CONRAD-JOHNSON PREMIER TWELVE MONO AMP

I have reviewed a number of pieces of conrad-johnson equipment over the years and have always been favorably impressed by their music-transferring properties. It was with pleasant anticipation that I received a pair of Premier Twelve tube power amplifiers.

The mono Premier Twelve, like the smaller stereo Premier Eleven and the flagship mono Premier Eight, represents conrad-johnson's current thinking on how to make musically accurate-sounding tube power amplifiers. Using four GE 6550 tubes, each Premier Twelve amplifier produces some 140 watts of output power. The output transformers are said to use a new winding technology that allows greater high-frequency power bandwidth. Most unusual is the lack of electrolytic capacitors in the high-voltage power supply; the Premier Twelves have proprietary polypropylene capacitors for this function. A lone 4,700-μF electrolytic is used in the front-end tube d.c. supply—bypassed, of course, by 2 μF of polypropylene capacitance.

Chassis construction is a bit unusual but very attractive overall. From the side, the main chassis looks like one cycle of a square wave. The ends of this aluminum piece form the rear panel and a front subpanel. The transformers and polypropylene filter capacitors are mounted on the upper surface of this piece; the main p.c. board sits in the well between this platform and the front subpanel portion. Black panels bolt on to form the chassis sides. A pale gold-colored piece forms the front panel; another, with holes for the tubes and for access to their bias adjusters, closes off the chassis over the main p.c. board. A nicely constructed vented cage can be mounted over this cover, to protect people and hot tubes from each other. All in all, a most robust and attractive packaging job.

The main signal p.c. board is populated with appropriate high-quality parts, including a large number of conrad-johnson's proprietary polystyrene capacitors and polypropylene caps from other manufacturers. Another, smaller, p.c. board, toward the rear of the unit, serves to mount the various rectifier diodes and internal fuses and to act as a tie point and interconnection for various power-supply circuits.

Circuit Description

The signal circuitry of the Premier Twelve is essentially like that of past conrad-johnson tube power amplifiers. This well-proven topology consists of an input stage using a 5751 dual triode with both halves paralleled, acting as a common-cathode amplifier. Plate output of this input stage is direct-coupled to a long-tailed-pair, phase-inverter, second stage made up of two 6FQ7 tubes with both halves paralleled. The phase inverter's plate output is coupled through separate capacitors to each of the four output tubes' control

SPECS

Power Output: 140 watts rms into 4 ohms, 30 Hz to 15 kHz, at no more than 1% THD or IM distortion.
Sensitivity: 950 mV for full output.
Small-Signal Distortion: Less than 0.1%, midband.
Polarity: Noninverting.
Frequency Response: 20 Hz to 20 kHz, +0, –0.5 dB.
Hum and Noise: 98 dB below full output.
Input Impedance: 100 kilohms.
Dimensions: 17½ in. W x 7¼ in. H x 15 in. D (44.5 cm x 18.4 cm x 38.1 cm).
Weight: 48 lbs. (21.8 kg).
Price: $3,295 each.
Company Address: 2733 Merrilee Dr., Fairfax, Va. 22031.
For literature, circle No. 92

Photos: Michael Groen

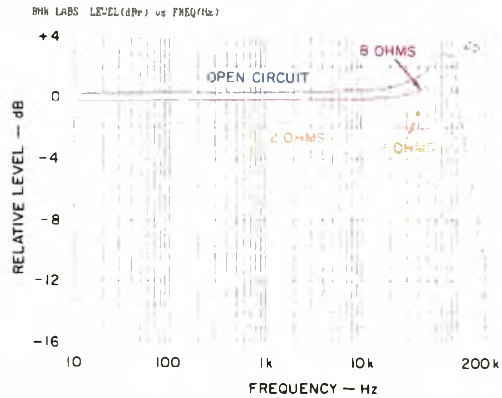

Fig. 1—Frequency response.

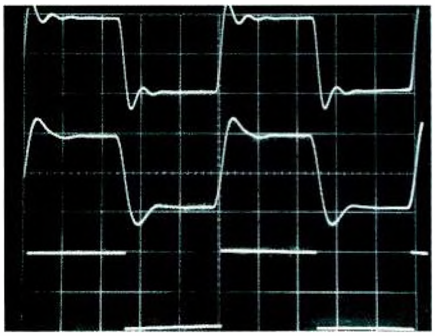

Fig. 2—Square-wave response (from top) at 10 kHz, 8 ohms (20 μS/div.); 10 kHz, 8 ohms & 2 μF (20 μS/div.), and 40 Hz, 8 ohms (5 mS/div.).

