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Part No. 53518

SPECIFICATIONS AND INSTRUCTIONS

Tentative

MODEL T-3500 IONOVAC

Electro-Voice
Super High-Frequency Driver

Fig. 1 GENERAL DESCRIPTION:--The Electro-Voice Model T3500 IONOVAC Super High-Frequency Driver utilizes a new method of converting electrical energy into sound waves in the air. This is done by modulating at audio frequencies the ion stream created by a high frequency current. In this way the audio component rarefies and compresses the air at the base of a small, cone-like quartz cell, one end of which is free to emit sound waves into the listening area.

Because no moving parts are employed, the generation of the frequencies it is designed to reproduce is accomplished with virtually no distortion because there is no physical mass for which corrections are required; air movement is achieved directly by the electrical signal.

The Model T3500 is produced in two assemblies: the reproducer and the electronics which are joined by a fixed length coaxial cable.

PURPOSE:--The Model T3500 Super High-Frequency Driver has been designed for the reproducing of signals above 3500 cps over an angle of 160° with so little deviation from the original source as to eliminate the reproducer as a variable in the sound reproducing chain. It is intended especially for use with maximum quality high-fidelity music systems.

PHYSICAL AND ELECTRICAL SPECIFICATIONS:

Response	3500 cps to 40,000 cps ± 4 db
Polar Pattern	160° Dispersion
Input Voltage for Full Output	.64 V/16 ohms--95 db at 3' from horn (Average Output from 3500-40,000 ∧)
Crossover Point	3500 cps w/12 db per octave slope
RETMA Sensitivity Rating	60 db
Input Impedance	16 ohms
Maximum Input Voltage	3500 cps, 2V) for less than)
Input Connector - Screw Terminals	7000 cps, 4V) 1% RMS distortion
Output	95 db at 3', over angle of 160°

Tubes	1-5U4GA/GB, 1-12AU7, 1-6146
Osc. Freq.	20 mc.
Line Voltage	115 V A.C., 60 cy. (105 or 125 volts w/taps)
Power Consumption	78 Watts
Fuse	3 amp
Power Cord Length	6'
RF Cable Length	6'
Horn	9 1/16" long, 1 7/8" wide
Cutout Hole for Mtg. Horn Behind Baffle	7 7/8" x 1 3/8"
Tweeter Mtg. Hole Spacing	8 3/8"
Overall Dim of Unit	7 1/2" deep, 9 1/4" high, 4" wide
Overall Dim of Osc.-Power Supply	5" wide, 12 3/4" long, 5 1/2" high
Weight	Horn Assy. 4 lbs. Osc.-Pwr. Supply 9 1/2 lbs.
Shipping Weight	16 lbs.
Finish	Chrome and Gray Wrinkle

THEORY OF OPERATION

For many years it has been the audio engineer's dream to design a massless sound reproducer. In the design of all present-day reproducers the inertia of the mass, regardless how slight, prevents the exact reproduction of sound, especially in the higher order of frequencies above 3,000 cycles. Many excellent designs have been made with the masses reduced greatly, but the design for the distortion-free massless reproducer had not been achieved until the advent of the Model T3500 Ionovac. The Ionovac uses no mechanical or moving parts. It employs the principle of electrical potentials acting directly on air to create sound pressures. This gives it the extraordinary ability to follow with complete identity the impulses of very high frequencies including transient responses.

It is well know that air can be ionized in a strong electrical field. The amount of ionization is in direct proportion to the electrical force applied; as the electrical force is varied, the ionization will vary. This principle is employed in the Ionovac to create sound pressures. The electrical field is created between two metallic elements by use of radio frequencies. A simple rf oscillator is employed to create electrical force. This oscillator

is modulated by frequencies in the audio and ultrasonic range, creating pressure waves in the air conforming exactly to the original sound.

In figure 1 is shown the manner in which the cathode emits ions under the stress set up between it and the anode, consisting of 4 turns of wire on the outside of the cell. Figure 2 discloses in simplified form the electrical schematic consisting of an oscillator-modulator coupled through a coaxial linkage to the cell and horn assembly.

In figure 3, a through d, is depicted the sequence which shows the direct translation of electrical energy into sound energy. Air, in the normal state, consists of molecules in a passive condition; in "b" we see the cathode causing strains in the air molecules, resulting finally in the generation of ions visibly evidenced by a glow of violet and ultra-violet light, as in "c". In "d" we see the condition of the area in the cell; this is shown as a state of stress under "no signal" situation which is set up by the unmodulated RF. In "e", as the RF is modulated by audio, increased stress is obtained as the RF is increased and more ions result; this condition is followed by rarefication of the gas as the trough of the modulated RF wave causes a diminution of stress and ions.

