

THE MINI-FI

A mono amplifier for \$10 . . . stereo for \$15! Two tubes, 20 db of feedback, direct coupling and Ultra-Linear output produce the cleanest two watts you've ever heard!

By Dave Gordon



AUDIOPHILES usually prefer 15 watts or more per channel for living room hi-fi, but there are times when an amplifier that puts out a clean couple of watts will do a specific job more efficiently. For instance, a small, high-quality amplifier is well suited for use with a tape deck, or it can feed the center-channel speaker in a stereo setup.

The EI Mini-Fi is just such an amplifier. Simple and easily built, it delivers an exceptionally clean 2 watts and fills the bill where power requirements are low but fidelity requirements are high. And it can be constructed in either of two versions—mono or stereo. Building cost runs about \$10 for the mono model, about \$15 for stereo.

With the Mini-Fi, an inexpensive FM tuner and EI's Duoflex speaker (July '62 issue) or similar system, you can have a top-quality FM radio at a fraction of the cost of commercial equivalents. Or if you want an outstanding phonograph at minimum cost, you can feed the output of a high-quality ceramic cartridge directly into the Mini-Fi's input jack.

Two keys to the Mini-Fi's quality are a carefully selected output transformer

and a new tube, the ECL86, which combines a high-gain triode with a sensitive output pentode.

The Mini-Fi's circuit has several off-beat aspects (see schematic). Starting at input jack J1, control R1 establishes the level of input signal. If the associated equipment has a built-in volume control, R1 may be omitted. Capacitor C1 is necessary to prevent the grid bias achieved by the 10-megohm grid resistor (R2) from being shorted out by the input load. The 68-ohm cathode resistor (R3) does not function as a bias resistor but simply lifts the cathode off ground

PARTS LIST

Resistors: 1/2 watt, 10% unless otherwise indicated

R1—500,000 ohm or 1 megohm pot. w/switch S1

R2—10 megohm R4—470,000 ohms

R3—68 ohms R5—1,200 ohms

R6—680,000 ohms

R7—Any value 7,500 to 10,000 ohms, 10 watt adjustable

Capacitors:

C1—.01 mf ceramic disc

C2, C3—.02 mf ceramic disc

C4—40 mf @ 450 V; 10 mf @ 450 V; 80 mf @ 200 V triple-section can-type electrolytic (see text)

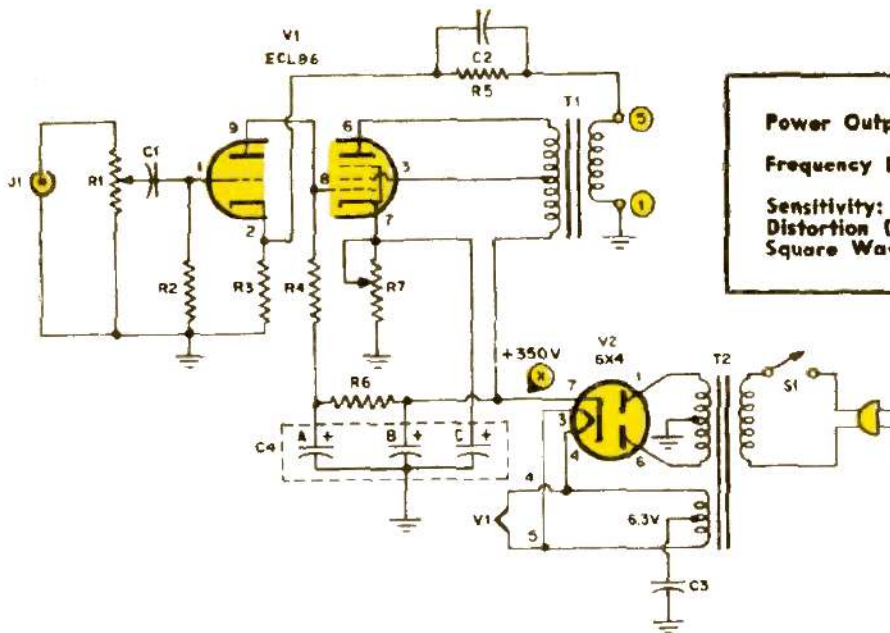
T1—Universal output transformer (Lafayette TR13) see text

T2—Power transformer. Secondaries: 6.3 V @ 1.5 a, 750 V @ 40 ma, center-tapped (see text)

