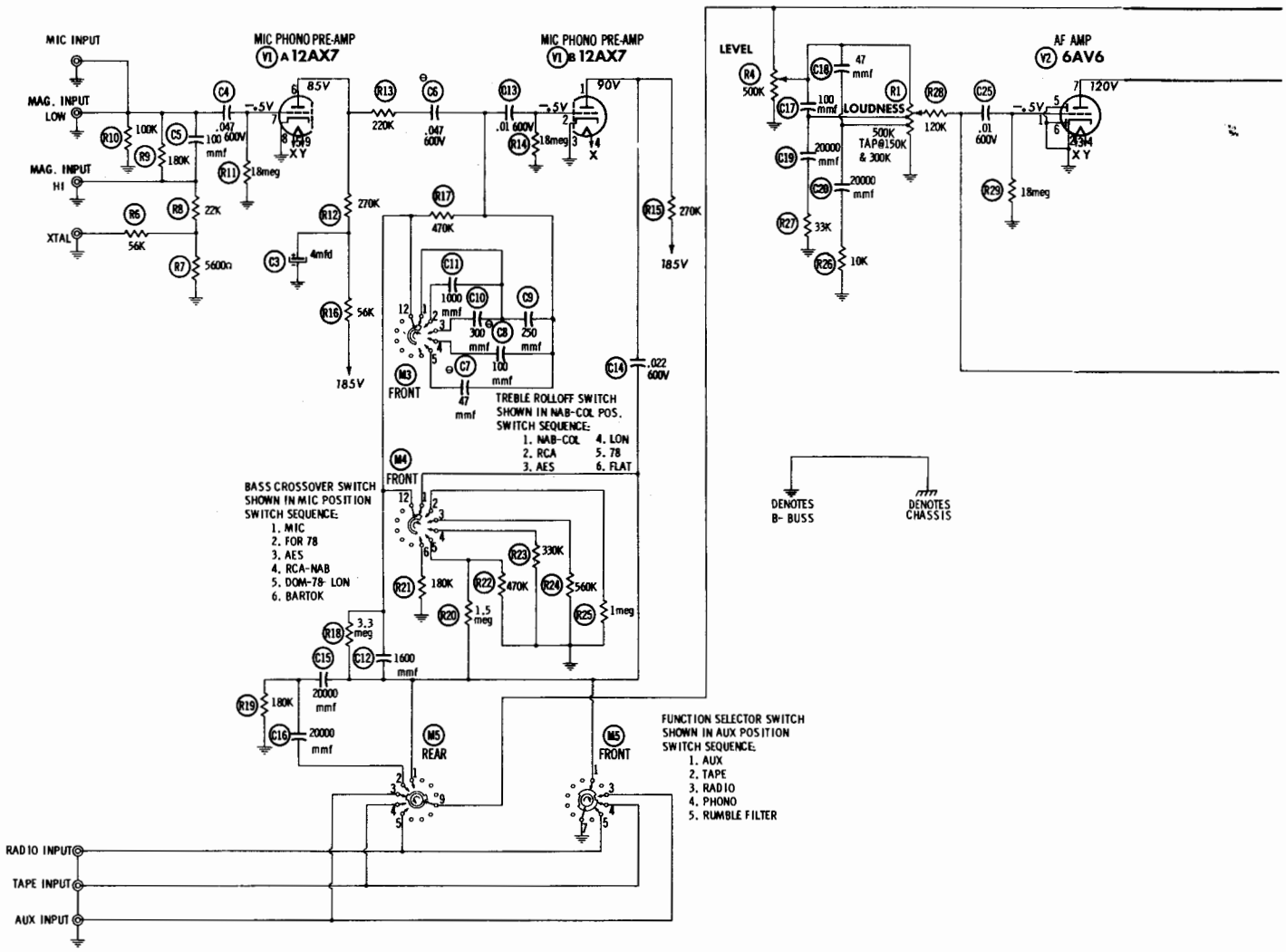
Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA							NOTES
	CAP.	VOLT	NEWCOMB PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C4	.047	600	CP-49	BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	
C5	100		CM-14	SI-100	D6-101	LT6T1	GP-100	UC-531	5GA-T1	
C6	.047	600	CP-49	BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	Note 1
C7	47		CM-3	SI-47	D6-470	LT6Q47	GP-47	UC-5447	5GA-Q47	Note 2
C8	100		CM-14	SI-100	D6-101	LT6T1	GP-100	UC-531	5GA-T1	Note 3
C9	250		CM-22	BPD-00025	DD-251	L10T25	ED-250	UC-5325	5GA-T25	
C10	300		CM-15	SI-300	D6-301	LT6T3	GP-300	UC-533	5GA-T3	
C11	1000		CM-38	SI-1000	D6-102	LT6D1	GP-1000	DC521	5HK-D1	
C12	1600		CM-52	BPD-0015	DD-162	BYA10D15	GP-1500	UC-5215	5HK-D15	
C13	.01	600	CP-45	BPD-01	DD-103	CUB6S1	GP-10000	GEM-611	6TM-S1	
C14	.022	600	CP-47	BPD-02	DF-203	CUB6S22	ED-02	GEM-6122	6TM-S22	
C15	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2	
C16	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2	
C17	100		CM-14	SI-100	D6-101	LT6T1	GP-100	UC-531	5GA-T1	
C18	47		CM-3	SI-47	D6-470	LT6Q47	GP-47	UC-5447	5GA-Q47	
C19	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2	
C20	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2	
C21	10000		CM-32	BPD-01	DD-103	BYA6S1	ED-01	DC511	5HK-S1	
C22	1000		CM-38	SI-1000	D6-102	LT6D1	GP-1000	DC521	5HK-D1	
C23	470		CM-25	SI-470	D6-471	LT6T47	GP-470	UC-5347	5GA-T47	
C24	470		CM-25	SI-470	D6-471	LT6T47	GP-470	UC-5347	5GA-T47	
C25	.01	600	CP-45	BPD-01	DD-103	CUB6S1	GP-10000	GEM-611	6TM-S1	
C26	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2	
C27	.047	600	CP-49	BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	
C28	30		CM-16	SI-30		L10Q3	ED-30		5GA-Q3	
C29	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2	
C30	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-02		5HK-S2	

Note 1. Some versions may use .1 MFD @ 400V in this application.
Note 2. Some versions may use 100 MMF in this application.
Note 3. Some versions may use 150 MMF in this application.

CHASSIS—TOP VIEW





SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

A PHOTOFACT STANDARD NOTATION SCHEMATIC

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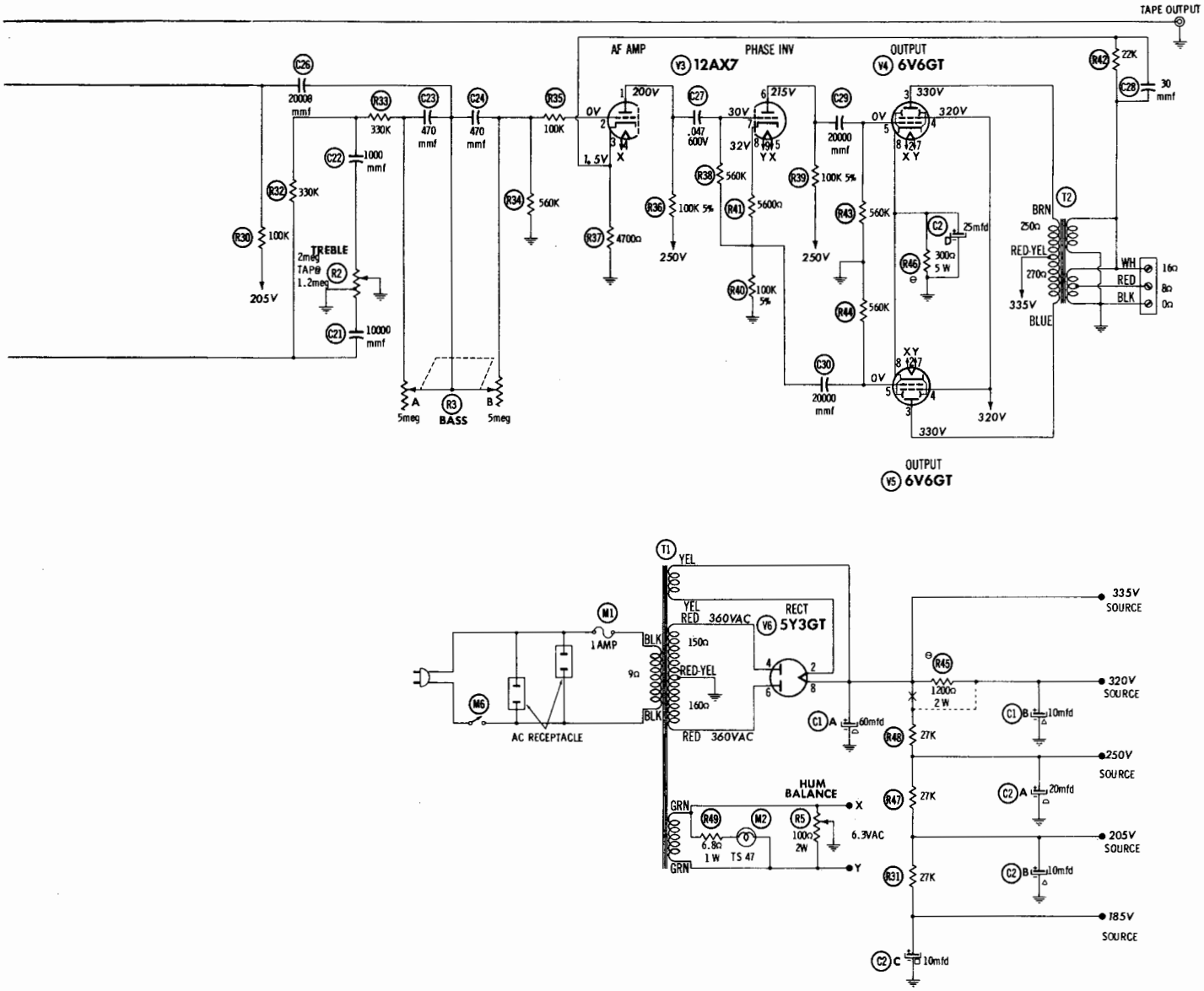

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7	†340K	18Meg	0Ω	26Ω	26Ω	†405K	18Meg	0Ω	26Ω
V2	6AV6	18Meg	0Ω	26Ω	26Ω	0Ω	0Ω	†155K		
V3	12AX7	†127K	660K	4700Ω	26Ω	26Ω	†127K	650K	100K	26Ω
V4	6V6GT	TP	26Ω	†250Ω	†1200Ω	560K	TP	26Ω	300Ω	
V5	6V6GT	TP	26Ω	†270Ω	†1200Ω	560K	TP	26Ω	300Ω	
V6	5Y3GT	NC	20K (Min)	NC	150Ω	TP	160Ω	NC	20K (Min)	

ALL MEASUREMENTS TAKEN IN "AUX" POSITION.
† MEASURED FROM PIN 8 OF V6.
NC NO CONNECTION.
TP TIE POINT.

PARTS LIST AND DESCRIPTIONS (Continued)

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	NEWCOMB PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	
R1A	500K	½	RV-71-K	ABT-160			UDT-285	Loudness, Tap ⓐ 150K & 300K
B	Shaft			AK-4			Not Req.	
R2A	2Meg	½	RV-59-K		A47F3-2Meg	Q18-139X	UT-451	Treble, Tap ⓐ 1.2Meg
B	Shaft				KSS-3	Not Req.	Not Req.	
R3A	5Meg	½	RV-57-K					Bass
B	5Meg	½						Bass
R4A	500K	½	RV-86-K	B-59	A47-500K-S	Q11-133	U50	Level
B	Shaft			Not Req.	KSS-3	Not Req.	Not Req.	
R5	100Ω	2	RV-75					Hum Balance (Wire Wound)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	NEWCOMB PART No.	IRC PART No.	
R6	56K		RR-25	BTS-56K	
R7	5600Ω		RR-15	BTS-5600	
R8	22K		RR-21	BTS-22K	
R9	180K		RR-29	BTS-180K	
R10	100K		RR-27	BTS-100K	
R11	18Meg		RR-140	BTS-18Meg	
R12	270K		RR-31	BTS-270K	
R13	220K		RR-30	BTS-220K	
R14	18Meg		RR-140	BTS-18Meg	
R15	270K		RR-31	BTS-270K	
R16	56K		RR-25	BTS-56K	
R17	470K		RR-33	BTS-470K	
R18	3.3Meg		RR-42	BTS-3.3Meg	
R19	180K		RR-29	BTS-180K	
R20	1.5Meg		RR-39	BTS-1.5Meg	
R21	180K		RR-29	BTS-180K	
R22	470K		RR-33	BTS-470K	
R23	330K		RR-32	BTS-330K	
R24	560K		RR-34	BTS-560K	
R25	1Meg		RR-37	BTS-1Meg	
R26	10K		RR-18	BTS-10K	
R27	33K		RR-23	BTS-33K	

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	NEWCOMB PART No.	IRC PART No.	
R28	120K		RR-28	BTS-120K	
R29	18Meg		RR-140	BTS-18Meg	
R30	100K		RR-27	BTS-100K	
R31	27K		RR-22	BTS-27K	
R32	330K		RR-32	BTS-330K	
R33	330K		RR-32	BTS-330K	
R34	560K		RR-34	BTS-560K	
R35	100K		RR-27	BTS-100K	
R36	100K 5%		RR-50	BTS-100K 5%	
R37	4700Ω		RR-14	BTS-4700	
R38	560K		RR-34	BTS-560K	
R39	100K 5%		RR-50	BTS-100K 5%	
R40	100K 5%		RR-50	BTS-100K 5%	
R41	5600Ω		RR-15	BTS-5600Ω	
R42	22K		RR-21	BTS-22K	
R43	560K		RR-34	BTS-560K	
R44	560K		RR-34	BTS-560K	
R45	1200Ω	2	RR-146	BTB-1200	
R46	300Ω	5		PW7-300	Note 1
R47	27K		RR-22	BTS-27K	
R48	27K		RR-22	BTS-27K	
R49	6.8Ω	1	RR-149		

Note #1. 250Ω 5 W Used in Some Versions (Part #RR-94).

PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	NEWCOMB PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117VAC ⓐ .64A	690VCT ⓐ .078A	5VAC ⓐ2A	6.3VAC ⓐ1.7A	TR-166	P9310 ①		PC8409 ①	24R02U ①	

① Tape Center Tap On 6.3V Winding.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	NEWCOMB PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	
T2	7300Ω CT	16Ω Tap ⓐ 8Ω	TR-178						

FUSE

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			NEWCOMB PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M1	3AG Slo/ Blo	1A 250V	FA-4		313001. (3AG Slo/ Blo 1A)	B41001	MDL1	HKP

MISCELLANEOUS

ITEM No.	PART NAME	NEWCOMB PART No.	NOTES
M2	Pilot Light		TS47
M3	Switch	SY-89	Treble Roll-Off, (Rotary Wafer Type)
M4	Switch	SY-89	Bass Cross-Over, (Rotary Wafer Type)
M5	Switch	SY-91	Function Selector (Rotary Wafer Type)
M6	Switch		Power On-Off

NEWCOMB MODEL CO-1020

NEWCOMB
MODEL CO-1020

TRADE NAME	Newcomb Model CO-1020
MANUFACTURER	Newcomb Audio Products Co., 6824 Lexington Ave., Hollywood 38, Calif.
TYPE SET	AC Operated 7 Channel 20 Watt Audio Amplifier
TUBES (Six)	Types 12AX7 Preamplifier, 6AV6 AF Amplifier, 12AX7 AF Amp.-Phase Inv., (2) 6L6GB Output, 5U4GA Rectifier
POWER SUPPLY	110-120 Volts AC-60 Cycles RATING .96 Amp. @ 117 Volts AC (105 Watts)

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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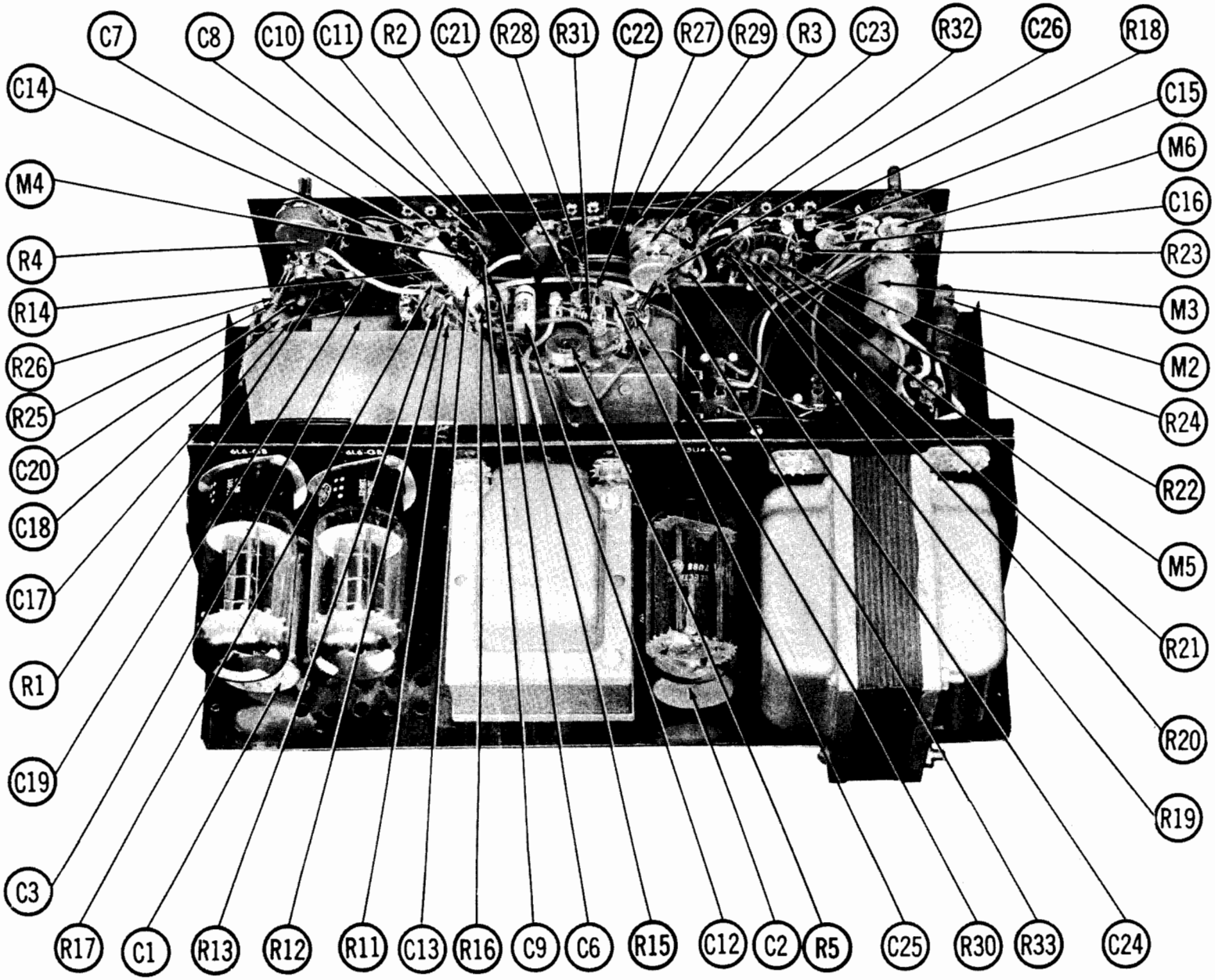