In figure 4 is recapitulated pictorially the conditions of pressure and rarefication. In succession this causes sound to be propagated through the length of the horn.

HOW SOUND IS SPREAD UNIFORMLY THROUGHOUT THE ENTIRE LISTENING AREA WITH THE MODEL T3500

Electro-Voice has been preeminent in the development of the efficient diffraction principle of wide sound dispersion. The manner in which the higher frequencies are propagated completely throughout the listening area can be understood best by referring to figure 5.

A small sound source compared to the wavelength of the sound radiates energy equally in all directions, giving perfect coverage. A large horn, in this case 8 inches wide, is shown in operation emitting a series of sound waves 1 inch from crest to crest, a frequency of about 13,000 cps. To observe easily how large horns beam the sound, consider the large horn as containing many sources smaller than the wavelength. As each source generates its own wave train, we see that a succession of pressure waves cause interference patterns at the sides of the horn, cancelling the pressure and rarefaction areas. The area to the front of the horn begins to emit directional plane waves, and the pressure lines suggest how these undesirable, on axis waves are formed.

A succeeding diagram, for clarity, shows how cancellation occurs between just 2 of the sources. The dotted line represents sound from the left source, and the solid line is the wave from the right source. It can be seen that the distance separating the two sources makes the dotted wave and solid wave travel to the right side 180° out of phase, cancelling virtually all the 13,000 cps sound.

But in the Diffraction Horn of the Model T3500, we see that the lateral dimension of the horn is less than the size of the single source point so that cancellation cannot occur, and the 13,000 cps wave train proceeds with equal strength in all directions.

At 15,000 cps the dispersion is 160°, at 13,000 cps in excess of 180°. However, on a flat baffle or a corner of the room this is more than the dispersion needed.

This wide dispersion is vital for full stereo effects, for it is well established that depth and lateralization depend strongly on the quality of the sound resulting from the last 2 octaves. It will be seen clearly that cone tweeters and horns several inches in width will beam the sound at 10 kc over an angle no more than 15°, almost directly down the axis. This beaming will destroy the beneficial effects of stereo reproduction, and cause the most obvious spatial distortions.

INSTALLATION INSTRUCTIONS

For proper installation it is necessary to use an Electro-Voice Model X36, 3500 cps cross-over network, with an associated Model AT37 level control. If an alternative network is used, it must have a 12 db per octave slope, suitable to matching the 16-ohm input impedance of the Ionovac. The level control must be a 16-ohm L Pad type, rated at 5 watts sine-wave. These units are installed in the usual manner in accordance with other accompanying instructions.

IMPORTANT: Care must be taken in the installation to provide the correct operating voltage for the Ionovac. The power transformer is provided with three voltage taps. These are for voltages from 95-105 volts (Green-Black Wire), 105-115 volts (Yello-Black Wire), and 115-125 volts (Red-Black Wire). The unit is normally connected to the 115-125 volt tap (117 volts nominal. Determine your average line voltage. MAKE SURE YOU ARE USING THE CORRECT TAP. Power requirements are 50-60 cycles, 75 watts.

IMPORTANT: Be sure to replace all covers removed from the Ionovac. All screws must also be replaced for proper opation. This is important.

Adequate ventilation must be supplied for the Electronic Power Supply. This should be installed in the same manner as a power amplifier. It should not be entirely enclosed.

The length of the coupling cable has been calculated by the factory and should not be altered. If it is absolutely necessary to lengthen the cable, similar methods must be employed to calculate the length, as with a radio transmitter antenna. It is suggested you write the factory for information after you have determined the additional length desired.

Two mounting brackets are provided. These fasten over the chassis, in between the two end covers. It is suggested that the Electronic Power Supply be mounted in a horizontal position in the bottom of the cabinet.

OPERATING INSTRUCTIONS

Turn the AC power on. In about 45 seconds, the air in the ion-cavity will ionize, setting up a characteristic sound created by the breakdown of the air. This sound will gradually disappear in about 1 minute. The unit will be ready for operation within two minutes. This time may vary, depending on the ambient temperature conditions. This time is required to bring the ionization to full power.

Adjust the AT37 brilliance control of the very high frequency channel for pleasing balance.

In the event of momentary power interruption, the ionization will extinguish, and will not be automatically restored until the unit has had time to recycle. It will be necessary to turn the Ionovac power off for about one minute, to allow the thermal starting components to return to their starting positions.

