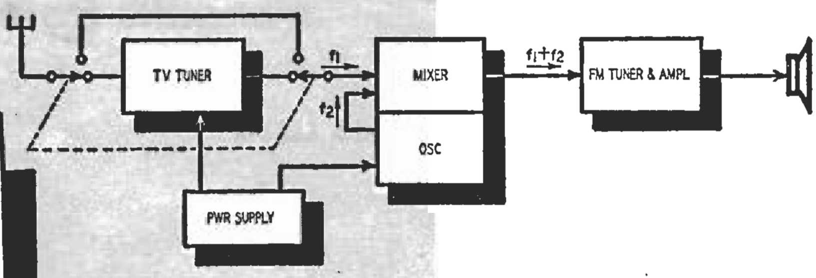
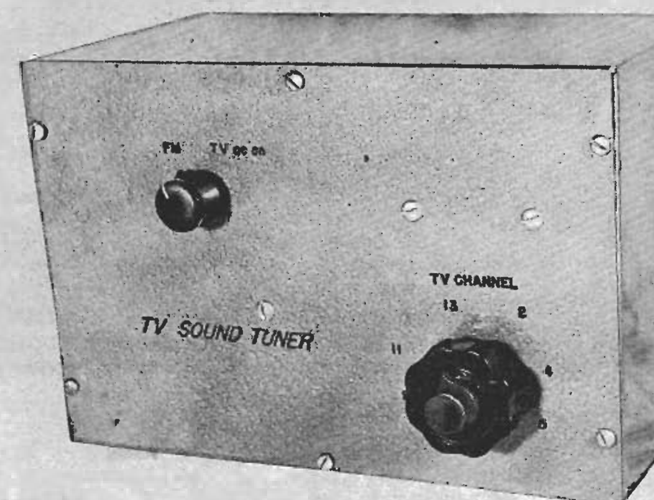


Fig. 1—Block diagram shows plan of the TV sound tuner system.

TV SOUND TUNER

Improve your TV sound with the help of your FM receiver

By RICHARD GRAHAM



Panel view of tuner. In FM position, switch provides feedthrough to FM tuner from antenna input.

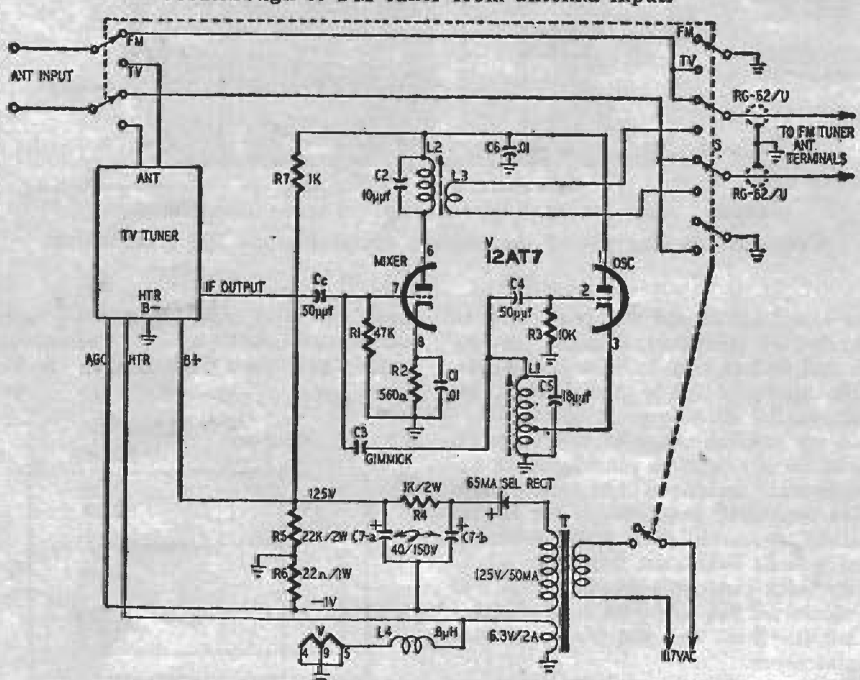


Fig. 2—Schematic diagram of the TV sound tuner. The switch is shown in the FM position.