CHASSIS TOP VIEW

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Preamplifier	12AX7	
V2	AF Amplifier	6AV6	
V3	AF Amp. -Phase Inv.	12AX7	
V4	Output	6L6GB	
V5	Output	6L6GB	
V6	Rectifier	5U4GA	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING CAP.	RATING VOLT.	REPLACEMENT DATA NEWCOMB PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▲60	500	CE-33	AFH3-53	D0680		TMT-46		R2409 *
B	▲10	475							
C2A	▲20	475	CE-30	AFH4-19-10		FP474.5			R2405 *
B	■10	475							
C	▲10	475							
D	25	50							
C3	4	450	CE-1	PRS450V4	BR445	TC70	TD-4-450	FM-4504	TVA-1702

* Non catalog Item

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

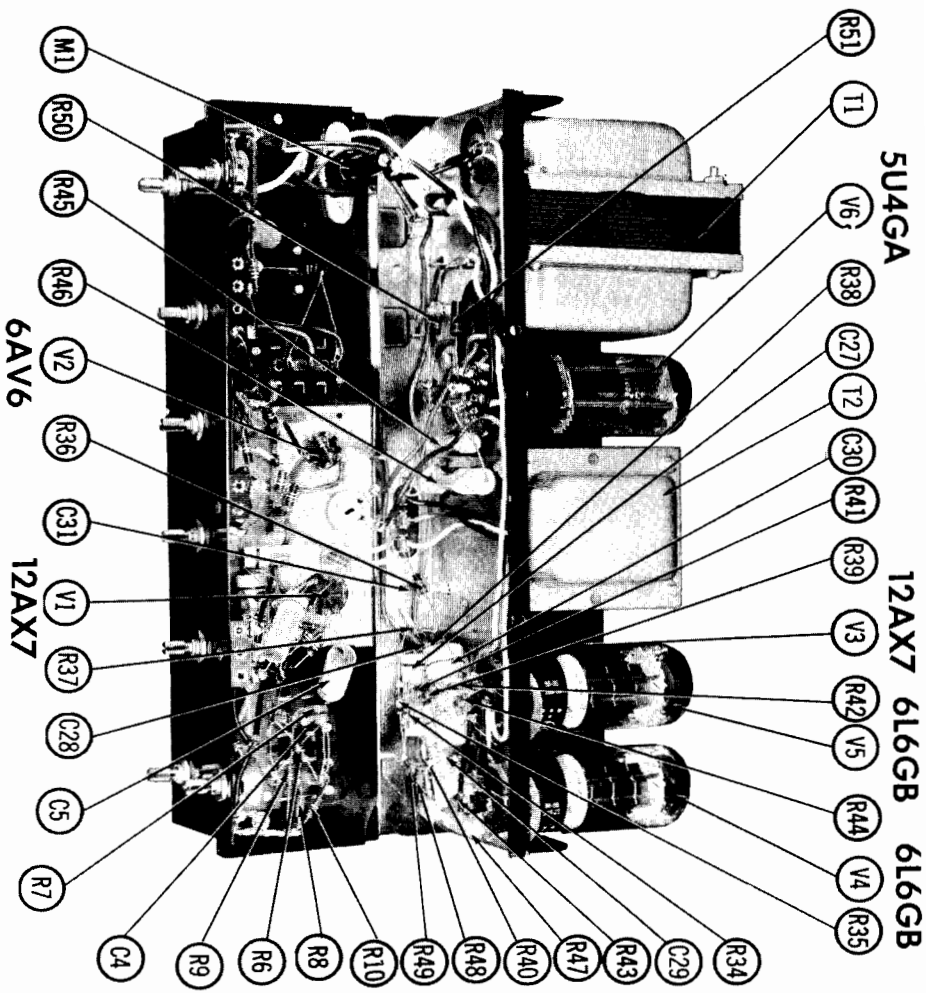
ITEM No.	RATING CAP.	RATING VOLT	REPLACEMENT DATA NEWCOMB PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C4	100		CM-14	SI 100	D6-101	LT6T1	GP-100	UC-531	5GA-T1	
C5	.047	600	CP-49	BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	
C6	.047	600	CP-49	BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	Note 1
C7	47		CM-3	SI 47	D6-470	LT6Q47	GP-47	UC-5447	5GA-Q47	
C8	100		CM-14	SI 100	D6-101	LT6T1	GP-100	UC-531	5GA-T1	
C9	250		CM-22	SI 250	D6-251	LT6T25	GP-250	UC-5325	5GA-T25	
C10	350		CM-26	SI 350	D6-351	LT6T35	GP-350	UC-5335	5GA-T35	Note 2
C11	1000		CM-38	SI 1000	D6-102	LT6D1	GP-1000	DC521	5HK-D1	
C12	.01	600	CP-45	BPD-01	DD-103	CUB6S1	GP-10000	GEM-611	6TM-S1	
C13	.022	600	CP-47	BPD-02	DD-203	CUB6S22	ED-.02	GEM-6122	6TM-S22	
C14	1600		CM-52	BPD-0015	DD-152	L10D15	ED-1500	UC-5215	5HK-D15	
C15	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-.02		5HK-S2	
C16	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-.02		5HK-S2	
C17	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-.02		5HK-S2	
C18	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-.02		5HK-S2	
C19	100		CM-14	SI 100	D6-101	LT6T1	GP-100	UC-531	5GA-T1	
C20	47		CM-3	SI 47	D6-470	LT6Q47	GP-47	UC-5447	5GA-Q47	
C21	10000		CM-32	BPD-01	DD-103	BYA6S1	ED-.01	DC511	5HK-S1	
C22	1000		CM-38	BPD-001	DD-102	BYA6D1	ED-1000	DC521	5HK-D1	
C23	470		CM-25	SI 470	D6-471	LT6T47	GP-470	UC-5347	5GA-T47	
C24	470		CM-25	SI 470	D6-471	LT6T47	GP-470	UC-5347	5GA-T47	
C25	10000		CM-32	BPD-01	DD-103	BYA6S1	ED-.01	DC511	5HK-S1	
C26	20000		CM-35	BPD-02	DD-203	BYB6S2	ED-.02		5HK-S2	
C27	.047	600	CP-49	BPD-05	DF-503	CUB6S47		GEM-6147	6TM-S47	
C28	100		CM-14	SI 100	D6-101	LT6T1	GP-100	UC-531	5GA-T1	
C29	.1	600	CP-52	P688N-1	DF-104	CUB6P1		GEM-601	6TM-P1	
C30	.1	600	CP-52	P688N-1	DF-104	CUB6P1		GEM-601	6TM-P1	
C31	250		DM-22	BPD-00025	D6-251	LT6T25	GP-250	UC-5325	5GA-T25	

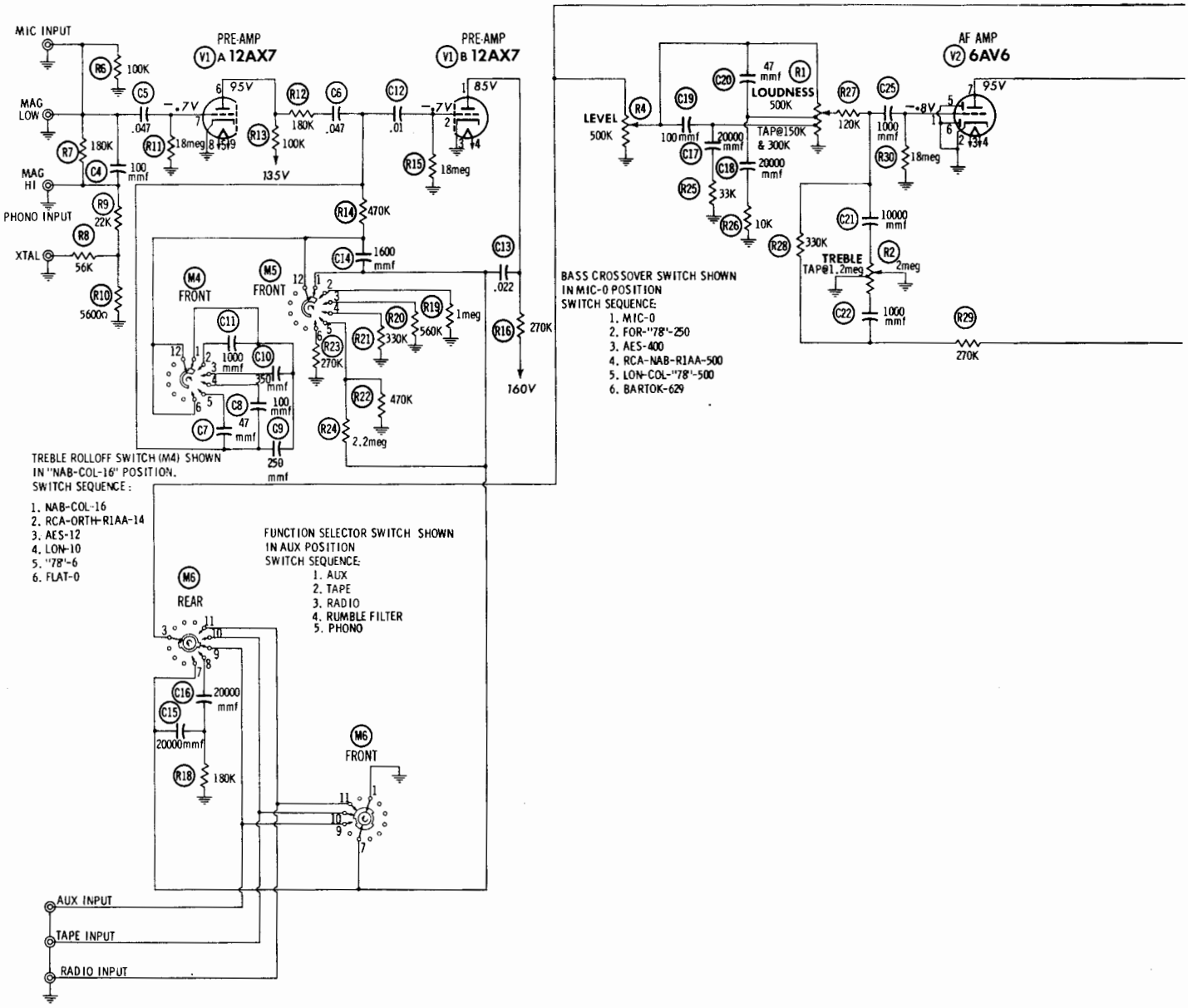
Note 1. Some versions may use .1MFD in this application (Part #CP-52)
Note 2. Some versions may use 300MMF in this application

CONTROLS

ITEM No.	RATING RESISTANCE	RATING WATTS	REPLACEMENT DATA NEWCOMB PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	INSTALLATION NOTES
R1	500K	½	RV-71-K				UDT-285	Loudness, Tap ⓐ 150K & 300K
R2A	2Meg	½	RV-59-K		A47F3-2Meg	Q18-139X	UT-451	Treble, Tap ⓐ L 2Meg
B	Shaft				KSS-3	Not req.	Not req.	
R3A	5Meg	½	RV-57-K					Bass
B	5Meg	½						
R4A	500K	½	RV-86-K	B-59	A47-500K-S	Q11-133	U50	Level
B	Shaft			Not req.	KSS-3	Not req.	Not req.	
R5	100Ω	2	RV-75					Hum Balance

CHASSIS—TOP VIEW





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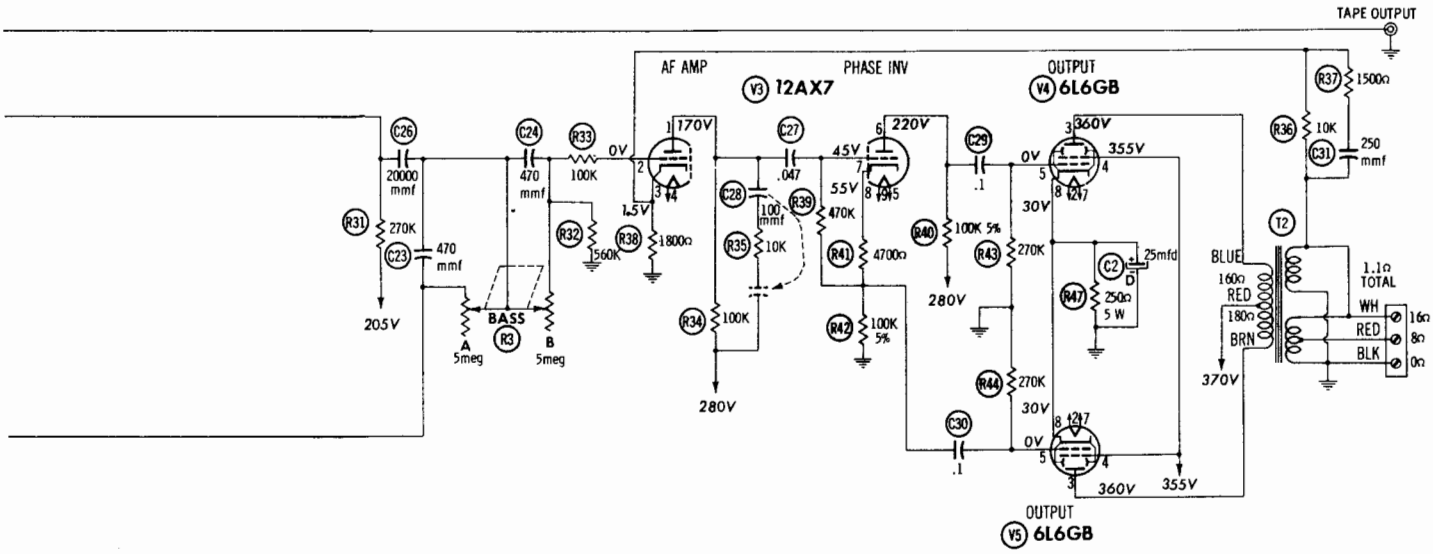
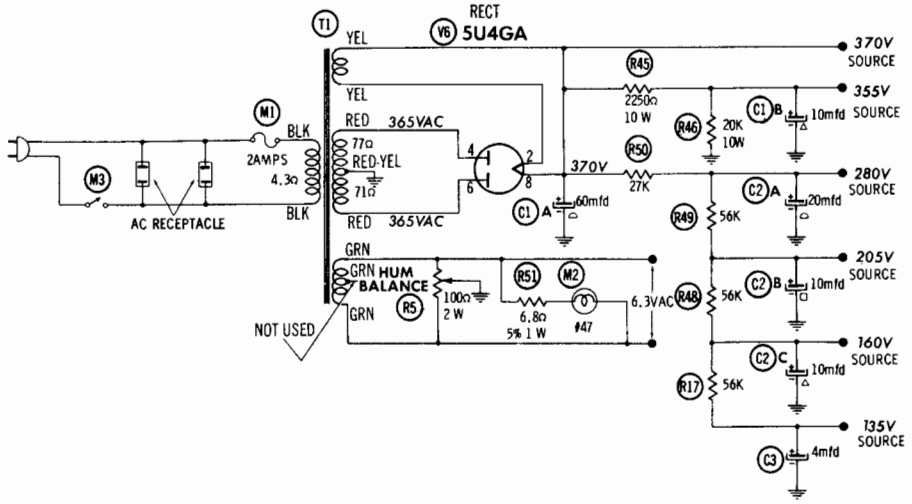




RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7	†410K	18Meg	0Ω	26Ω	26Ω	†295K	18Meg	0Ω	26Ω
V2	6AV6	18Meg	0Ω	26Ω	26Ω	0Ω	0Ω	†355K		
V3	12AX7	†127K	660K	1800Ω	26Ω	26Ω	†127K	570K	100K	26Ω
V4	6L6GB	TP	26Ω	†160Ω	†2250Ω	270K	NC	26Ω	250Ω	
V5	6L6GB	TP	26Ω	†180Ω	†2250Ω	270K	TP	26Ω	250Ω	
V6	5U4GB	TP	20K(Min)	TP	77Ω	TP	71Ω	TP	20K(Min)	

† MEASURED FROM PIN 8 OF V6
NC NO CONNECTION
TP TIE POINT

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	NEWCOMB PART No.	IRC PART No.	
R6	100K		RR-27	BTS-100K	
R7	180K		RR-29	BTS-180K	
R8	56K		RR-25	BTS-56K	
R9	22K		RR-21	BTS-22K	
R10	5600Ω		RR-15	BTS-5600	
R11	18Meg		RR-140	BTS-18Meg	
R12	180K		RR-29	BTS-180K	
R13	100K		RR-27	BTS-100	
R14	470K		RR-33	BTS-470K	
R15	18Meg		RR-140	BTS-18Meg	
R16	270K		RR-31	BTS-270K	
R17	56K		RR-25	BTS-56K	
R18	180K		RR-29	BTS-180K	
R19	1Meg		RR-37	BTS-1Meg	
R20	560K		RR-34	BTS-560K	
R21	330K		RR-32	BTS-330K	
R22	470K		RR-33	BTS-470K	
R23	270K		RR-31	BTS-270K	
R24	2.2Meg		RR-40	BTS-2.2Meg	
R25	33K		RR-23	BTS-33K	
R26	10K		RR-18	BTS-10K	
R27	120K		RR-28	BTS-120K	
R28	330K		RR-32	BTS-330K	

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	NEWCOMB PART No.	IRC PART No.	
R29	270K		RR-31	BTS-270K	
R30	18Meg		RR-140	BTS-18Meg	
R31	270K		RR-31	BTS-270K	
R32	560K		RR-34	BTS-560K	
R33	100K		RR-27	BTS-100K	
R34	100K		RR-27	BTS-100K	
R35	10K		RR-18	BTS-10K	
R36	10K		RR-18	BTS-10K	
R37	1500Ω		RR-8	BTS-1500	
R38	1800Ω		RR-9	BTS-1800	
R39	470K		RR-33	BTS-470K	
R40	100K 5%		RR-50	BTS-100K 5%	
R41	4700Ω		RR-14	BTS-4700	
R42	100K 5%		RR-50	BTS-100K 5%	
R43	270K		RR-31	BTS-270K	
R44	270K		RR-31	BTS-270K	
R45	2250Ω	10	RR-126	1 3/4A-2250	
R46	20K	10	RR-104	PW10-20K	
R47	250Ω	5	RR-94	PW7-250	
R48	56K		RR-25	BTS-56K	
R49	56K		RR-25	BTS-56K	
R50	27K		RR-22	BTS-27K	
R51	6.8Ω 5%	1	RR-149		

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	NEWCOMB PART No.	Holldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117VAC ② .96A	720VCT ② .122A	5V ② 3A	6.3VCT ② 2.8A	TR-118	P9316 ①	P-3173 ②	PC8411 ①	24R064 ①	R-14A ① ②

① Tape Center Tap On 6.3V Winding.
② Drill New Mounting Holes.