If ionization is extinguished during operation, the cause can be due to the following:

a. Momentary power interruption.

b. AC power line not connected to proper voltage tap.

c. Extreme line voltage fluctuations, caused by the heavy starting currents of appliances, such as refrigerators, air conditioners, etc.

d. Defective or improper crossover network, allowing strong low frequency transients to extinguish the arc. (Must be 12 db per octave slope below 3500 cps.)

TUNING

Upon replacement of major components of the oscillator section, it will be necessary to realign the oscillator. The T-3500 as it comes from the factory has been adjusted and locked at the optimum point. To check whether or not the unit requires alignment, connect an oscilloscope between the screen grid and ground of the 6146 oscillator tube. Apply .2 volt rms sine wave at 3500 cycles to the 16-ohm input. If a clean sine wave is obtained, the changing of components has not changed alignment. If a distorted sine wave appears, the following procedure should be employed:

Turn the tuning screw in the counter-clockwise position until the tuning plate of the condenser is at an angle. The waveform on the oscilloscope should be very distorted and small in size. Turn the tuning screw in the clockwise position slowly while observing the screen of the oscilloscope. The waveform should increase in size until a peak is reached. This peak will be slightly distorted, and is not the proper place for tuning. Continue turning the screw, and the wave form will decrease slightly in size, but will assume a perfect shape. Just at the point where the distortion disappears is the correct alignment point.

FIELD SERVICE INFORMATION

If upon application of power, and after a reasonable length of time, the Ionovac fails to ionize, the following checks should be made:

Make certain that the tube filaments are operating.

Turn the unit off, and allow to cool for two minutes. This will allow the thermal components to recycle. At the end of this time, reapply power. If the unit still fails to ionize, make the following checks:

1. Remove the plug button located on the bottom cover of the electronics assembly. Take a wooden lead pencil and try to draw an RF arc from the adjustment screw located immediately below the plug button. This is done by touching the lead of the pencil to the screw and removing it slightly. An arc will indicate that the oscillator is in operation. Be careful not to touch the metal chassis during the test. If it is impossible to obtain an RF arc, remove the four cap nuts and the cover located at the same end as the cable connector. Check to see that the filament of the 6146 oscillator tube is operating. Substitute tubes for those in the unit and check for operation. Be sure and replace this cover exactly as found, as these things affect the tuning of the oscillator. For proper operation all covers must be in place.

2. Remove the bottom cover and check voltages as indicated on the schematic diagram. If the screen grid voltage of the 6146 oscillator tube is off, check the 12AU7 circuit components, because these determine screen voltage. Replace defective components and replace the bottom cover.

3. If it is possible to obtain an RF arc, indicating that the oscillator is operating, check the coupling cable to the horn assembly for loose connections. If these appear normal, look in the throat of the horn for the protective screen, indicating that the Ionovac cell is in place. If the cell is not in place, remove the left-hand side cover as viewed from the front of the horn. This is accomplished by removing the E-V decal located in the lower center. After the decal is removed, loosen the screw located underneath a few turns. Tap lightly on the screw. This will cause the side covers to open slightly. A screw driver can be inserted in the gap between the side cover and the horn, and the side cover pried off.

Once the side cover is off, check to see that the Ionovac cell and point are in place. Make sure that all connections are intact. The lead pencil test can be made on the terminals of the cell and it should be possible to draw an RF arc. (Note: be careful not to touch the metal chassis during this test as discomfort, but little harm, will result.)

If these checks do not disclose the trouble, it will be necessary to return both assemblies to the Electro-Voice Repair Department.