IT'S no secret to the serious audiophile that the audio quality of most TV receivers leaves much to be desired. TV has attracted and brought into our home via this medium many live performances by name artists and performers in both the popular and classical fields. This rich source of quality audio performances which might ordinarily be tape-recorded for future enjoyment is often marred by the poor audio performance of the TV receiver. Even feeding the audio signal directly from the FM discriminator in the TV set into a high-quality audio amplifier and speaker system often results in a 60-cycle vertical sync buzz and a 15,750-cycle horizontal sync whistle.

R1—47,000 ohms, ½ watt
R2—560 ohms, ½ watt
R3—10,000 ohms, ½ watt
R4—1,000 ohms, 2 watts
R5—22,000 ohms, 2 watts
R6—22 ohms, 1 watt
R7—1,000 ohms, ½ watt
C1—.01 μf, ceramic
C2—10 μμf, ceramic
C3—Gimmick (two pieces of hookup wire twisted together for length of ½ inch)
C4—50 μμf, ceramic
C5—18 μμf, ceramic
C6—.01 μf, ceramic
C7—40-40 μf, 150 volts, electrolytic
C_c—Coupling capacitor, approximately 120 μμf (used only if not already in tuner)
SEL RECT—Selenium rectifier, 65 ma
T—Power transformer, secondary 125 volts @ 50 ma, 6.3 volts @ 2 amps (Stancor PA8421)
S—8-pole 2-position rotary switch (7 poles used)
V—12AT7
9-pin miniature socket and shield
L1—*For 21-mc tuners:* 4 turns of No. 20 wire spaced ½ inch long, tapped at 1¾ turns from ground end. Coil form: ¾-inch diameter (Cambridge-Thermionic LS3 slug-tuned or equivalent)
For 41-mc tuners: 5½ turns of No. 20 wire spaced ½ inch long, tapped at 2 turns from ground end. Coil form: ¾-inch diameter (Cambridge-Thermionic LS3 slug-tuned or equivalent)
L2—5 turns of No. 20 wire spaced ½ inch long. Coil form: ⅜ inch long, ⅜-inch diameter (Cambridge-Thermionic LS3 slug-tuned or equivalent)
L3—2 turns of hookup wire over L2
L4—Filament choke, 0.8 μh (J. W. Miller 6175 or equivalent)
TV tuner, any type with 21- or 41-mc output
Cabinet
Bracket
Line cord
Length of RG-62/U coaxial cable
Length of 300-ohm lead-in

Fortunately this problem isn't really a difficult one to solve if one already has an FM tuner. Since the sound portion of TV transmission is FM, all that is necessary is the FM tuner and a means of converting the TV frequencies to one within its tuning range. This can be done by feeding the output of a TV tuner into a converter stage to change the TV tuner output frequency to one somewhere in the 88–108-mc FM band. The frequency mixing that takes place in the TV sound tuner discussed in this article is identical to that which takes place in the front end of any superhet receiver. In effect, we are using the FM tuner as an if amplifier. A block diagram of the TV sound tuner is shown in Fig. 1.

The TV tuner can be practically any type. (Some experimentation may be required when using tuners having a low-impedance link output. In some cases the link can be eliminated by tapping directly from the plate of the mixer through a coupling capacitor.) The winding of oscillator coil L1 (Fig. 2) depends on whether a 21- or 41-mc TV tuner is used; data are given in the parts lists for both types. The 21-mc type will probably be preferred by the builder since it is readily available, at very reasonable prices.