CHASSIS—BOTTOM VIEW

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	NEWCOMB PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	
T2	6300Ω CT	16Ω Tap ② 8Ω	TR-161	Z1403 ①	A-3130 ①	A-3307 ①	22S68 ①	S-60A ①	① Drill new mounting holes.

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			NEWCOMB PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M1	3AG	2A	FA-5		312002. (3AG2A)	341001	AGC2	HKP

MISCELLANEOUS

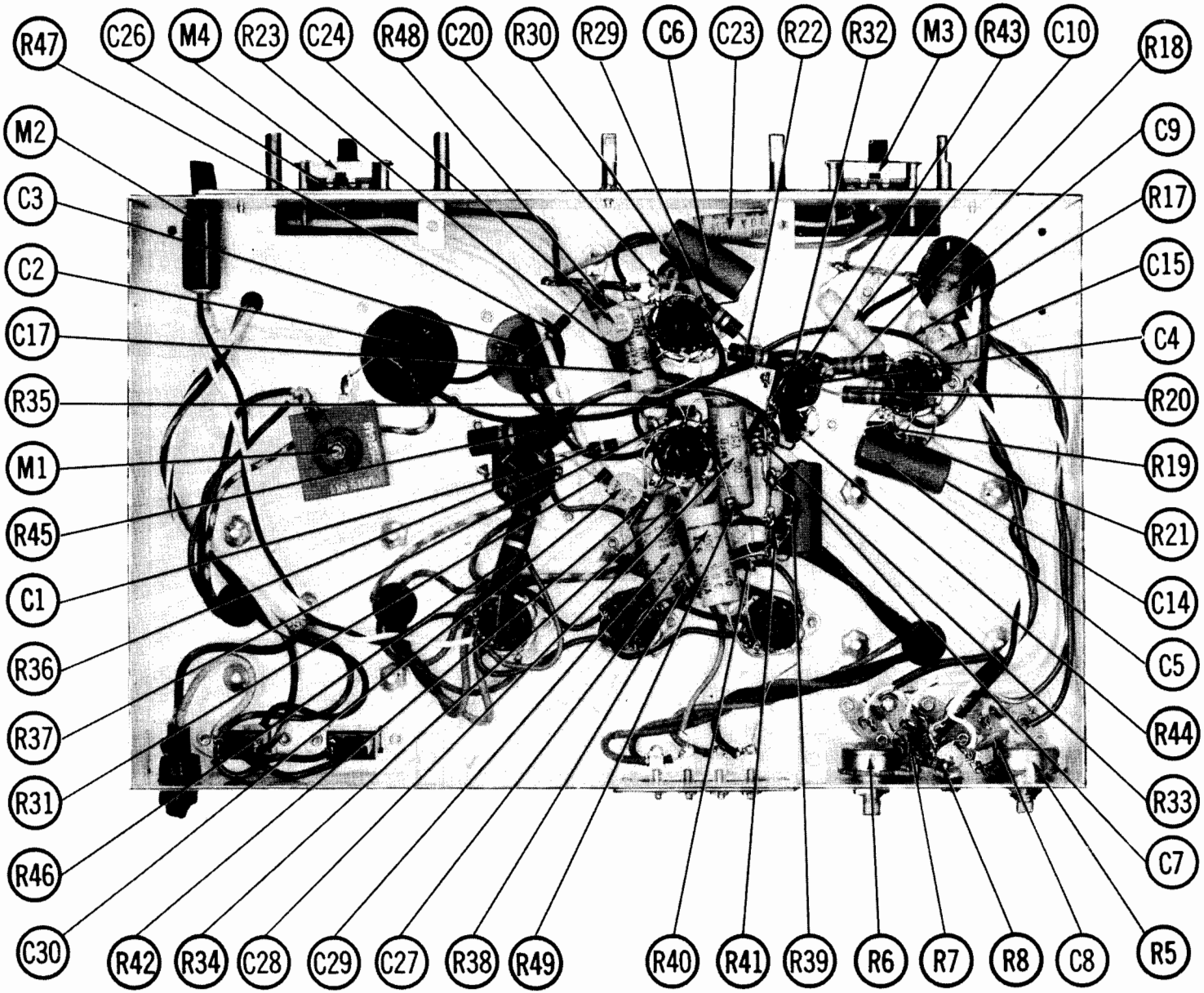
ITEM No.	PART NAME	NEWCOMB PART No.	NOTES
M2	Pilot Light		#47
M3	Switch		ON-OFF
M4	Switch	SY-89	Treble Rolloff
M5	Switch	SY-89	Bass Crossover
M6	Switch	SY-91	Selector

PILOT MODEL
AA-903B

TRADE NAME	Pilot Model AA-903B
MANUFACTURER	Pilot Radio Corp., 37-06 36th St., Long Island City 1, N. Y.
TYPE SET	AC Operated 5 Channel Audio Amplifier
TUBES (Six)	Types 12AX7 Phono Preamplifier, 12AX7 AF Amplifier, 12AX7 AF Amp. - Phase Inv., (2) EL84 (or) 6BQ5 Output, EZ81 (or) 6CA4 Rectifier
POWER SUPPLY	105-120 Volts AC-60 Cycles RATING .72 Amp. @ 117 Volts AC (71 Watts)

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co., Inc., as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co., Inc., by the manufacturers of the particular type of replacement part listed. Reproduction or use, without express permission, of editorial or pictorial content, in any manner, is prohibited. No patent liability is assumed with respect to the use of the information contained herein. © 1957 Howard W. Sams & Co., Inc., Indianapolis 5, Indiana. Printed in U.S. of America



CHASSIS-BOTTOM VIEW

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Phono Preamplifier	12AX7	
V2	AF Amplifier	12AX7	
V3	AF Amp. - Phase Inv.	12AX7	

Note 1. Alternate Type 6BQ5

ITEM No.	USE	TYPE	NOTES
V4	Output	EL84	Note 1
V5	Output	EL84	Note 1
V6	Rectifier	EZ81	Note 2

Note 2. Alternate Type 6CA4

ELECTROLYTIC CAPACITORS

ITEM No.	RATING CAP.	RATING VOLT.	REPLACEMENT DATA PILOT PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▲20	350	24-153	AFH4-14	D0130	FP444	TMQ-12	Q-040	TVL-4763
B	■20	350							
C	▲20	350							
D	20	350							
C2	500	25	24-152	AFH1-08	A0120	WP057	TMS-10	S-040	TVL-1220
C3	100	25	24-154	AFH1-21	XA0241	WP055	TMS-9	S-035	TVL-1423
C4A	▲10	350	24-151	AFH3-28	C0220	FP259	TMT-28	S-215	TVL-3639.7
B	■40	350						MT-4510	
C5	25	25	24-50	PRS25V25	BBR25-25	TC26	TD-25-25	MT-0225	TVA-1205
C6	25	25	24-50 ①	PRS25V25	BBR25-25	TC26	TD-25-25	MT-0225	TVA-1205
C7	25	25	24-50	PRS25V25	BBR25-25	TC26	TD-25-25	MT-0225	TVA-1205

① Not used in some versions.

FIXED CAPACITORS

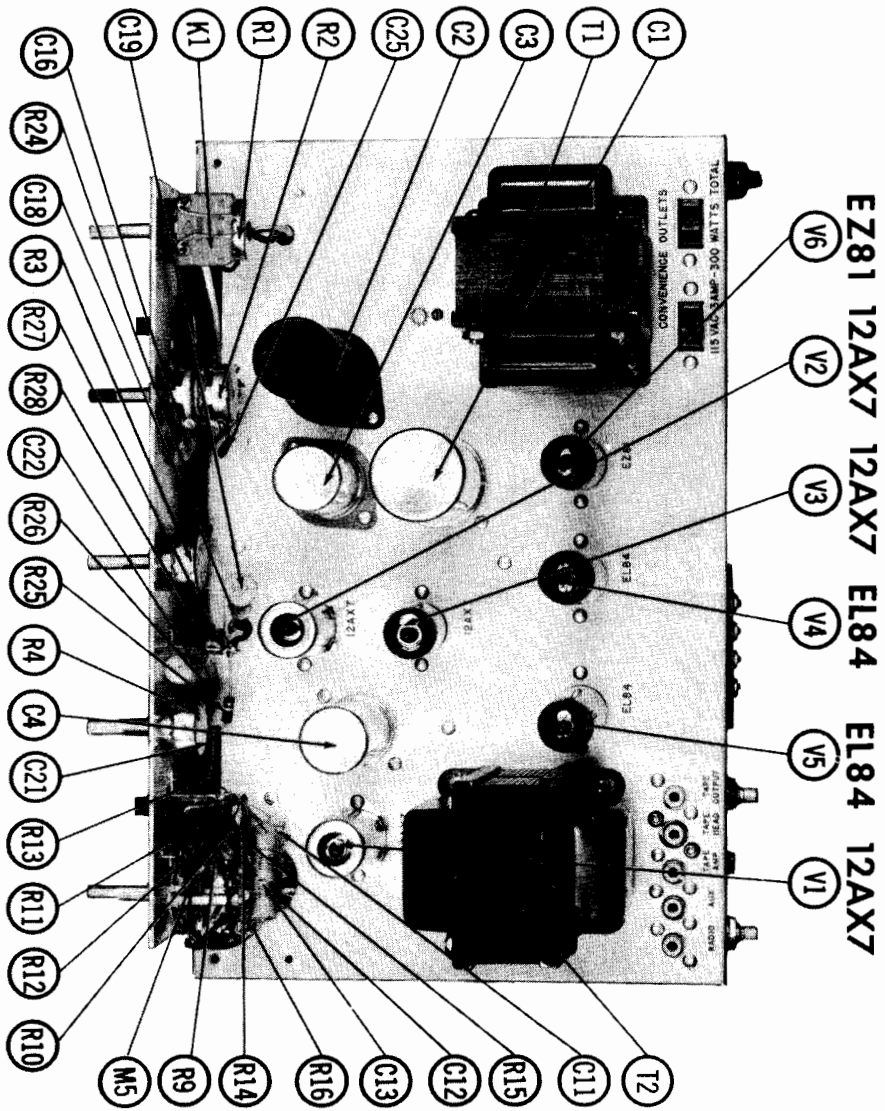
Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

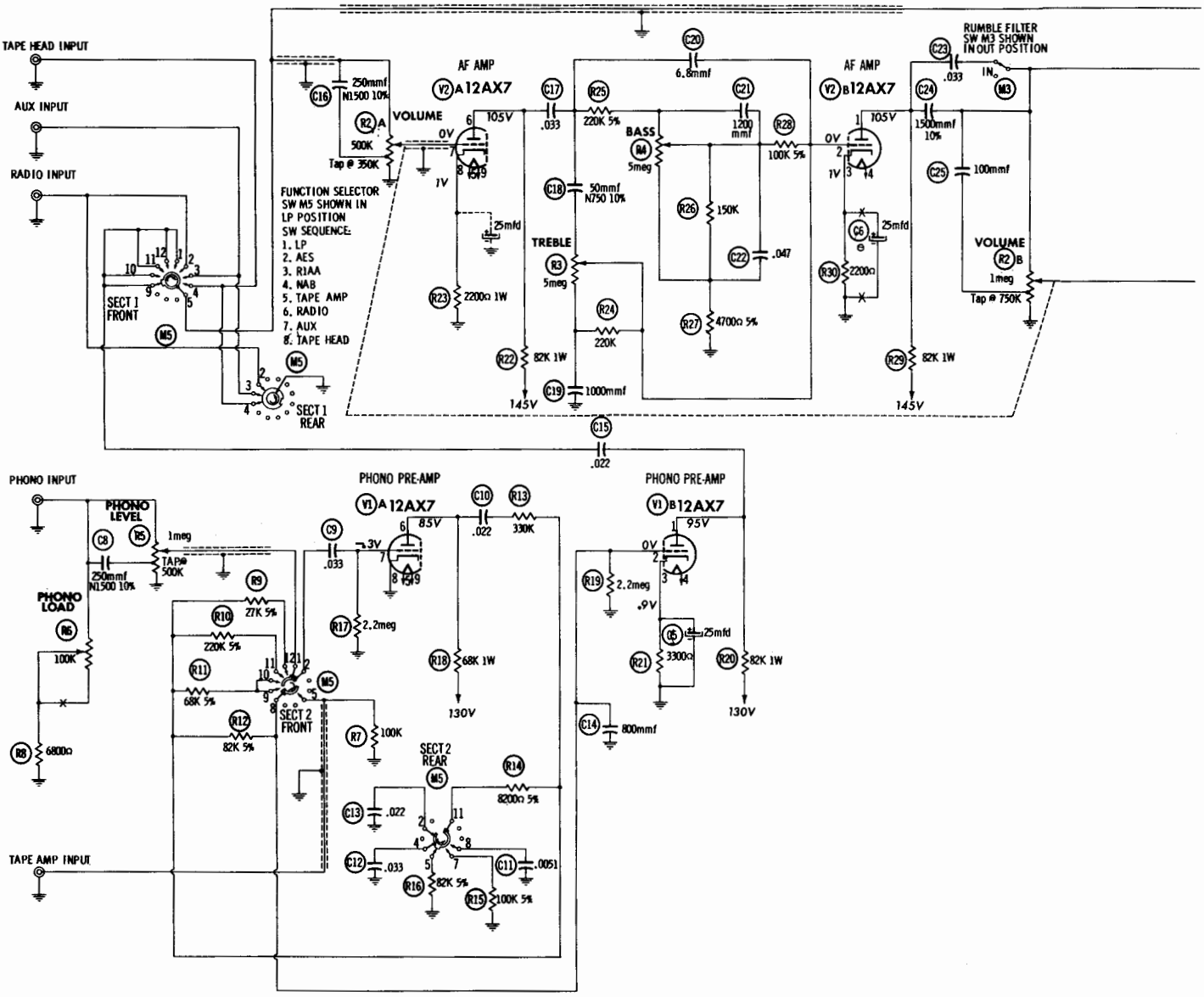
ITEM No.	RATING CAP.	RATING VOLT	REPLACEMENT DATA PILOT PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C8	250									N1500 10%
C9	.033	400		BPD-03	DF-303	CUB6S33		GEM-4133	6TM-S33	
C10	.022	400		BPD-02	DD-203	CUB4S22	ED-02	GEM-4122	4TM-S22	
C11	.0051	400		BPD-005	D6-502	CUB6D5	GP-5000	GEM-625	6TM-D5	
C12	.033	400		BPD-03	DF-303	CUB6S33		GEM-4133	6TM-S33	
C13	.022	400		BPD-02	DD-203	CUB4S22	ED-02	GEM-4122	4TM-S22	
C14	800			BPD-0008	DD-801	L10T8			5GA-T8	
C15	.022	400		BPD-02	DD-203	CUB4S22	ED-02	GEM-4122	4TM-S22	
C16	250									N1500 10%
C17	.033	400		BPD-03	DF-303	CUB6S33		GEM-4133	6TM-S33	
C18	50				TCN-50	C10Q5U	TC7-50			N750 10%
C19	1000			BPD-001	DD-102	BYA6D1	ED-1000	DC521	5HK-D1	
C20	6.8			NPO-SI 6.8	TCZ-6R8	C10V68C	TCO-6.8	ZT-5568	5TCCB-V68	
C21	1200				D6-122	L10D12	ED-0012	UC-5212	5GA-D12	
C22	.047	400		BPD-05	DF-503	CUB4S47		GEM-4147	4TM-S47	
C23	.033	400		BPD-03	DF-303	CUB6S33		GEM-4133	4TM-S33	
C24	1500			1464-0015		1R5D15			MS-215	10%
C25	100			BPD-0001	DD-101	L10T1	ED-100	UC-531	5GA-T1	
C26	1500			1464-0015		1R5D15			MS-215	10%
C27	.1	400		P488N-1	DF-104	CUB4P1		GEM-401	4TM-P1	
C28	.1	200		P488N-1	DF-104	CUB2P1		GEM-201	2TM-P1	
C29	.1	400		P488N-1	DF-104	CUB4P1		GEM-401	4TM-P1	
C30	150			N750-SI 150	TCN-150	C10T15U	TC7-150		5TCU-T1	N750 10%