TP1—2-screw terminal strip

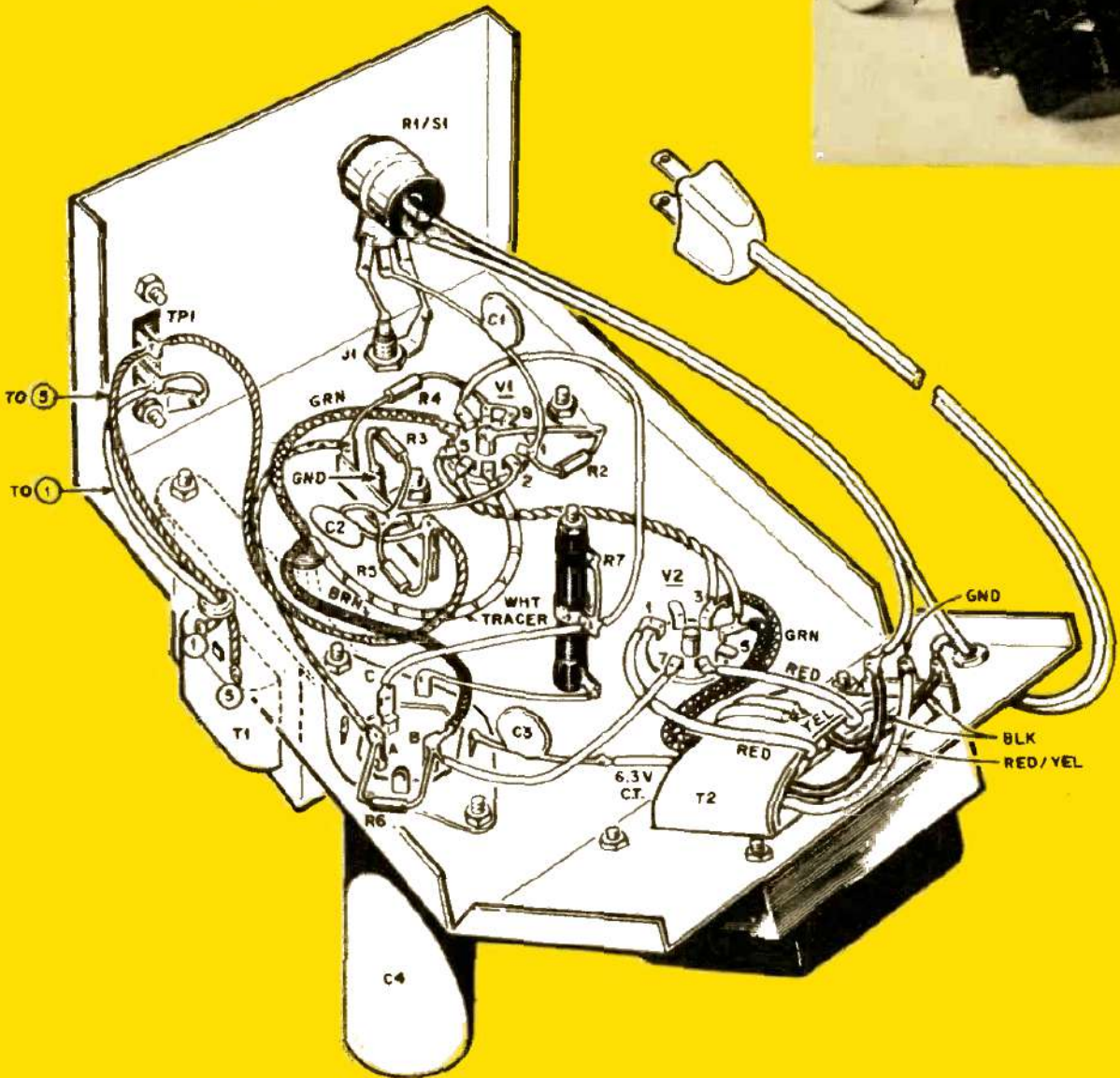
J1—Phono jack

Misc.—7-pin tube socket, 9-pin socket, 4-lug terminal strip, wire, etc.



TECH SPECS
Power Output: 2.25 watts (rms) before clipping (@ 1 kc)
Frequency Response: +0db, -3db; 25 cps-40 kc (@ .75 watts)
Sensitivity: .275 volts (rms) for fu l output
Distortion (HD): 1% @ 1 watt, 2.5% @ 2.25 watts
Square Wave Response: No ringing at any frequency

Output transformer T1 is wired in an Ultra-Linear or split-load configuration. A slight advantage is realized by this hookup in the below-100 cycles performance of the Mini-Fi amplifier.