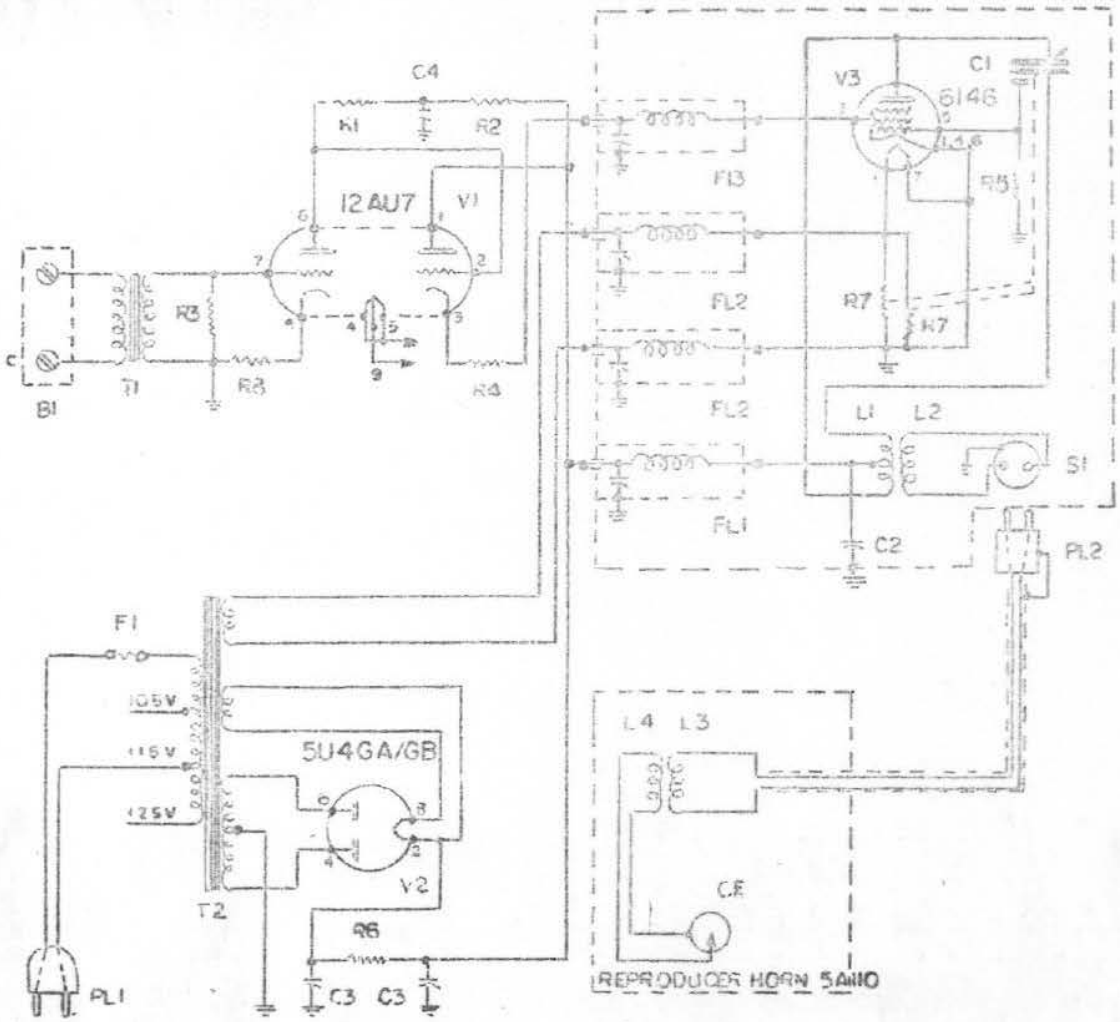
C4
R1
R2
12AU7
V1
B1
T1
R3
R8
R4
V3
6146
C1
FL3
FL2
FL2
FL1
R5
R7
K7
L1
L2
S1
C2
PL2
F1
105V
115V
125V
5U4GA/GB
V2
T2
R6
C3
C3
PL1
L4
L3
C.E
REPRODUCER HORN SAMO

Figure 6

LIST OF ELECTRICAL PARTS

LEGEND	DESCRIPTION	QNTY	PART NO.
C1	Capacitor Tank & Coupling	1	115-1358
C2	" .01 MFD 1000V.	1	199-1007-103
C3	" 20 " 600V.	2	199-2060-206
C4	" .01 " 600V.	1	199-4038-103
L1	Inductor Primary	1	195-22
L2	" Secondary	1	195-23
PL1	Cord-Power	1	200-138
V1	Electron Tube 12AU7	1	262-12AU7
V2	" " 5U4GA/GB	1	262-5U4GAGB
V3	" " 6146	1	262-6146
F1	Fuse - Sloblo MDL-2 2 AMP.	1	320-010-0200
S1	Connector - RF	1	597-102
R1	Resistor 100K OHM 1 W.	1	600-0116-104
R2	" 120 K OHM "	1	600-0116-124
R3	" 15K " "	1	600-0116-153
R4	" 5600 " "	1	600-0116-562
R5	" 33K " "	1	600-0116-333
R6	" 350 " 7 W.	1	600-9037
R7	" 20 OHM SPL. Thermal	2	600-9040
R8	" 4700 OHM 1 W.	1	600-0116-472
B1	Terminal Strip	1	703-259
T1	Transformer - Input	1	710-32
T2	" - Power	1	710-4125
FL1	Inductor B/ RF Filter	1	115-1359
FL2	" Fil. RF "	2	115-1360
FL3	" Screen "	1	115-1361
CE	Cell - VYCOR	1	115-1354
L3	Inductor Primary	1	195-21
L4	" Secondary	1	195-25
PL2	Cable - RF	1	200-136