CONTROLS

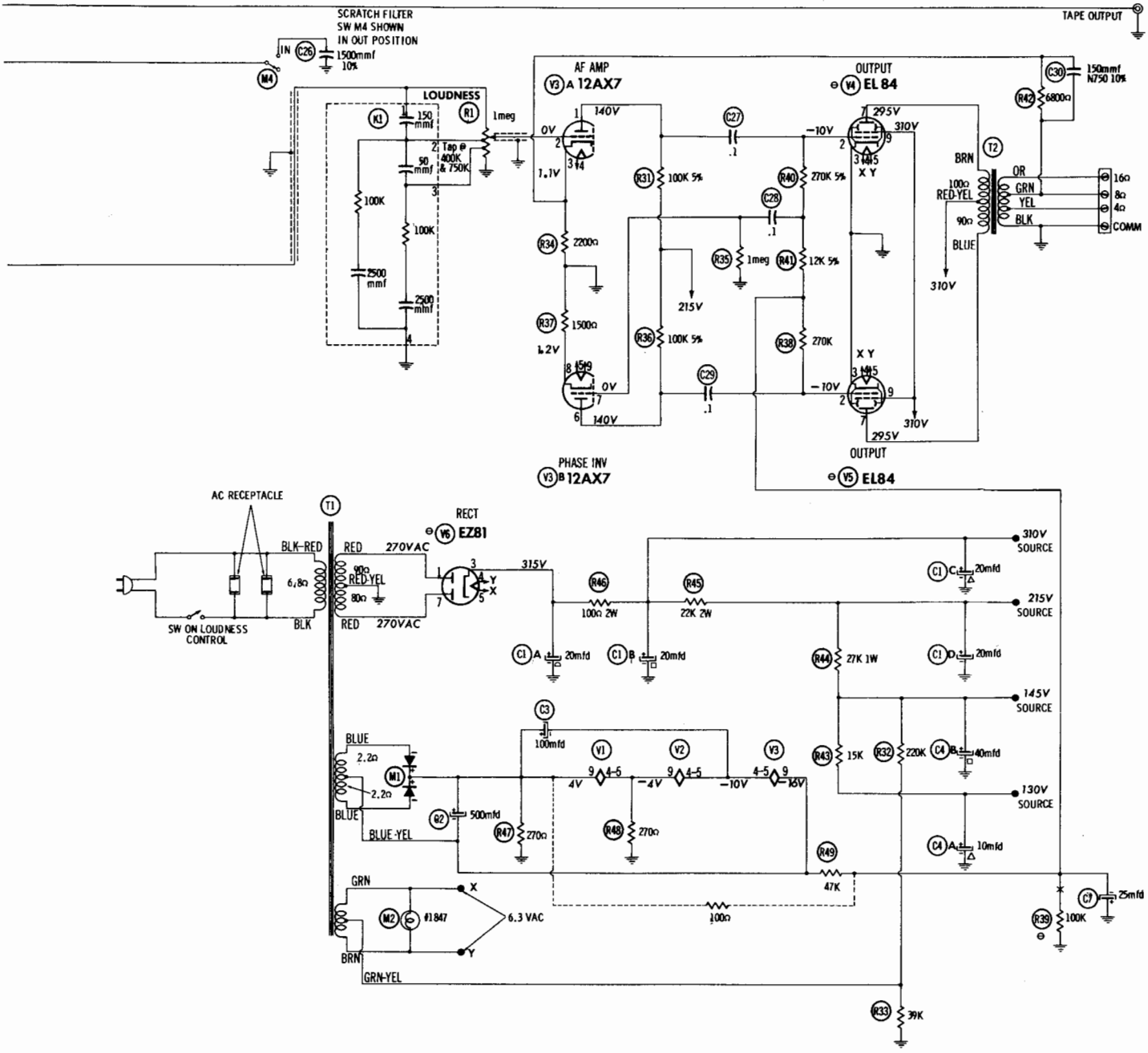
ITEM No.	RATING RESISTANCE	RATING WATTS	REPLACEMENT DATA PILOT PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	1Meg	½	36-66	C170S				Loudness, Tap ② 400K & 750K
B	Switch							
R2A	500K	½	36-65					Volume, Tap ② 350K
B	1Meg	½						Volume, Tap ② 750K
R3A	5Meg	½	37-35	B-87	A47-5Meg-S	Q11-141	U67	Treble
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
R4A	5Meg	½	37-35	B-87	A47-5Meg-S	Q11-141	U67	Bass
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
R5A	1Meg	½	39-41	ABT-74	A47F5-1Meg	Q19-137X	UT-443	Phono Level, Tap ② 500K
B	Shaft			AK-1	FKS-1/4	Not Req.	Not Req.	
R6A	100K	½	39-32	B-40	A47-100K-S	Q11-128	U41	Phono Load
B	Shaft			Not Req.	FKS-1/4	Not Req.	Not Req.	

CHASSIS—TOP VIEW





A PHOTOFACT STANDARD NOTATION SCHEMATIC
Howard W. Sams & Co., Inc. 1957



RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7	†.145K	2.2Meg	3300Ω	135Ω	135Ω	†130K	2.2Meg	0Ω	135Ω
V2	12AX7	† 130K	100K	2200Ω	135Ω	135Ω	† 130K	0Ω	2200Ω	135Ω
V3	12AX7	† 120K	0Ω	2200Ω	135Ω	135Ω	† 120K	1Meg	1500Ω	135Ω
V4	EL84	NC	380K	0Ω	35K	35K	NC	† 200Ω	NC	† 100Ω
V5	EL84	NC	370K	0Ω	35K	35K	NC	† 190Ω	NC	† 100Ω
V6	EZ81	90Ω	NC	20K(Min)	35K	35K	NC	80Ω	NC	NC

ALL MEASUREMENTS TAKEN IN "LP" POSITION
† MEASURED FROM PIN 3 OF V6
NC NO CONNECTION

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

⊖ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA PILOT PART No.	REPLACEMENT DATA IRC PART No.	NOTES
R7	100K			BTS-100K	
R8	6800Ω			BTS-6800	
R9	27K 5%			BTS-27K 5%	
R10	220K 5%			BTS-220K 5%	
R11	68K 5%			BTS-68K 5%	
R12	82K 5%			BTS-82K 5%	
R13	330K			BTS-330K	
R14	8200Ω 5%			BTS-8200 5%	
R15	100K 5%			BTS-100K 5%	
R16	82K 5%			BTS-82K 5%	
R17	2.2Meg			BTS-2.2Meg	
R18	68K	1		BTA-68K	
R19	2.2Meg			BTS-2.2Meg	
R20	82K	1		BTA-82K	
R21	3300Ω			BTS-3300	
R22	82K	1		BTA-82K	
R23	2200Ω	1		BTA-2200	
R24	220K			BTS-220K	
R25	220K 5%			BTS-220K 5%	
R26	150K			BTS-150K	
R27	4700Ω 5%			BTS-4700 5%	

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA PILOT PART No.	REPLACEMENT DATA IRC PART No.	NOTES
R28	100K 5%			BTS-100K 5%	
R29	82K	1		BTA-82K	
R30	2200Ω			BTS-2200	
R31	100K 5%			BTS-100K 5%	
R32	220K			BTS-220K	
R33	39K			BTS-39K	
R34	2200Ω			BTS-2200	
R35	1Meg			BTS-1Meg	
R36	100K 5%			BTS-100K 5%	
R37	1500Ω			BTS-1500	
R38	270K			BTS-270K	
R39	100K			BTS-100K	Note 1
R40	270K 5%			BTS-270K 5%	
R41	12K 5%			BTS-12K 5%	
R42	6800Ω			BTS-6800	
R43	15K			BTS-15K	
R44	27K	1		BTA-27K	
R45	22K	2		BTB-22K	
R46	100Ω	2		BTB-100	
R47	270Ω			BTS-270	
R48	270Ω			BTS-270	
R49	47K			BTS-47K	

Note 1. Not used in some versions.

TRANSFORMER (POWER)

ITEM No.	RATING PRI.	RATING SEC. 1	RATING SEC. 2	RATING SEC. 3	REPLACEMENT DATA PILOT PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordorson PART No.	Triad PART No.
T1	117VAC @ .72A	540VCT @ .108A	6.3VCT @ 2.5A	32VCT @ 320A	55-58					

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE PRI.	IMPEDANCE SEC.	REPLACEMENT DATA PILOT PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	NOTES
T2	7300Ω CT	16Ω Tap @ 8Ω, 4Ω	56-51	Z1405 ①			22S66 ①	S-24A ①	① Fabricate mounting

PARTS LIST AND DESCRIPTIONS (Continued)

COMPONENT COMBINATIONS

ITEM No.	USE	DESCRIPTION	PILOT PART No.	REPLACEMENT DATA
K1	Tone Compensation	150MMF, 50MMF, 2500MMF, 2500MMF, 100K, 100K		Centralab PC-325

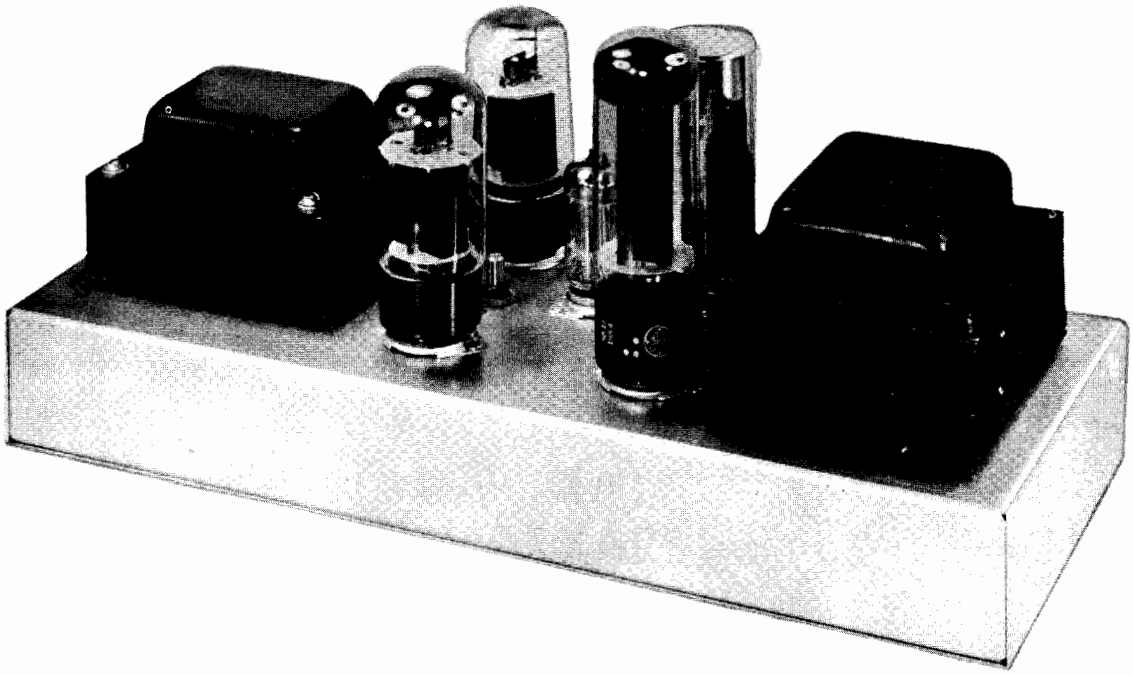
SELENIUM RECTIFIER

ITEM No.	RATING CURRENT (Measured)	REPLACEMENT DATA PILOT PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	SARKES TARZIAN PART No.	NOTES
M1	.320A	110-519	1017	C1B	604B	

MISCELLANEOUS

ITEM No.	PART NAME	PILOT PART No.	NOTES
M2	Pilot Light	68-10	#1847
M3	Switch	101-41	Rumble Filter (Slide Type SPST)
M4	Switch	101-41	Scratch Filter (Slide Type SPST)
M5	Switch	100-115	Selector (Rotary Wafer Type)

H. H. SCOTT
MODEL 223



H. H. SCOTT
MODEL 223

TRADE NAME	H. H. Scott Model 223
MANUFACTURER	Hermon Hosmer Scott, Inc., 385 Putnam Ave., Cambridge 39, Mass.
TYPE SET	AC Operated Audio Amplifier
TUBES (Four)	Types 12AX7 AF Amp.-Phase Inv., (2) 6L6GB Output, 5U4GA Rectifier
POWER SUPPLY	110-120 Volts AC-60 Cycles. RATING .97 Amp. @ 117 Volts AC

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	AF Amp.-Phase Inv.	12AX7	
V2	Output	6L6GB	
V3	Output	6L6GB	
V4	Rectifier	5U4GA	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING CAP.	RATING VOLT.	REPLACEMENT DATA H. H. Scott PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▲20	475		AFH4-19-20	BO500	FP475	TMQ-123	Q-075	TVL-4834
B	■20	475			BO500			MT-4720	
C	▲20	475							
D	20	475							
C2	50	100		PRS150V50	BR5015	TC49	TD-50-150	FM-1550	TVA-1414

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING CAP.	RATING VOLT	REPLACEMENT DATA H. H. Scott PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C3	.0068	400		BPD-0068	D6-682	CUB6D68		GEM-6268	6TM-D68	
C4	.0027	400		BPD-0025	D6-272					
C5	100			BPD-0001	DD-101	G042	ED-100	UC-531	5GA-T1	
C6	20000			BPD-02	DD-203	K085	ED-02		5HK-S2	
C7	.047	400		BPD-05	DF-503	CUB4S47		GEM-4147	4TM-S47	
C8	330			BPD-00033	DD-331	G056	ED-330	UC-5333	5GA-T33	
C9	.047	400		BPD-05	DD-503	CUB4S47		GEM-4147	4TM-S47	

CONTROLS

ITEM No.	RATING RESISTANCE	RATING WATTS	REPLACEMENT DATA H. H. Scott PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	500K	½		B-60	A47-500K-Z	Q13-133	U48	Level
B	Shaft			Not Req.	RS-2	Not Req.	Not Req.	
R2A	50K	½		AB-31	A47-50K-S	Q11-123	SU-35	Balance
B	Shaft			AK-1	FKS-1/4	RQ	Not Req.	

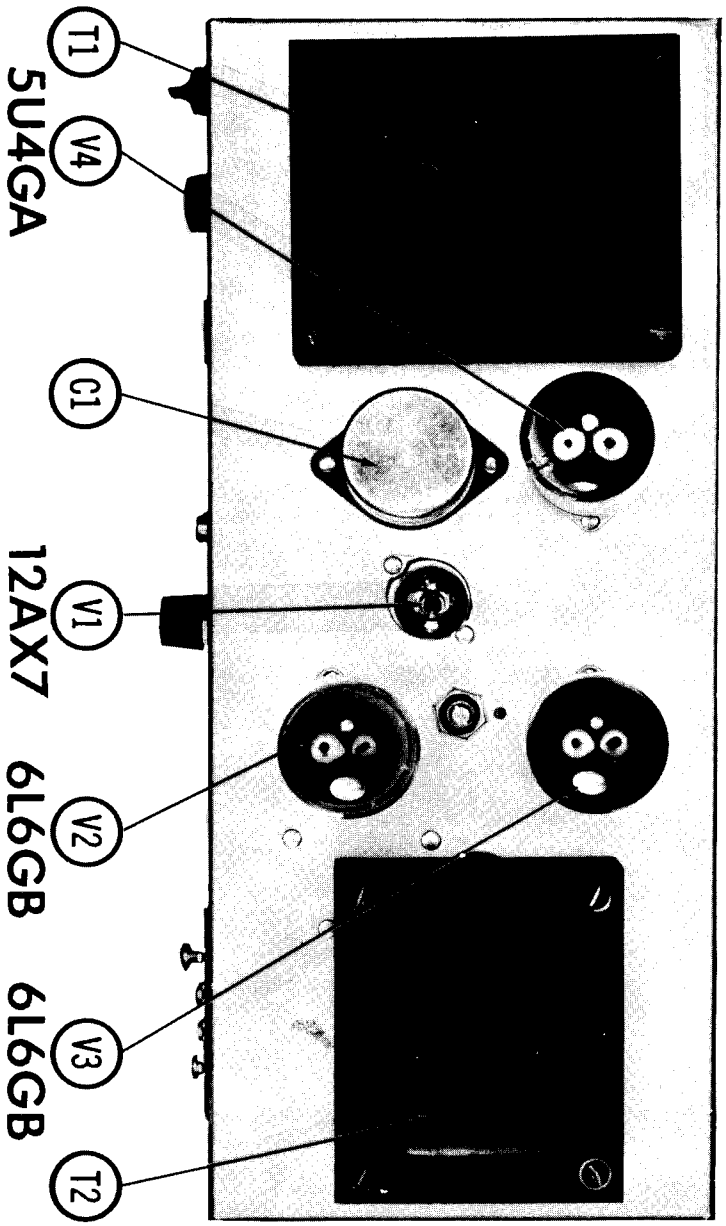
RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA H. H. Scott PART No.	REPLACEMENT DATA IRC PART No.	NOTES
R3	2.2Meg			BTS-2.2Meg	
R4	100K	1		BTA-100K	
R5	220K			BTS-220K	
R6	1800Ω			BTS-1800	
R7	12K			BTS-12K	
R8	2.2Meg			BTS-2.2Meg	
R9	100K	1		BTA-100K	
R10	270K			BTS-270K	
R11	1500Ω			BTS-1500	
R12	12K			BTS-12K	
R13	330K			BTS-330K	

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA H. H. Scott PART No.	REPLACEMENT DATA IRC PART No.	NOTES
R14	6800Ω			BTS-6800	
R15	1000Ω			BTS-1000	
R16	330K			BTS-330K	
R17	1000Ω			BTS-1000	
R18	160Ω	5		PW7-150	
R19	25K	10		1 3/4A-25K	
R20	3300Ω	2		BTB-3300	
R21A	33Ω	4			
B	160Ω	5			
C	1500Ω	2			

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	H. H. Scott PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117VAC @ .97A	700VCT @ .130A	5VAC @ 3A	6.3VCT @ 2.1A	TR-10-3	P9315	P-2953①	PM8411 ①	22R07	R-168 ①

① Fabricate mounting.