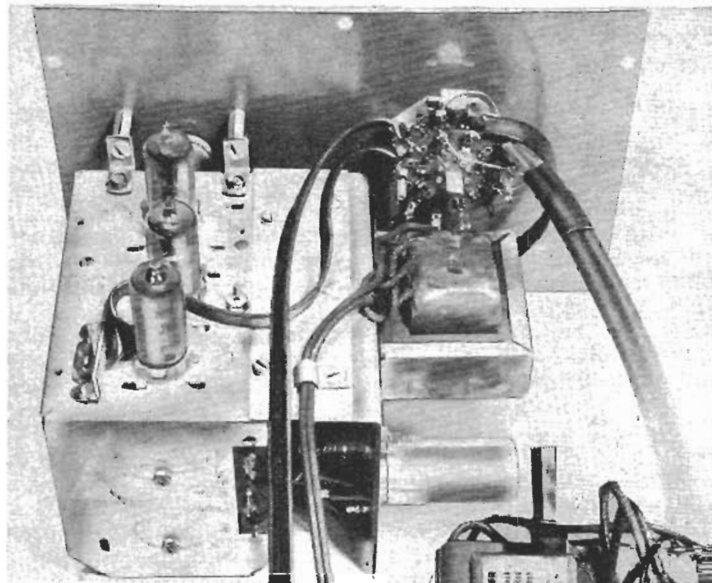
The circuitry

The converter portion of the TV sound tuner consists of a single 12AT7. One half of this double triode functions as a mixer and the other as a fixed-frequency oscillator. The output of the TV tuner is fed through capacitor C_c to the mixer grid. The oscillator output is also fed to this grid through C3. These two signals are mixed to produce a new frequency which, in this case, is chosen to be the *sum* of the TV tuner output and the TV sound tuner oscillator frequencies.

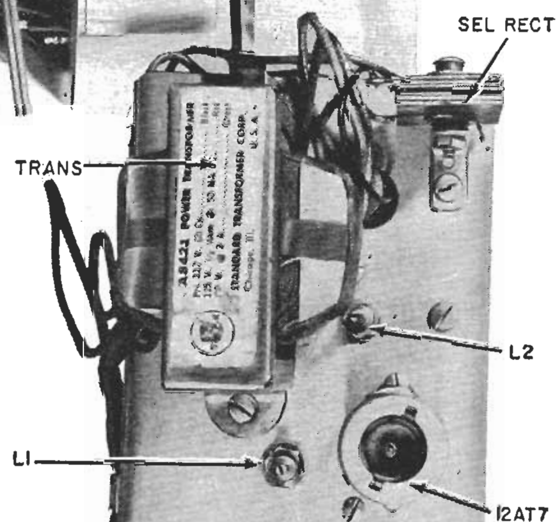
Coil L2 and capacitor C2 in the mixer plate circuit resonate to this sum frequency. A link (L3) around L2 is connected to the FM tuner antenna terminals. Thus this newly produced sum frequency is fed into the FM tuner and, if the FM tuner is set to this sum frequency, TV sound can be received. The particular channel received is selected by the TV tuner channel-selector switch.

For example: If we use a TV tuner with a 21-mc output, the oscillator in the TV sound tuner must be at 69 mc to produce an output of 90 mc into the FM tuner. The point selected on the FM tuner to receive TV sound is arbitrary—just pick an empty spot on the FM dial where no other station is received. The oscillator frequency on the TV sound tuner can be varied by adjusting L1 to vary the output frequency to the FM receiver.

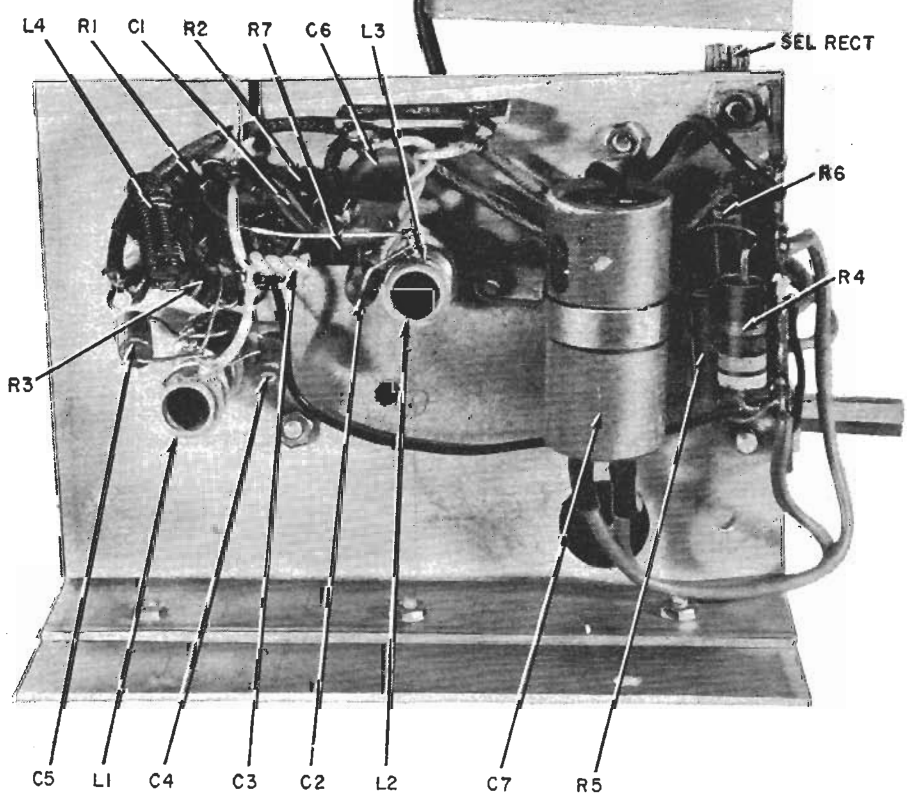
The rotary switch S performs three functions: It transfers the antenna to either the TV sound tuner or the FM tuner. When the TV sound tuner is used, the unused contacts of the antenna changeover portion of switch S are