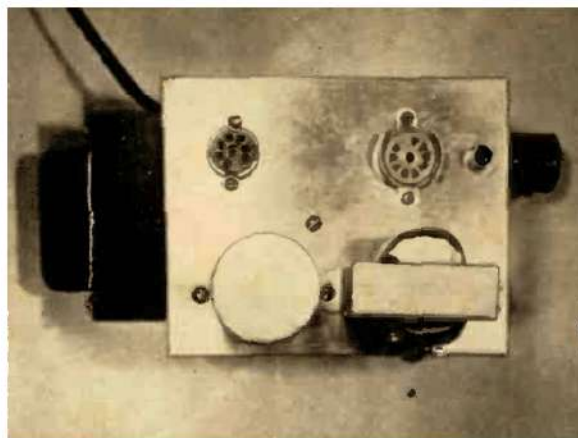
sufficiently to allow feedback to be applied to the cathode. Resistor R4 serves as both the plate load resistor of the triode and the grid return of the pentode. This means that the pentode grid is operating with a voltage on it equal to the plate voltage of the triode. Since the ECL86 pentode requires about 8.75 volts bias on the grid, an over-large cathode resistor (R7) provides a voltage drop equal to 8.75 volts plus the triode's plate voltage.

For optimum results, the bias on the output tube must be adjusted critically with R7. It's not possible to specify an exact resistance for R7 because with a direct-coupled circuit, in which one tube's plate voltage is another tube's grid voltage, the normal voltage variations tend to add up. As measured with respect to the cathode (in other words, with the positive lead of your meter on pin 7 and the negative on pin 8), R7 should be adjusted for 8 volts. With respect to ground, both pins 7 and 8 will show anywhere from 100 to 150 volts positive, but pin 7 will be 8 volts more positive than pin 8. The grid voltage on the output tube should be measured with a VTVM (preferably) or a 20,000 ohms/volt VOM.

If the equipment is available, a better way to determine the correct bias on the pentode is to use an audio generator and oscilloscope. Connect an 8-ohm load resistor to the output terminals of the amplifier, feed a 1-kc signal into J1 and, with R1 on full, adjust R7 for maximum undistorted output as viewed on the scope. The level of the 1-kc signal fed into J1 and R7 should be adjusted with respect to each other, so maximum signal output with minimum clipping is obtained.

Since the cathode of V1's pentode section is operating with over 100 volts on it (to compensate for the high grid voltage), the plate and screen grid must be raised above their normal 250 volts by an additional 100 volts to insure proper current flow. This accounts for the high plate and screen voltages on the ECL86.

Parts Substitutions. Certain parts changes are permissible. Wired as shown, the Mini-Fi has an input sensitivity of .25 volts. In other words, .25 volts applied to J1 (with R1 wide open)



Top chassis view of Mini-Fi shows socket and component placement. Keep V2 away from filter C4.

will drive the Mini-Fi to full output. However, if more gain is desired, feedback resistor R5 can be increased in value. Capacitor C2 should be decreased in the same ratio. Input control R1 may be 500,000 ohms to 2 megohms.

Output transformer T1 was selected on a price vs. quality basis. There's no point in substituting another transformer unless it's in the \$6-or-over-range. If a better quality transformer is used, feedback components R5 and C2 will have to be readjusted. Select R5 so that approximately .25 volts input drives the amplifier to full output. The value of C2 will have to be established experimentally as follows. Set R1 half open and use the smallest value of C2 that eliminates the resulting supersonic oscillation as viewed on a scope. As an alternative, feed in a 10-kc square wave and adjust C2 for the flattest tops.

Power transformer T2 may be a surplus or junkbox component. Its high-voltage secondary can range from 600 volts center-tapped to 750 volts center-tapped (300-0-300 to 375-0-375) with at least a 40 ma rating. If the high-voltage secondary is in the 600-650 volts center-tapped range, no additional parts are required. However, if the DC voltage at the 6X4 cathode (pin 7) exceeds 380 volts, install a resistor between pin 7 of V2 and C4B. This point is marked X on the schematic. The value of the resistor is determined experimentally, but should be a 4-watt job at 500 ohms or higher. In any case, select the resistor to provide about 350-375 volts at C4B.