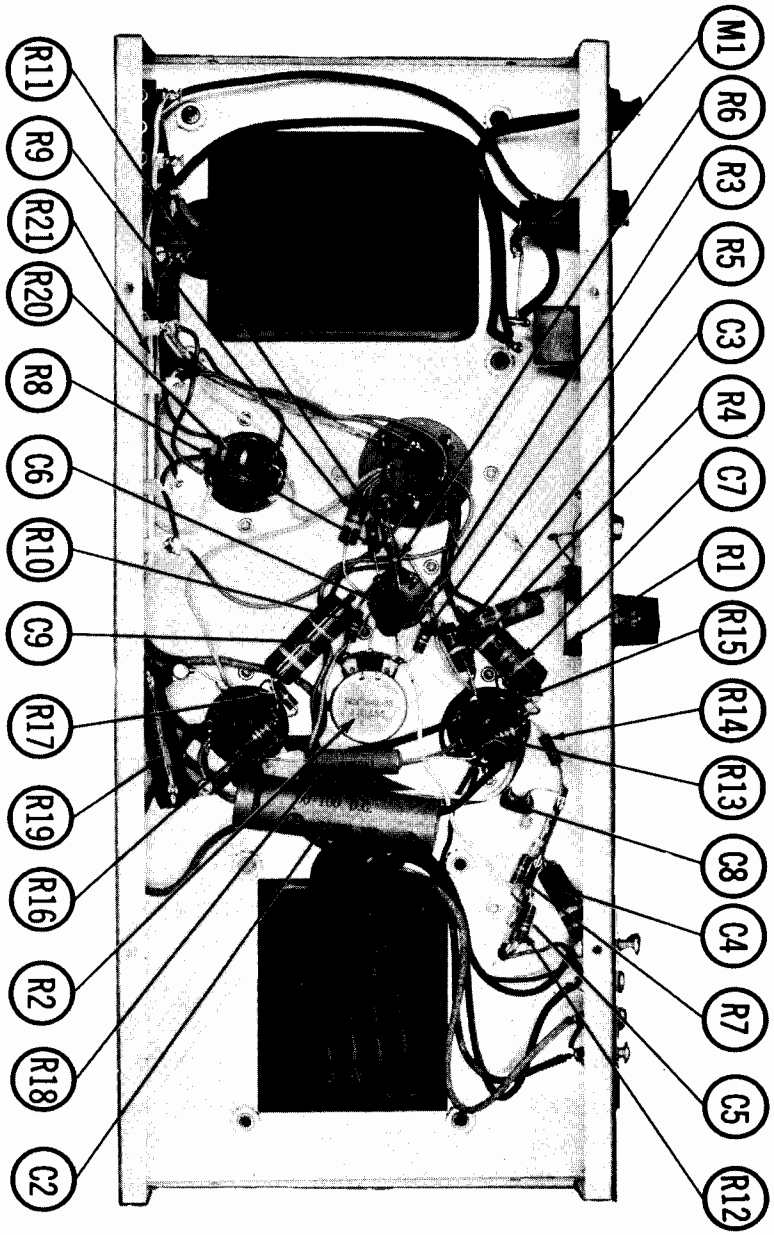
TRANSFORMER (AUDIO OUTPUT)

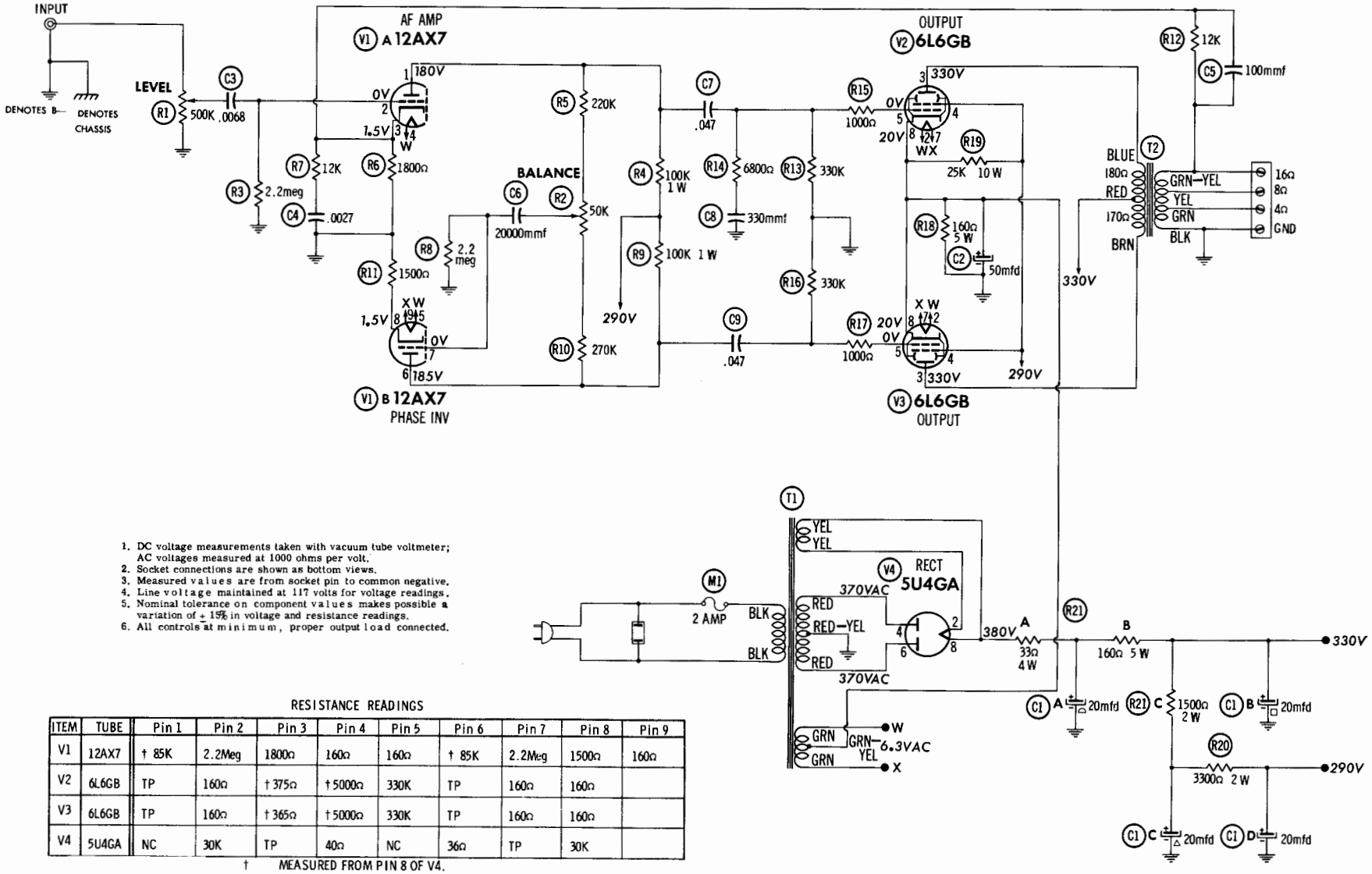
ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	H. H. Scott PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	
T2	7300Ω CT	16Ω tap @ 8Ω, 4Ω	TRA-10-14						

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			H. H. Scott PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M1	3AG	2A			313002. (3AG S/B 2A)	342003.	MDL2	HKP

CHASSIS—BOTTOM VIEW





1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7	† 85K	2.2Meg	1800Ω	160Ω	160Ω	† 85K	2.2Meg	1500Ω	160Ω
V2	6L6GB	TP	160Ω	† 375Ω	† 5000Ω	330K	TP	160Ω	160Ω	
V3	6L6GB	TP	160Ω	† 365Ω	† 5000Ω	330K	TP	160Ω	160Ω	
V4	5U4GA	NC	30K	TP	40Ω	NC	36Ω	TP	30K	

† MEASURED FROM PIN 8 OF V4.
NC NO CONNECTION.
TP TIE POINT.

A PHOTOFACT STANDARD NOTATION SCHEMATIC

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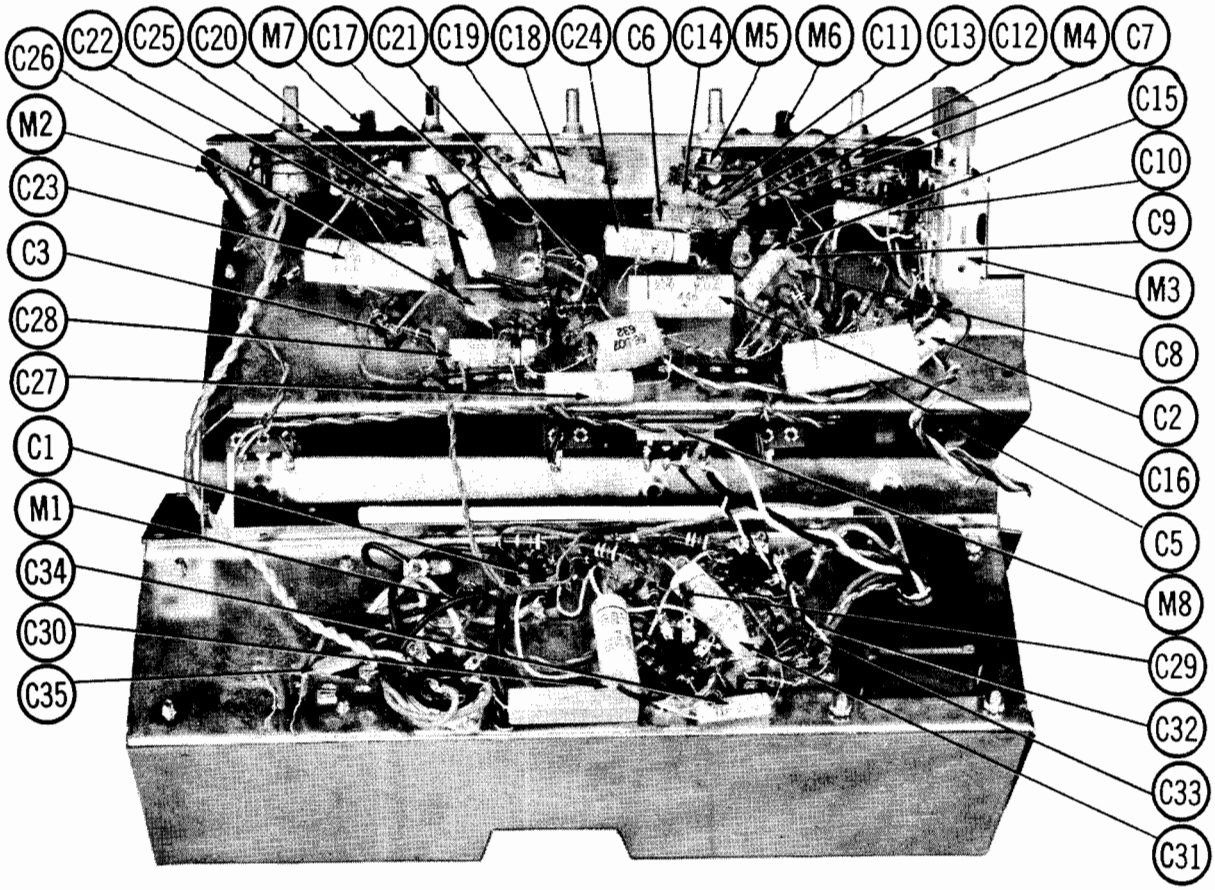
SHERWOOD MODEL S-1000-II

SHERWOOD MODEL S-1000-II

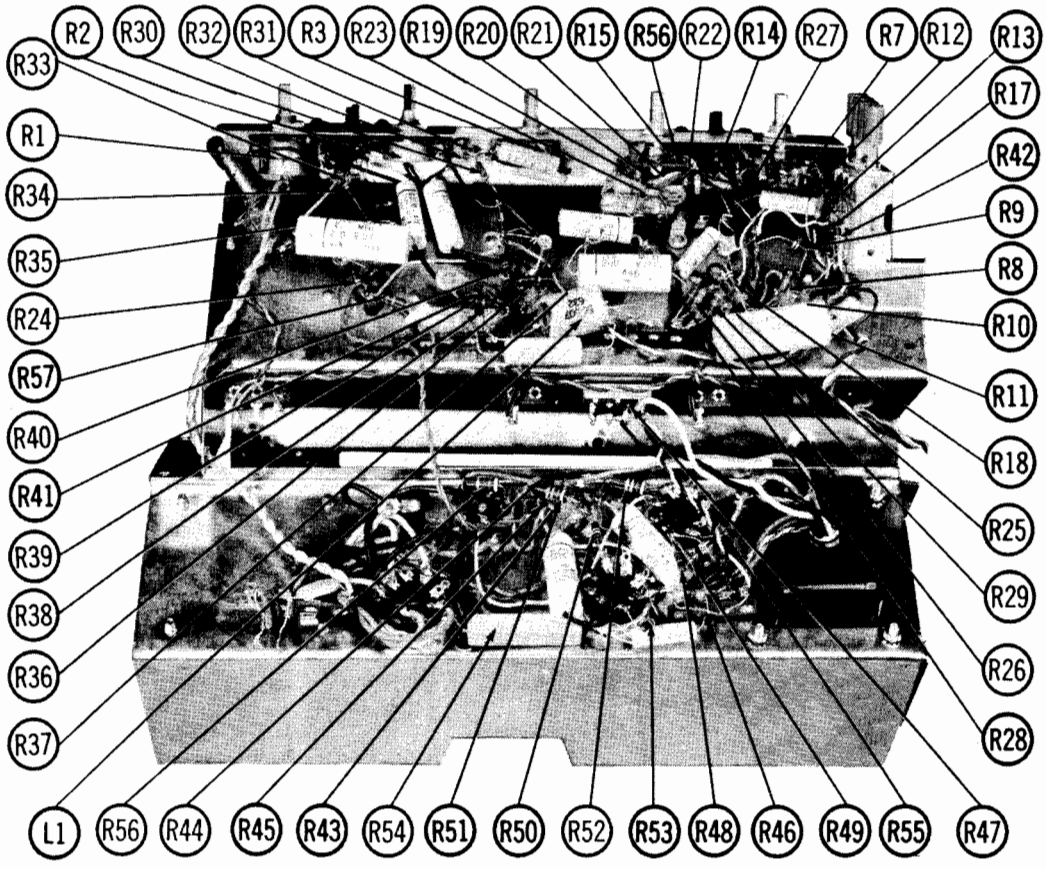
TRADE NAME	Sherwood Model S-1000-II
MANUFACTURER	Sherwood Electronic Laboratories, Inc., 2802 W. Cullom Ave., Chicago 18, Illinois
TYPE SET	AC Operated 20 Watt Audio Amplifier
TUBES (Seven)	Types EF86/6267 (or) Z729 Preamplifier, 12AX7/ECC83 Preamp.-Cath. Follower, 12AX7/ECC83 AF Amplifier, 6BA8A AF Amp.-Phase Inv., (2) 6L6GB Output, 5Y3GT Rectifier
POWER SUPPLY	110-120 Volts AC-60 Cycles RATING .96 Amp. @ 117 Volts AC (100 Watts)

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co., Inc., as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co., Inc., by the manufacturers of the particular type of replacement part listed. Reproduction or use, without express permission, of editorial or pictorial content, in any manner, is prohibited. No patent liability is assumed with respect to the use of the information contained herein. © 1958 Howard W. Sams & Co., Inc., Indianapolis 5, Indiana. Printed in U.S. of America



CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION



CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE
V1	Preamplifier	EF86/6267 Note 1
V2	Preamp. - Cath. Follower	12AX7/ECC83
V3	AF Amplifier	12AX7/ECC83
V4	AF Amp. - Phase Inv.	6BA8A

ITEM No.	USE	TYPE
V5	Output	6L6GB
V6	Output	6L6GB
V7	Rectifier	5Y3GT

Note 1. Alternate Type Z729

ELECTROLYTIC CAPACITORS

ITEM No.	RATING CAP.	RATING VOLT.	REPLACEMENT DATA SHERWOOD PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▲40	400		AFH4-85-25	D0655	FP431-3		Q-310	R2528 *
B	■40	400							
C	▲5	350							
D	50	50							
C2	50	5		SRE6V50	BBR50-6	TT6X50	TD-50-6	MMT-650	TE-1100
C3A	▲10	400		AFH2-47	B0370	FP231	TMD-41	D-200	R2322 *
B	■15	400							