TV sound tuner circuit is mounted on L bracket bolted to chassis of TV tuner.



Top view of bracket shows major components.



Underside of bracket contains coils, wiring and minor components.

grounded. This prevents reradiation of the TV sound tuner output through the capacitance of the switch contacts and the antenna. Rotary switch S also turns the TV sound tuner on when placed in the TV position.

The power supply is a standard transformer-fed half-wave selenium rectifier circuit. A small negative voltage of about 1 volt is developed across resistor R6 by the current drawn through it by the TV tuner and bleeder resistor R5. This is applied to the agc lead on the tuner. The voltage may vary slightly according to the current requirements of the tuner. The current through R5 stabilizes this bias voltage against variations due to different tuners.

Aligning the tuner

No special tools or instruments are required for alignment. First set the TV tuner on a channel known to be in use. Next set the FM tuner dial on an unused frequency between 89 and 107 mc.

Now you adjust the oscillator frequency by turning the screw on L1 until the channel selected is heard. The last step is to adjust L2 for maximum signal out, or minimum noise in the speaker. This adjustment is broad.

The TV sound tuner was constructed on an L-shaped bracket fastened with self-tapping screws to the edge of the TV tuner. No specific dimensions are given since sizes and shapes of TV tuners vary considerably. The L-shaped chassis is used because it permits short, direct leads between the TV tuner output leads and the 12AT7 mixer–oscillator. In general all leads associated with the 12AT7 should be kept short. Long leads on the oscillator section invite frequency instability among other things. Therefore, keep these leads short and rigid.

The unit is housed in an aluminum utility box for shielding as well as appearance. The oscillator in the TV sound tuner can conceivably cause interference to neighboring TV receivers. Arrange the TV sound tuner oscillator frequency (the difference between the FM tuner frequency setting and the TV tuner output frequency) to fall on an unused TV channel in your area.

The output of the TV sound tuner is fed to the FM tuner through a pair of RG-62/U coaxial cables. Effectively, these cables are in series, thus preserving a reasonable impedance match with only a small loss in signal. One can also use a shielded 300-ohm cable if it is available. It is desirable to use a shielded output cable because of the radiation possibilities. END

THREE CHEERS

—L. R. Davis

A toast is due that customer,
He's rare, there is no doubt of it;
Who, when his set is brought to shop,
Has kept his fingers out of it!

Selenium Diode Voltage Regulators

By J. R. GNESSIN

A VERY interesting application of selenium rectifiers is to provide voltage regulation, especially for nominal 1.5-volt filaments which actually operate on 1.35 volts. This voltage can be obtained from local ac sources and kept within exceedingly fine limits with selenium rectifiers.

A surplus stepdown transformer supplies 10 volts ac center-tapped, from a local 117-volt source, as shown in the figure. A full-wave selenium rectifier REC1 (International Rectifier Corp., JD-508G or similar) provides two rectified voltages, one of which is used for control while the other provides the actual output voltage. An output regulator diode REC2 (IRC JD-500G or similar) regulates the actual output to 1.35 volts dc at 0.5 ampere within narrow limits.