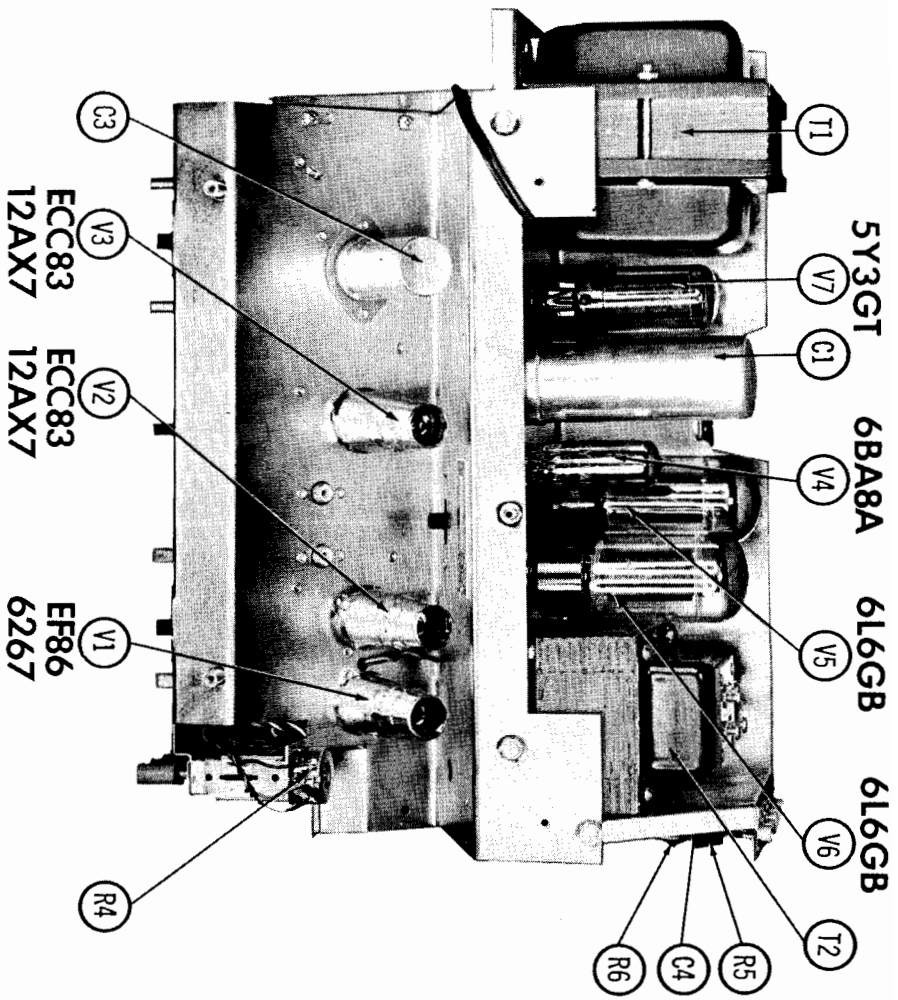
* Non Catalog Item

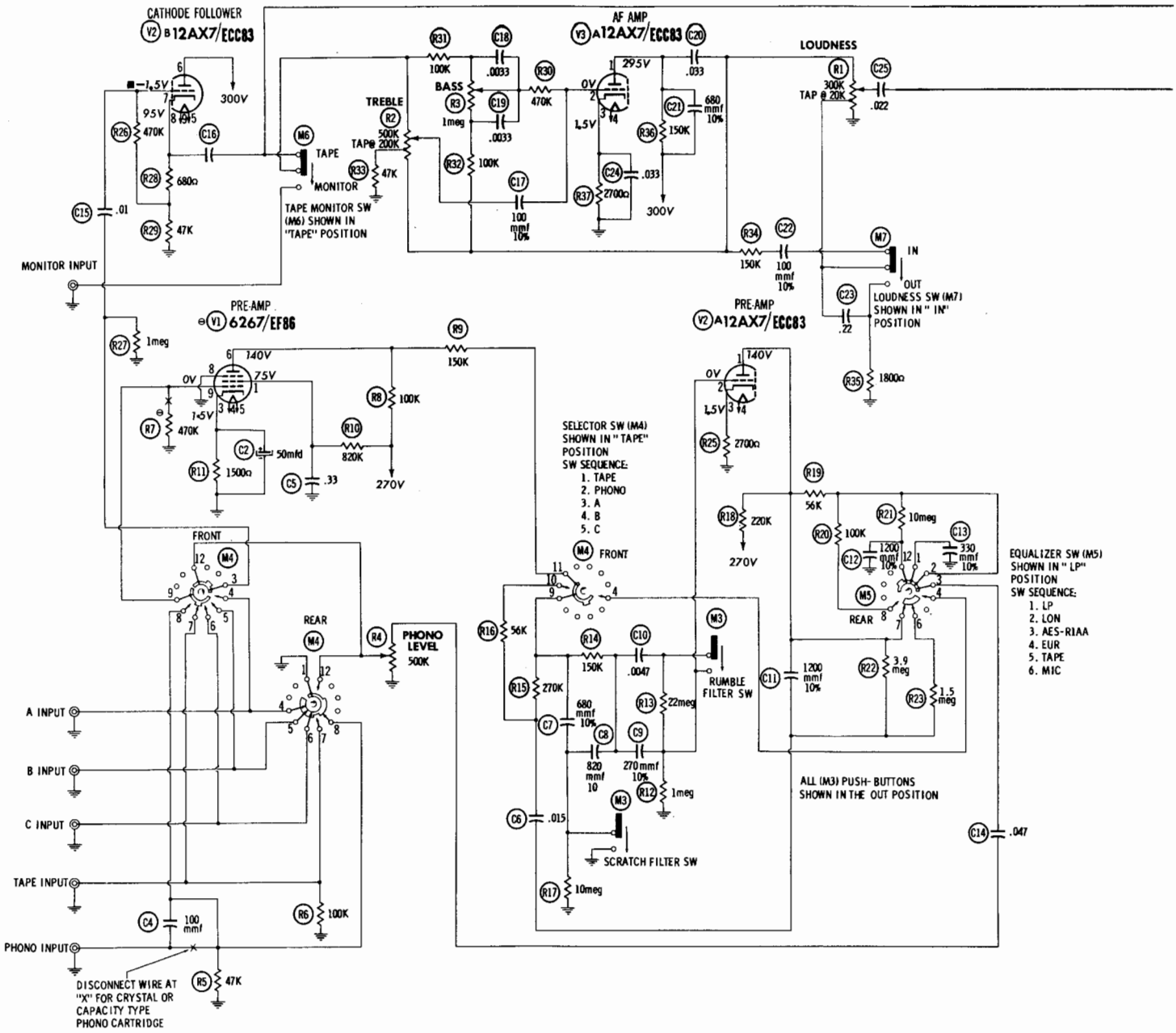
FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

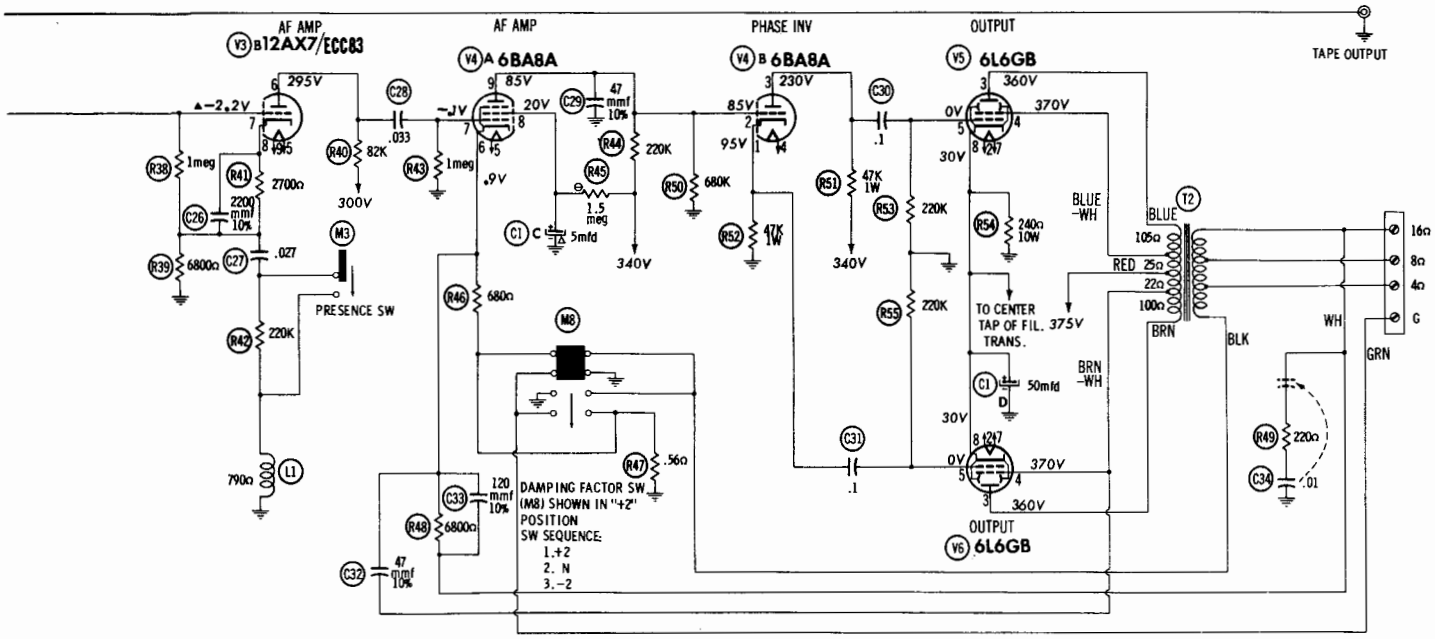
ITEM No.	RATING CAP.	RATING VOLT	REPLACEMENT DATA SHERWOOD PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C4	100			1468-0001	D6-101	5W5T1	ED-100	MC235	1FM-31	
C5	.33	200		P288N-33				GEM-2033		
C6	.015	400		P488N-015	DD16-153	CUB6S15	ED-015	GEM-4115	4TM-S15	
C7	680				D6-681	1R5T68	ED-680		MS-368	10%
C8	820					1R5T82	ED-820		MS-382	10%
C9	270				D6-271	5R5T27	ED-270		MS-327	10%
C10	.0047	400		P488N-0047	D6-472	CUB6D47	GP-4700	GEM-6247	6TM-D47	
C11	1200					1R5D12	ED-1200		MS-212	10%
C12	1200					1R5D12	ED-1200		MS-212	10%
C13	330				D6-331	5R5T33	ED-330		MS-333	10%
C14	.047	400		P488N-047	DF-503	CUB4S47		GEM-4147	4TM-S47	
C15	.01	400		P488N-01	D6-103	CUB4S1	GP-10000	GEM-411	4TM-S1	
C16	.15	200		P288N-15		CUB2P15		GEM-2015	2TM-P15	
C17	100			1469-0001	D6-101	22R5T1	CY10C101K	MCB235	MS-31	10%
C18	.0033	400		P488N-0033	D6-332	CUB6D33	GP-3300	GEM-6233	6TM-D33	
C19	.0033	400		P488N-0033	D6-332	CUB6D33	GP-3300	GEM-6233	6TM-D33	
C20	.033	400		P488N-033	DF-303	CUB6S33		GEM-4133	6TM-S33	
C21	680				D6-681	1R5T68	ED-680		MS-368	10%
C22	100			1469-0001	D6-101	22R5T1	CY10C101K	MCB235	MS-31	10%
C23	.22	200		P288N-22		CUB2P22		GEM-2022	2TM-P22	
C24	.033	400		P488N-033	DF-303	CUB6S33		GEM-4133	6TM-S33	
C25	.022	400		P488N-022	DD-203	CUB4S22	ED-02	GEM-4122	4TM-S22	
C26	2200					1R5D22			MS-222	10%
C27	.027	400		P488N-025		CUB6S3		GEM-413	4TM-S3	
C28	.033	400		P488N-033	DF-303	CUB6S33		GEM-4133	6TM-S33	
C29	47			1469-000047	D6-470	22R5Q47	CY10C470K	ZT-5447	MS-447	10%
C30	.1	400		P488N-1	DF-104	CUB4P1		GEM-401	4TM-P1	
C31	.1	400		P488N-1	DF-104	CUB4P1		GEM-401	4TM-P1	
C32	47			1469-000047	D6-470	22R5Q47	CY10C470K	ZT-5447	MS-447	10%
C33	120			1469-00012	D6-121	22R5T12	ED-120		MS-312	10%
C34	.01	400		P488N-01	D6-103	CUB4S1	GP-10000	GEM-411	4TM-S1	
C35	5000	1400		DAC-9	DD30-502	HVE16D5	HD15-4700	GEM-1625	BL-D50	

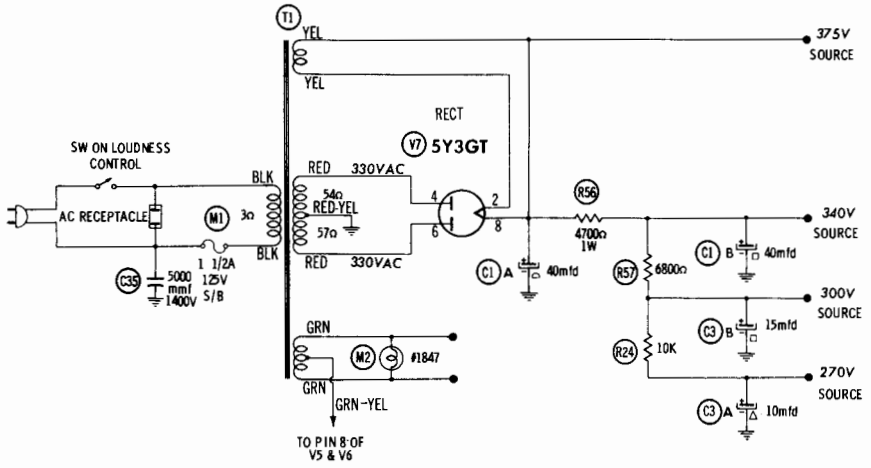
CHASSIS—TOP VIEW





A PHOTOFACT STANDARD NOTATION SCHEMATIC
Howard W. Sams & Co., Inc. 1958





RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	EF86/6267	†840K	0Ω	1500Ω	240Ω	240Ω	†120K	0Ω	0Ω	85K
V2	12AX7/ECC83	†240K	1meg	2700Ω	240Ω	240Ω	†11K	520K	47K	240Ω
V3	12AX7/ECC83	†160K	670K	2700Ω	240Ω	240Ω	†93K	1meg	9500Ω	240Ω
V4	6BA8A	47K	†160K	†52K	240Ω	240Ω	680K	1meg	†2.2meg	†160K
V5	6L6GB	0Ω	240Ω	†130Ω	†25Ω	220K	240Ω	240Ω	240Ω	
V6	6L6GB	0Ω	240Ω	†122Ω	†22Ω	220K	0Ω	240Ω	240Ω	
V7	5Y3GT	NC	20K(Min)	NC	54Ω	NC	57Ω	TP	20K(Min)	

† MEASURED FROM PIN 8 OF V7
■ MEASURED FROM PIN 8 OF V2
▲ MEASURED FROM PIN 8 OF V3
NC NO CONNECTION
TP TIE POINT

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

⊖ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

PARTS LIST AND DESCRIPTIONS (Continued)

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	SHERWOOD PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	
R1A	300K	½	671AB3					Loudness, Tap ② 20K
B	Switch							
R2A	500K	½	670AB1	BT-65	A47F6-500K	Q19-133X	UT-431	Treble, Tap ② 200K
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
R3A	1meg	½	670AB2	B-69	A47-1meg-S	Q11-137	U54	Bass
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
R4	500K	½	670AB7					Phono Level

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		SHERWOOD PART No.	NOTES
	OHMS	WATT		
R5	47K			Note 1
R6	100K			
R7	470K			
R8	100K			
R9	150K			
R10	820K			
R11	1500Ω			
R12	1meg			
R13	22meg			
R14	150K			
R15	270K			
R16	56K			
R17	10meg			
R18	220K			
R19	56K			
R20	100K			
R21	10meg			
R22	3.9meg			
R23	1.5meg			
R24	10K			
R25	2700Ω			
R26	470K			
R27	1meg			
R28	680Ω			
R29	47K			
R30	470K			

Note 1. Not used in some versions.

ITEM No.	RATING		SHERWOOD PART No.	NOTES
	OHMS	WATT		
R31	100K			Note 2
R32	100K			
R33	47K			
R34	150K			
R35	1800Ω			
R36	150K			
R37	2700Ω			
R38	1meg			
R39	6800Ω			
R40	82K			
R41	2700Ω			
R42	220K			
R43	1meg			
R44	220K			
R45	1.5meg			
R46	680Ω			
R47	0.56Ω			
R48	6800Ω			
R49	220Ω			
R50	680K			
R51	47K	1		
R52	47K	1		
R53	220K			
R54	240Ω	10		
R55	220K			
R56	4700Ω	1		
R57	6800Ω			

Note 2. Some versions may use 2.2meg.

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	SHERWOOD PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117V ②.96A	700VCT ② .125A	5V ② 2A	6.3V ② 2.9A	922AB1					

PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	SHERWOOD PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triod PART No.	
T2	5500Ω CT	16Ω Tap ② 8Ω, 4Ω	920AB1						

COILS

ITEM No.	USE	REPLACEMENT DATA				NOTES
		SHERWOOD PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	
L1	Tone Choke					140 Millihenries

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			SHERWOOD PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M1	3AG	1½A 125V S/B			3130I.5 (3AG 1½A 125V S/B)	342003	MDL1½	HKP

MISCELLANEOUS

ITEM No.	PART NAME	SHERWOOD PART No.	NOTES
M2	Pilot Lamp		#1847
M3	Switch Ass'y		Presence, Scratch Filter, Rumble Filter, Phono Level (Slide Type)
M4	Switch		Selector (Rotary Wafer Type)
M5	Switch		Equalization (Rotary Wafer Type)
M6	Switch		Tape Monitor (Slide Type SPDT)
M7	Switch		Loudness (Slide Type SPDT)
M8	Switch		Damping Factor (Slide Type DPDT)

WIRING DATA

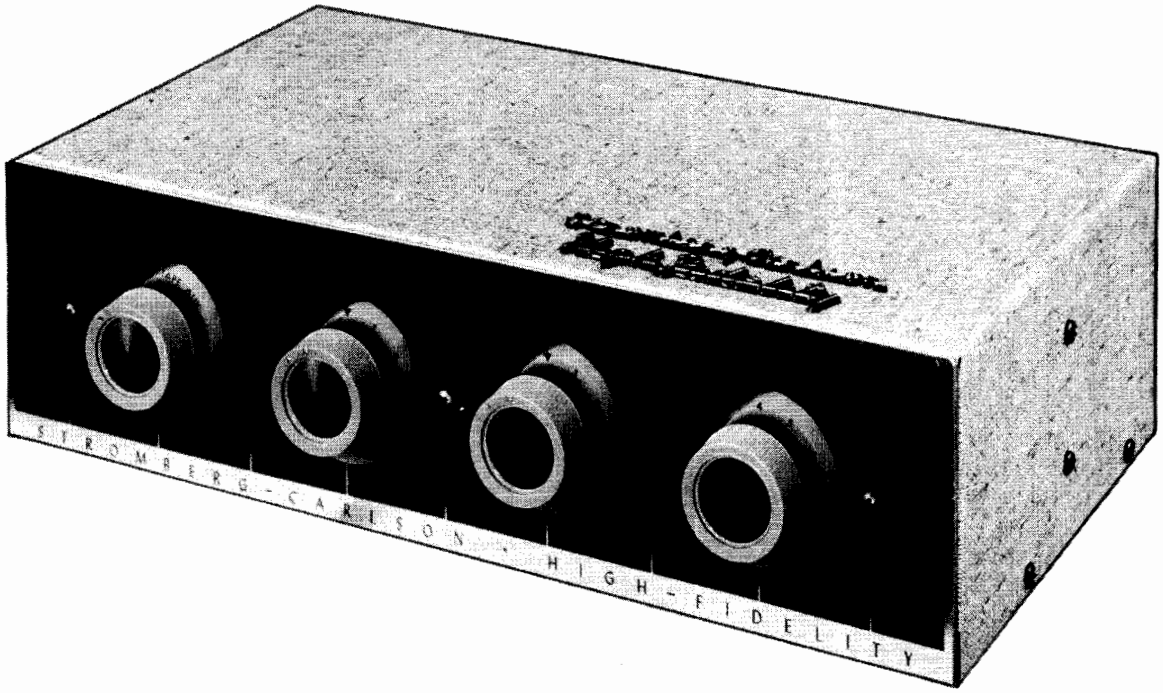
General-use Unshielded Hook-up Wire ..... Use BELDEN No. 8530 (Solid) Available in Ten Colors
8524 (Stranded) Available in Ten Colors

Power Cord ..... Use BELDEN No. 1765-B (6 Ft. Length)
1725-K (7½ Ft. Length)

Low-Loss Shielded Lead (Interconnecting)..... Use BELDEN No. 8401

Phono Pick-up Arm Cable ..... Use BELDEN No. 8430 (Two Conductor - Twisted)

STROMBERG-CARLSON MODEL AR-411



STROMBERG-CARLSON MODEL AR-411

TRADE NAME	Stromberg-Carlson Model AR-411
MANUFACTURER	Stromberg-Carlson Co., Service Dept., 1700 University Ave., Rochester 10, N. Y.
TYPE SET	AC Operated 4 Channel Audio Amplifier
TUBES (Six)	Types 12AT7 Phono Preamplifier, 12AX7 AF Amplifier, 6AV6 Phase Inverter, (2) 6CM6 Output, 5Y3GT Rectifier
POWER SUPPLY	105-125 Volts AC-50/60 Cycles RATING .68 Amp. @ 117 Volts AC (68 Watts)

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Phono Preamplifier	12AT7	
V2	AF Amplifier	12AX7	
V3	Phase Inverter	6AV6	

ITEM No.	USE	TYPE	NOTES
V4	Output	6CM6	
V5	Output	6CM6	
V6	Rectifier	5Y3GT	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA						
	CAP.	VOLT.	Stromberg-Carlson PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▲40	450	35590			FP447 TC47		Q-060 MT-0550	TVL-4705.8
B	■30	350							
C	▲15	300							
D	50	50							
C2A	▲20	450	111619	AFH2-69	B0500	FP234	TMD-61	D-225	TVL-2935
B	■20	450							
C3	50	6	111615-000	PRS25V50	BBR50-6	TC29	TD-50-6	MMT-650	TVA-1100

FIXED CAPACITORS

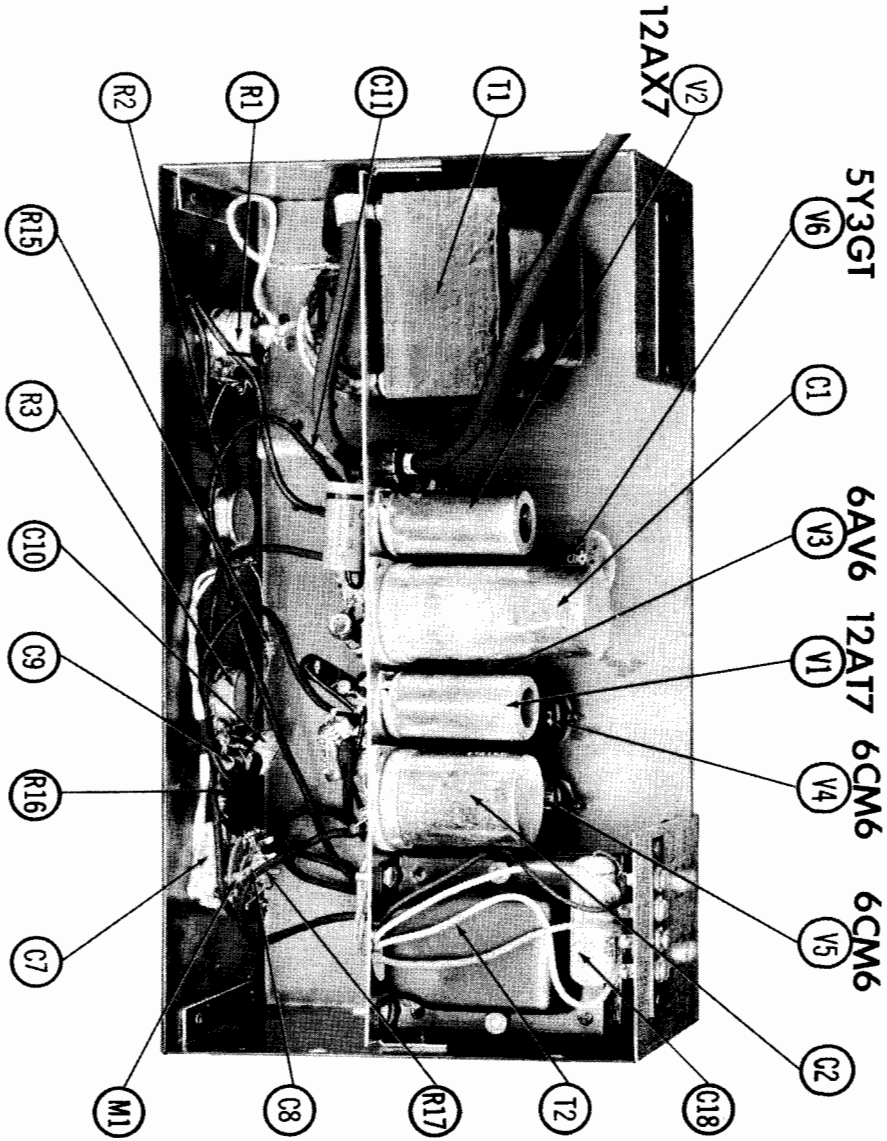
Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA							NOTES
	CAP.	VOLT	Stromberg-Carlson PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C4	.01	600		P688N-01	D6-103	CUB6S1	GP-10000	GEM-611	6TM-S1	
C5	470			S1 470	D6-471	LT6T47	GP-470	UC-5347	5GA-T47	
C6	220			S1 220	D6-221	LT6T22	GP-220	UC-5322	5GA-T22	
C7	.022	400		P488N-022	DD-203	CUB4S22	ED-02	GEM-4122	4TM-S22	
C8	470			S1 470	D6-471	LT6T47	GP-470	UC-5347	5GA-T47	
C9	470			S1 470	D6-471	LT6T47	GP-470	UC-5347	5GA-T47	
C10	.0047	600		P688N-0047	D6-472	CUB6D47	GP-4700	GEM-6247	6TM-D47	
C11	.022	400		P488N-022	DD-203	CUB4S22	ED-02	GEM-4122	4TM-S22	
C12	27			S1 27	D6-270	LT6Q27	GP-27	UC-5427	5GA-Q27	
C13	.047	400		P488N-047	DF-503	CUB4S47		GEM-4147	4TM-S47	
C14	220			S1 220	D6-221	LT6T22	GP-220	UC-5322	5GA-T22	
C15	.047	400		P488N-047	DF-503	CUB4S47		GEM-4147	4TM-S47	
C16	.047	400		P488N-047	DF-503	CUB4S47		GEM-4147	4TM-S47	
C17	.22	400		P488N-22		CUB4P22		GEM-4022	4TM-P22	

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	Stromberg-Carlson PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	
R1A	500K	½	145638	B-60-S	A47-500K-S	Q13-133	U48	Volume
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
C	Switch			Not Req.	SWE-12	76-1	US-26	
R2A	1Meg	½	145639	B-69	A47-1Meg-S	Q11-137	U54	Treble
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
R3A	5Meg	½	145630	B-87	A47-5Meg-Z	Q13-141	U65	Bass
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
R4A	100Ω	2	145632	WN-101	A43-100	W11-084	R100L	Hum Adj. (Wire Wound)
B	Shaft			Not Req.	FKS-1/4	SK5-K1t	Not Req.	

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING OHMS	RATING WATT	Stromberg-Carlson PART No.	NOTES
R5	1Meg			
R6	1Meg			
R7	1Meg			
R8	47K			
R9	220K			
R10	5600Ω			
R11	390K			
R12	470K			
R13	220K			
R14	5600Ω			
R15	47K			
R16	100K			
R17	470K			
R18	220K			
R19	6800Ω			

ITEM No.	RATING OHMS	RATING WATT	Stromberg-Carlson PART No.	NOTES
R20	470K			
R21	6800Ω			
R22	56K			
R23	680K			
R24	3.3Meg			
R25	22K			
R26	47K			
R27	47K			
R28	100K			
R29	100K			
R30	250Ω	5		
R31	2000Ω	5		
R32	22K			
R33	10K			
R34	100K			

TRANSFORMER (POWER)

ITEM No.	RATING PRI.	RATING SEC. 1	RATING SEC. 2	RATING SEC. 3	REPLACEMENT DATA Stromberg-Carlson PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117VAC @ .68A	620VCT @ .170A	5VAC @ 2A	6.3VAC @ 1.8A	161798 ①					

① Used in series 105A and later. Part #161789 used in series 105 and earlier.

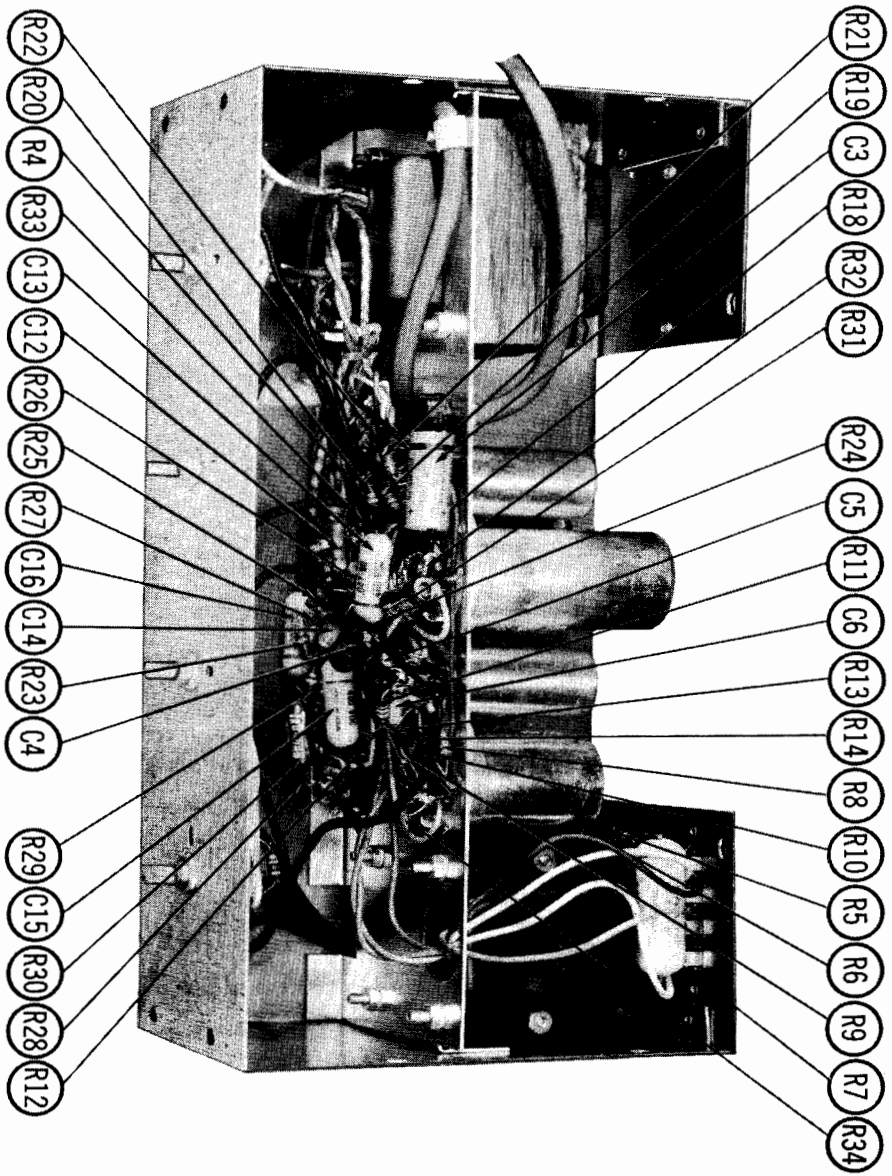
TRANSFORMER (AUDIO OUTPUT)

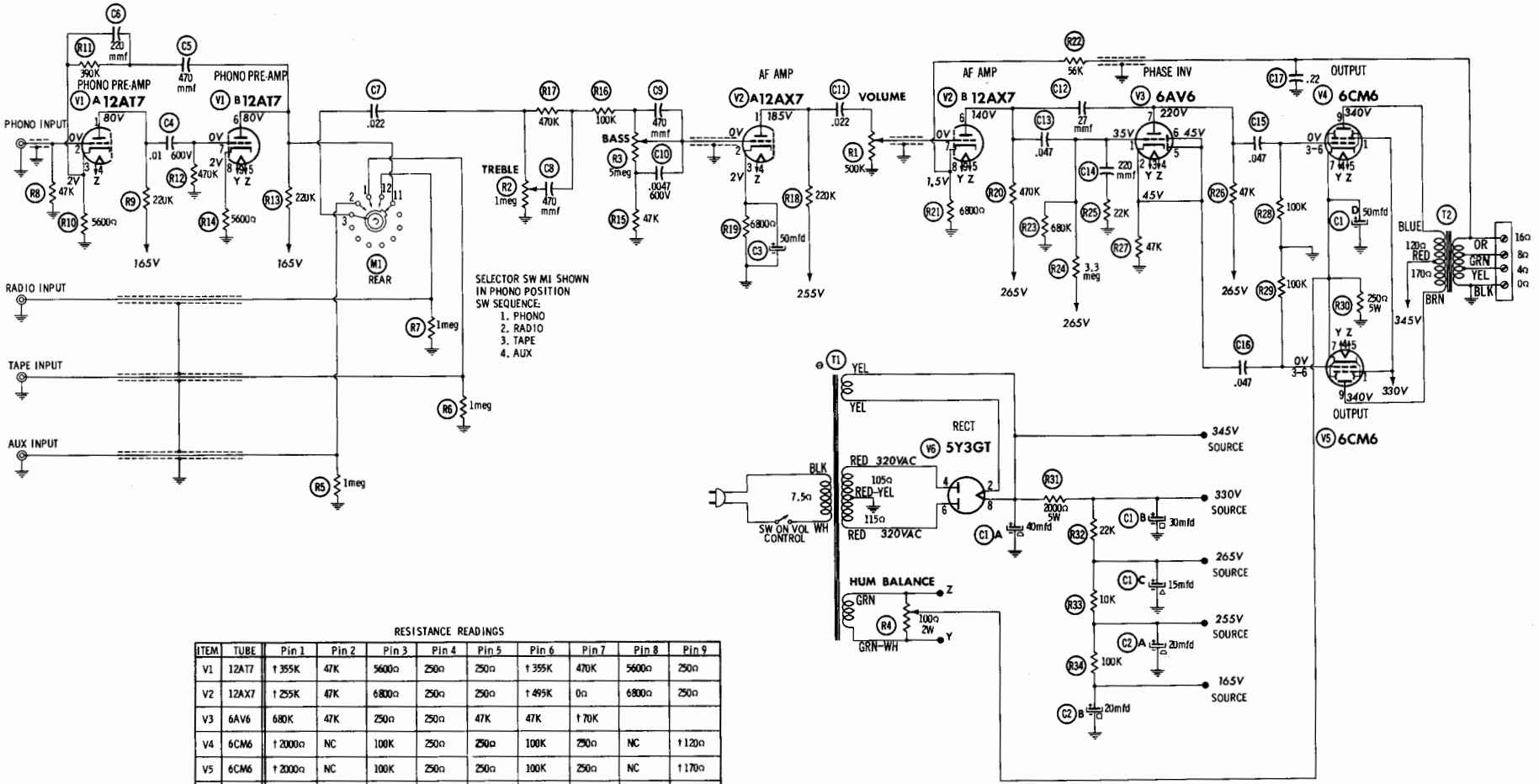
ITEM No.	IMPEDANCE PRI.	IMPEDANCE SEC.	REPLACEMENT DATA Stromberg-Carlson PART No.	Halldorson PART No.	Merit PART No.	Stoncor PART No.	Thordarson PART No.	Triad PART No.	NOTES
T2	6500Ω CT	16Ω Tap @ 8Ω, 4Ω	161345			A-3304	22S68		

MISCELLANEOUS

ITEM No.	PART NAME	Stromberg-Carlson PART No.	NOTES
M1	Switch	158682	Selector (Rotary Wafer Type)

CHASSIS—BOTTOM VIEW





RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AT7	†355K	47K	5600Ω	250Ω	250Ω	†355K	470K	5600Ω	250Ω
V2	12AX7	†255K	47K	6800Ω	250Ω	250Ω	†495K	0Ω	6800Ω	250Ω
V3	6AV6	680K	47K	250Ω	250Ω	47K	47K	†70K		
V4	6CM6	†2000Ω	NC	100K	250Ω	250Ω	100K	250Ω	NC	†120Ω
V5	6CM6	†2000Ω	NC	100K	250Ω	250Ω	100K	250Ω	NC	†170Ω
V6	5Y3GT	NC	20K(Min)	NC	105Ω	NC	115Ω	NC	20K(Min)	

ALL MEASUREMENTS TAKEN IN "PHONO" POSITION
† MEASURED FROM PIN 8 OF V6
NC NO CONNECTION

Θ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

A PHOTOFACT STANDARD NOTATION SCHEMATIC
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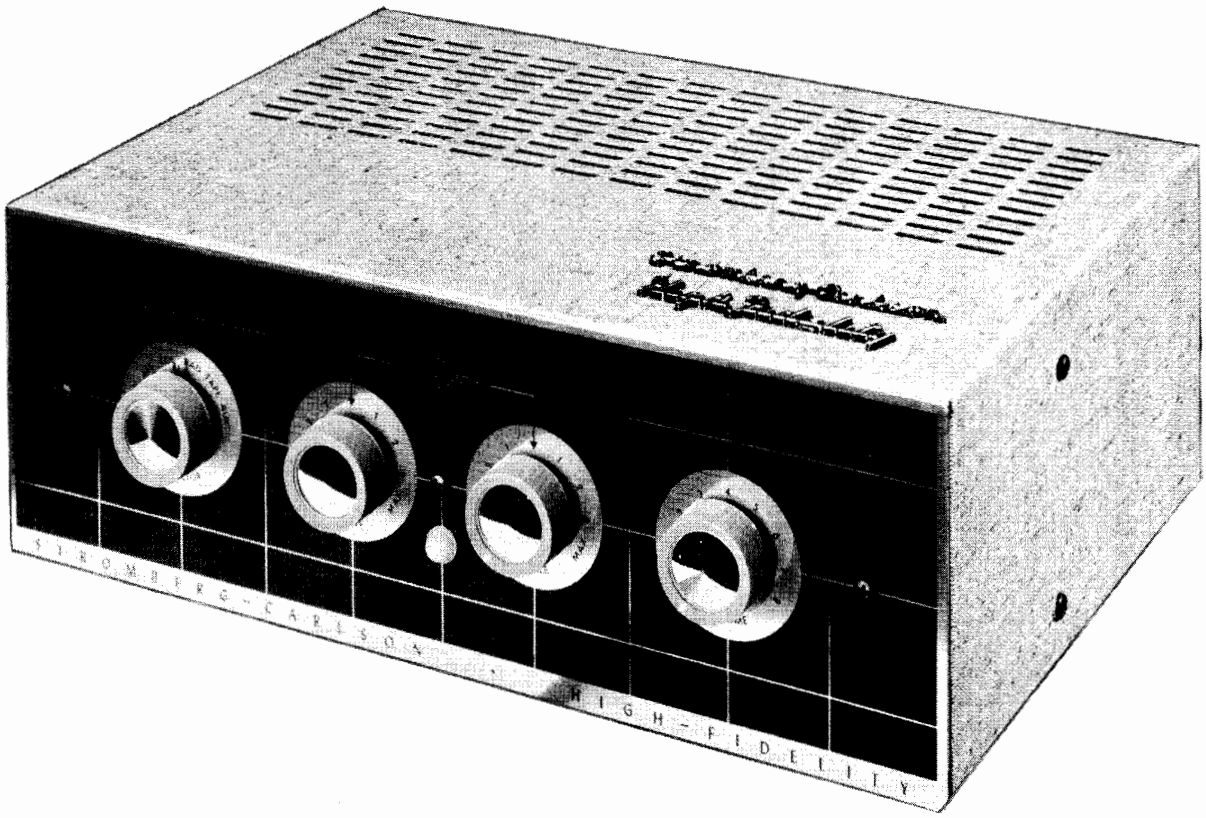
STROMBERG-CARLSON MODEL AR-419