Why? When the bottom of T1 secondary is negative, the electrons flow from the bottom of the winding, against the arrow direction of the rectifier REC1 to point B and ground. It can be seen that current at ground will flow through output bleeder R2 (and the external load) up to "+" output terminal. Some of the current will flow from ground against the arrow of REC2 up to "+". Here the two currents will combine, heading back toward the transformer. The currents again divide, part going through the filter choke to T, completing the circuit, while part goes up through R1 back to REC1 up against the arrow of the rectifier to the top of T, completing the circuit through the transformer winding. While it is true that the last division of current will find a lower resistance path through the filter choke than through R1, yet it can be seen that the path through R1 is toward a point of greater potential, overcoming voltage drop across R1.

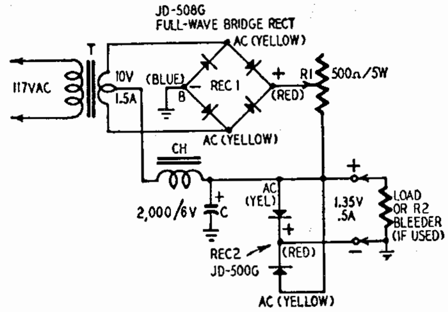
On the next half-cycle the top of T secondary is negative, permitting the electrons to flow from the top of the winding, against the arrow of the rectifier to point B, thence to ground, on through the external load and output bleeder R2, part dividing to go up through REC2, combining at point "+", again dividing to go through the filter choke to transformer as well as up through R1 and down against the arrow of rectifier JD-508G to the bottom of transformer T, completing the circuit and cycle.

REC1 thus rectifies the full voltage across T and also the voltage from center tap to ends. In effect it provides dual full-wave rectification, with output in the form of a voltage divider with approximately 5 volts from top of R1 to ground and approximately 2.5 from positive output terminal to ground, if rectifier REC2 were not in the circuit.

REC2 is the voltage regulator. As hooked up into the output circuit it loads the circuit, pulling the voltage down from approximately 2.5 to about 1.35 dc. The exact voltage at the output is determined by setting of R1 in the following manner:

The resistance of the voltage regulator varies inversely as the voltage across its terminals. The polarity will not change, since this is filtered dc. The amplitude might change as occasioned by fluctuating line voltage or load changes. To resist these voltage changes the voltage-regulator resistance goes up sharply as the voltage across it goes down and vice versa.

Resistor R1 together with rectifier REC2 forms a voltage divider from the 5-volt point to ground. R1 is set so the voltage at the output, under load, is exactly 1.35 (or whatever is required). Under quiescent conditions this will fall into the center of the regulating range of REC2.



T1—Stepdown transformer, line to 10 volts, center-tapped. (Not critical, 6.3- and 5-volt filament windings of power transformer can be used—for low currents a single 6.3-volt center-tapped winding.)
R1—500-ohm 5-watt pot
R2—Load. (If bleeder is used, resistance should be 5 times as high as load.)
C—2,000-μf 6-volt electrolytic
CH—Filter choke. Primary of old power transformer or other low-resistance inductor.
REC1—Full-wave bridge rectifier, ac input 26 volts max., dc output 0–20 volts @ 700 ma (IRC JD-508G or equivalent)
REC2—Full-wave rectifier, ac input 26 volts max., dc output (diodes in parallel) 800 ma (IRC JD-500G or equivalent)

The regulator circuits

Whatever the cause, if the voltage across the voltage regulator increases above 1.35 (or whatever voltage setting made) the resistance of the regulator decreases. This increases the current flow through it to such a value that the increased voltage drop across the filter choke and R1 bring the voltage across the regulator back to 1.35 volts. If the voltage across the regulator drops, the resistance across it increases, reducing the current through it, and the voltage drop across the filter choke and R1 and raising the voltage across the regulator.

In this manner, accurate output voltage of 1.35 can be safely connected to filament circuits, etc. with assurance that negligible output voltage changes will result despite normal line and load changes. END