STROMBERG-CARLSON
MODEL AR-419

TRADE NAME	Stromberg-Carlson Model AR-419
MANUFACTURER	Stromberg-Carlson Co., Service Dept., 1700 University Ave., Rochester 10, N. Y.
TYPE SET	AC Operated Audio Amplifier
TUBES (Six)	Types 6SJ7 AF Amplifier, 12AT7 AF Amplifier, 12AT7 AF Amp.-Phase Inv., (2) 6L6GB Output, 5U4GB Rectifier
POWER SUPPLY	110-120 Volts AC-60 Cycles RATING 1.1 Amp. @ 117 Volts AC (110 Watts)

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co., Inc., as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co., Inc., by the manufacturers of the particular type of replacement part listed. Reproduction or use, without express permission, of editorial or pictorial content, in any manner, is prohibited. No patent liability is assumed with respect to the use of the information contained herein. © 1957 Howard W. Sams & Co., Inc., Indianapolis 5, Indiana. Printed in U.S. of America

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	AF Amplifier	6SJ7	
V2	AF Amplifier	12AT7	
V3	AF Amp. - Phase Inv.	12AT7	
V4	Output	6L6GB	
V5	Output	6L6GB	
V6	Rectifier	5U4GB	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING CAP.	RATING VOLT.	REPLACEMENT DATA Stromberg-Carlson PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	■30	500	46320-000	AFH2-72	B0530	FP284	TMD-62	D-275	TVL-2937
B	▬30	500							
C2A	▬40	450	35590-000	AFH4-B5-25	D0650	FP431.3		Q-310	TVL-4705.8
B	▲15	300							
C	■30	350							
D	50	50							
C3	50	6		XPP6V50	BBR50-6	TT6X50	TD-50-6	MMT-650	TVA-1100

FIXED CAPACITORS

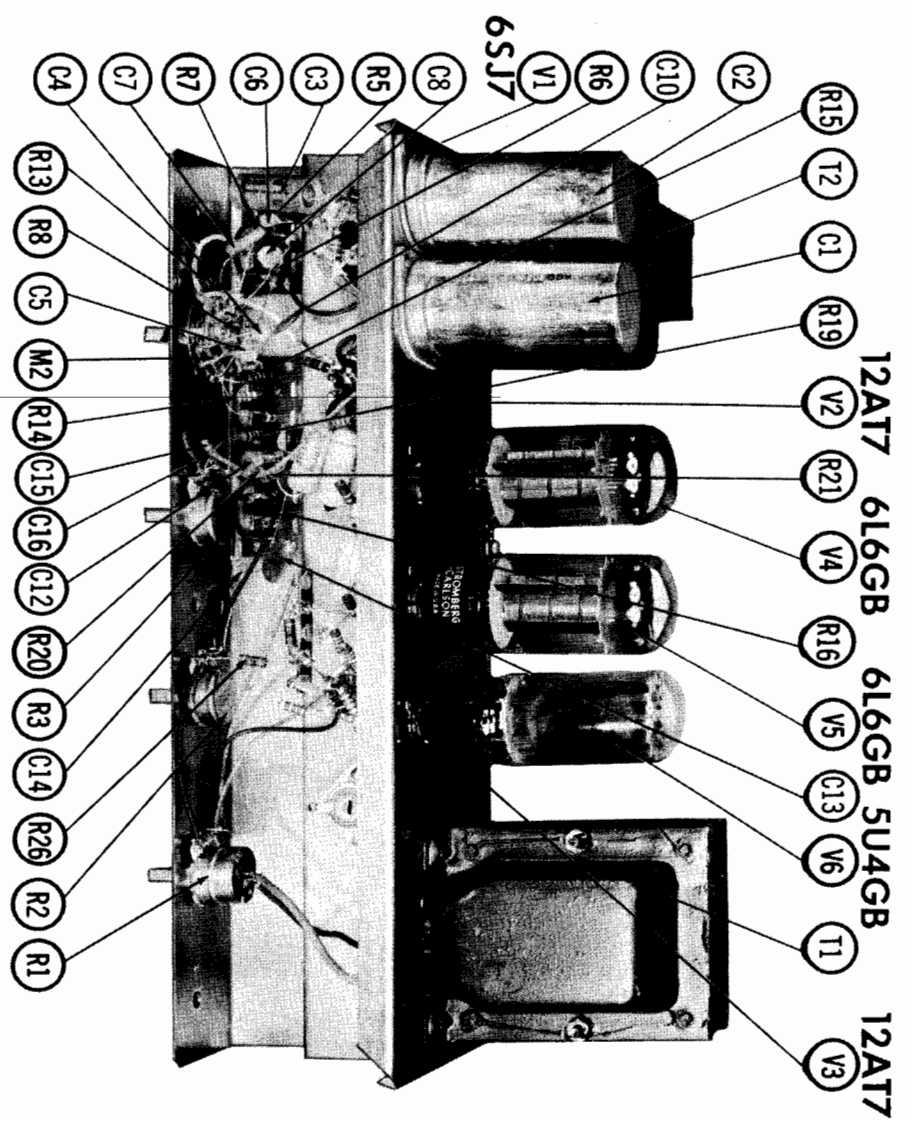
Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING CAP.	RATING VOLT	REPLACEMENT DATA Stromberg-Carlson PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C4	100			BPD-0001	DD-101	L10T1	ED-100	UC-531	5GA-T1	
C5	100			BPD-0001	DD-101	L10T1	ED-100	UC-531	5GA-T1	
C6	100			BPD-0001	DD-101	L10T1	ED-100	UC-531	5GA-T1	
C7	47			SI 47	D6-470	LT6Q47	GP-47	UC-5447	5GA-Q47	
C8	330			BPD-00033	DD-331	L10T33	ED-330	UC-5333	5GA-T33	
C9	.22	400		P488N-22		CUB4P22		GEM-4022	4TM-P22	
C10	4700			BPD-0047	DD-472	BYAI0D47	ED-0047	UC-5247	5GA-D47	
C11	.033	400		P488N-033	DF-303	CUB6S33		GEM-4133	6TM-S33	
C12	33			SI 33	D6-330	LT6Q33	GP-33	UC-5433	5GA-Q33	
C13	4700			BPD-0047	DD-472	BYAI0D47	ED-0047	UC-5247	5GA-D47	
C14	470			BPD-00047	DD-471	BYAI0T47	ED-470	UC-5347	5GA-T47	
C15	470			BPD-00047	DD-471	BYAI0T47	ED-470	UC-5347	5GA-T47	
C16	4700			BPD-0047	DD-472	BYAI0D47	ED-0047	UC-5247	5GA-D47	
C17	.033	400		P488N-033	DF-303	CUB6S33		GEM-4133	6TM-S33	
C18	470			BPD-00047	DD-471	BYAI0T47	ED-470	UC-5347	5GA-T47	
C19	.1	400		P488N-1	DF-104	CUB4P1		GEM-401	4TM-P1	
C20	.1	400		P488N-1	DF-104	CUB4P1		GEM-401	4TM-P1	
C21	.1	400		P488N-1	DF-104	CUB4P1		GEM-401	4TM-P1	

CONTROLS

ITEM No.	RATING RESISTANCE	RATING WATTS	REPLACEMENT DATA Stromberg-Carlson PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	500K	½	145622-000	B-60-S	A47-500K-Z	Q11-133	U46	Volume
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
C	Switch			Not Req.	SWE-12	76-1	US-26	
R2A	5Meg	½	145661-000	AB-88	A47-5Meg-Z	Q13-141	U65	Treble
B	Shaft			AK-7	FS-3	Not Req.	Not Req.	
R3A	5Meg	½	145661-000	AB-88	A47-5Meg-Z	Q13-141	U65	Bass
B	Shaft			AK-7	FS-3	Not Req.	Not Req.	
R4	100Ω	2	173853-000					Hum Adjust (Wire Wound)

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	Stromberg-Carlson PART No.	IRC PART No.	
R5	100K			BTS-100K	
R6	1Meg			BTS-1Meg	
R7	100K			BTS-100K	
R8	8.2Meg			BTS-8.2Meg	
R9	470K			BTS-470K	
R10	1.8Meg			BTS-1.8Meg	
R11	100K	1		BTA-100K	
R12	3300Ω			BTS-3300	
R13	470K			BTS-470K	
R14	470K			BTS-470K	
R15	33K			BTS-33K	
R16	1.8Meg			BTS-1.8Meg	
R17	33K			BTS-33K	
R18	1000Ω			BTS-1000	
R19	47K			BTS-47K	
R20	470K			BTS-470K	

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	Stromberg-Carlson PART No.	IRC PART No.	
R21	470K			BTS-470K	
R22	47K			BTS-47K	
R23	1500Ω			BTS-1500	
R24	4700Ω			BTS-4700	
R25	3300Ω			BTS-3300	
R26	100Ω			BTS-100	
R27	1000Ω			BTS-1000	
R28	470K			BTS-470K	
R29	47K			BTS-47K	
R30	47K			BTS-47K	
R31	220K			BTS-220K	
R32	220K			BTS-220K	
R33	200Ω	5			
R34	15K			BTS-15K	
R35	47K			BTS-47K	
R36	47K			BTS-47K	
R37	5000Ω	7		PW7-5000	

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	Stromberg-Carlson PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordorson PART No.	Triod PART No.
T1	117VAC @ 1.1A	720VCT @ .140A	5VAC @ 3A	6.3VAC @ 2.8A	161795-000	P9314 ①	P-3173 ①	PC8410 ①	24R05U ①	R-14A ①

① Drill new mounting holes.

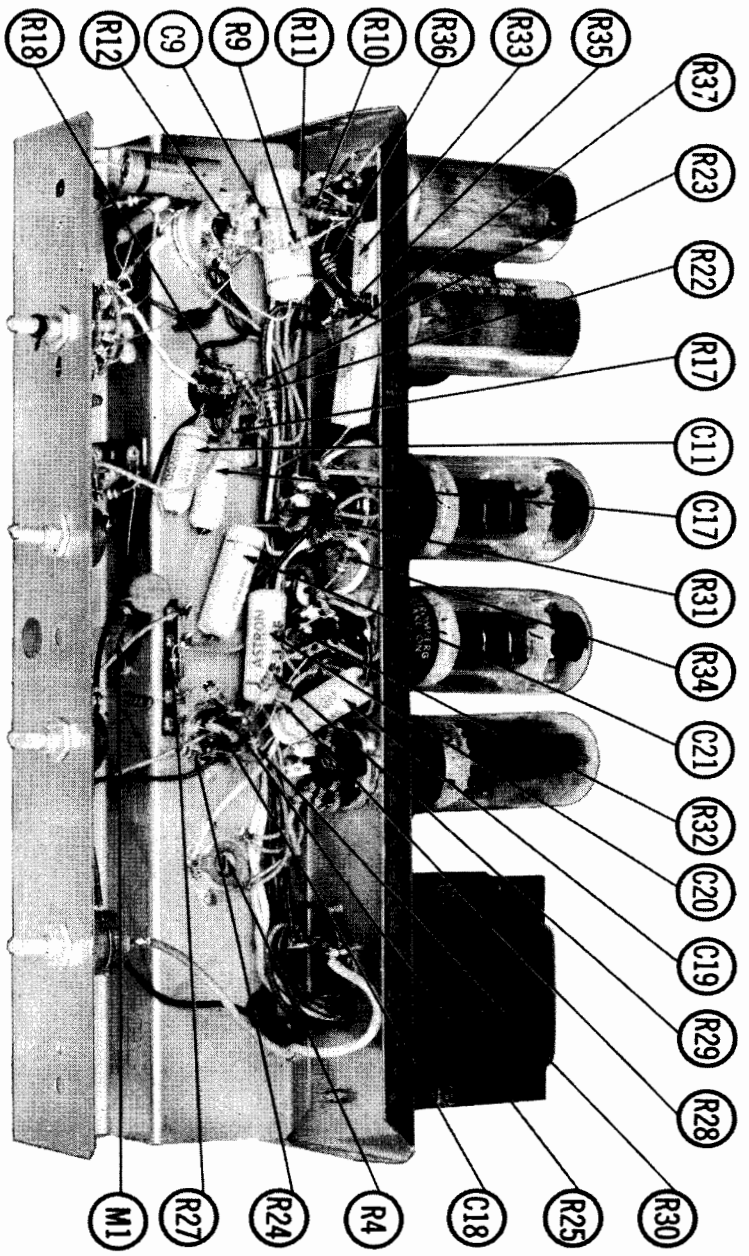
TRANSFORMER (AUDIO OUTPUT)

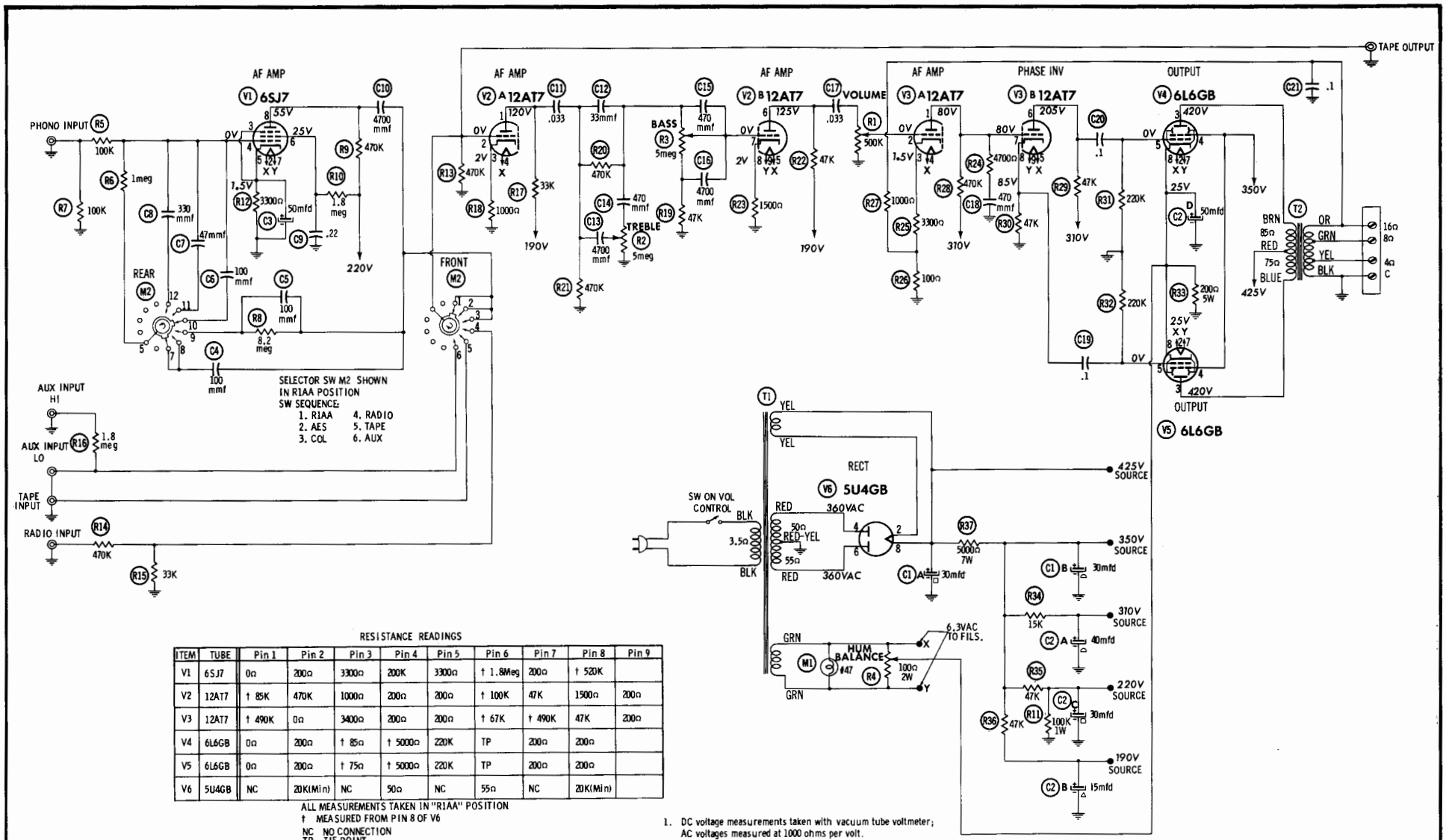
ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	Stromberg-Carlson PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordorson PART No.	Triod PART No.	
T2	5700Ω CT	16Ω Tap @ 8Ω, 4Ω	161355-000	Z1401	A-3131	A-3307	22S97 ①	S-60A	① Drill new mounting holes.

MISCELLANEOUS

ITEM No.	PART NAME	Stromberg-Carlson PART No.	NOTES
M1	Pilot Lamp		#47
M2	Switch	158692-000	Selector (Rotary Wafer Type)

CHASSIS—BOTTOM VIEW





RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	6SJ7	0Ω	200Ω	3300Ω	200K	3300Ω	† 1.8Meg	200Ω	† 520K	
V2	12AT7	† 85K	470K	1000Ω	200Ω	200Ω	† 100K	47K	1500Ω	200Ω
V3	12AT7	† 490K	0Ω	3400Ω	200Ω	200Ω	† 67K	† 490K	47K	200Ω
V4	6L6GB	0Ω	200Ω	† 85Ω	† 5000Ω	220K	TP	200Ω	200Ω	
V5	6L6GB	0Ω	200Ω	† 75Ω	† 5000Ω	220K	TP	200Ω	200Ω	
V6	5U4GB	NC	20K(Min)	NC	50Ω	NC	55Ω	NC	20K(Min)	

ALL MEASUREMENTS TAKEN IN "R1AA" POSITION
† MEASURED FROM PIN 8 OF V6
NC NO CONNECTION
TP TIE POINT

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

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SERVICING hi-fi PREAMPS AND AMPLIFIERS

SERVICING HI-FI PREAMPS AND AMPLIFIERS

Contains complete information on the circuitry, specifications and replacement parts for 1957-58 Preamps and Amplifiers. Data on the following brand names appears in this volume:

BELL SOUND
CHALLENGER
DAVID BOGEN
ELECTRO-VOICE
FISHER
GROMMES
HAMILTON
HARMON-KARDON
KNIGHT
MADISON FIELDING
NEWCOMB
PILOT
SCOTT (H. H.)
SHERWOOD
STROMBERG-CARLSON

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