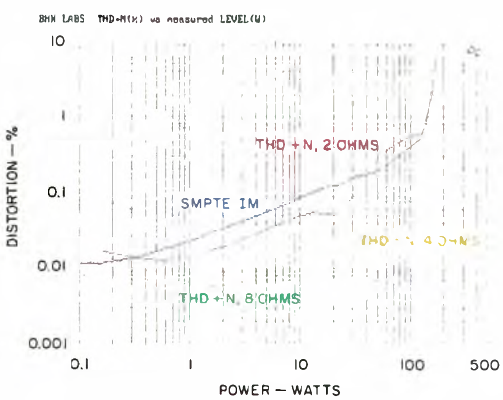

Fig. 3—THD + N for 8-, 4-, and 2-ohm loads and SMPTE-IM distortion for 4-ohm load.

grids. The a.c. balance is accomplished by a rheostat in series with a fixed resistor (to limit the minimum resistance), paralleling one of the plate resistors in the phase inverter. The output stage is a push-pull parallel arrangement with an "ultra-linear" connection to the output transformer's primary winding. An overall negative feedback loop is taken from the secondary of the output transformer to the first stage's cathode.

Separate voltage regulators for the first stage, phase inverter, and the bias supply for the output tubes are on the main p.c. board, next to the circuits they regulate. Each of these regulators uses the favorite conrad-johnson topology of a transistor current source feeding zener-diode voltage regulators that, in turn, feed Darlington-connected pass transistors. All bypass and filtering capacitors in these regulators are polystyrene or polypropylene.

For each output tube, there is an open-loop-connected op-amp that compares the tube's cathode current, sampled through a 20-ohm resistor, to a reference voltage. An LED, connected between the op-amp's output and ground, stays lit until the voltage drop across the cathode resistor equals the reference voltage, which signifies that the cathode current is now correct. Individual control-grid bias pots are adjusted until the indicator LED is just extinguished. Simple—and effective.

The main high-voltage supply consists of a full-wave bridge rectifier made up of discrete diodes, feeding a capacitor-input filter using one of the four 47-μF main filter polypropylene capacitors bypassed by a 0.15-μF polystyrene. A filter choke follows and is terminated in two more of the 47-μF units in parallel, bypassed by a 0.15-μF polystyrene capacitor. This point is the high-voltage supply for the output stage and feeds the center tap of the output transformer and the input to the front-end voltage regulators. The filter choke is paralleled by a 4-μF polypropylene and a 0.15-μF polystyrene capacitor in parallel; possibly, this is done to resonate the choke in order to reduce the final ripple to lower values.

Measurements

When first powering up one of the Premier Twelves on the bench, a.c. line draw was about 600 mA before plate current started to come up. With the output stage's plate current up and stabilized, the a.c. line draw became a healthy 2 amperes.

The two amplifiers I tested had 28.9 and 28.8 dB of gain. Their sensitivity figures were 101 and 102 mV. These measurements are referenced to 8 ohms, as is my usual practice; however, as we shall see, the

THE BIAS-SETTING SYSTEM, ADJUSTING A POT UNTIL AN LED JUST GOES OUT, IS SIMPLE BUT EFFECTIVE.

Premier Twelve is optimized for 2- to 4-ohm loads. Subsequent measurements, unless otherwise noted, will be presented for the amplifier that had the slightly greater distortion.

Frequency response at an output of 2.83 V, corresponding to 1 watt into 8 ohms, is shown in Fig. 1 for open-circuit, 8-, 4-, and 2-ohm loading. As can be seen, the Premier Twelve is a bit underdamped for loads greater than 2 ohms. Many cone speaker systems' high-frequency impedance characteristics approximate those of an open circuit, due to the inductance of the tweeter's voice-coil, and thus will have an ultrasonic peak of some 3 dB when used with this amp. This is a bit much for my own instincts as a circuit designer, but I presume that conrad-johnson compensated the amplifiers this way for sonic reasons.

Square-wave performance of the Premier Twelve is depicted in Fig. 2. Careful

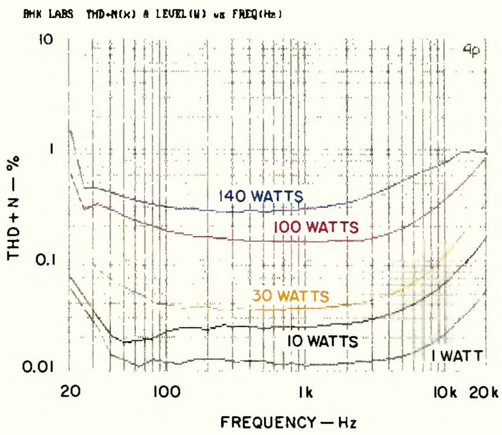

Fig. 4—THD + N vs. frequency, 4-ohm loading.

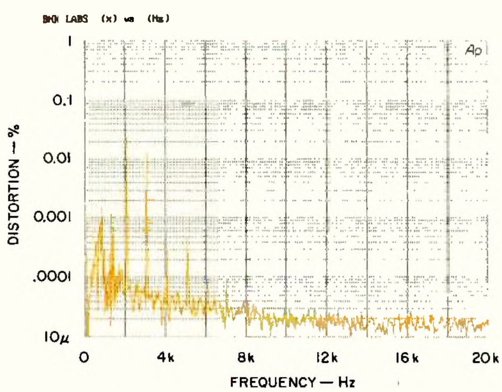

Fig. 5—Spectrum of harmonic distortion for 1-kHz signal at 10 watts into 4 ohms.

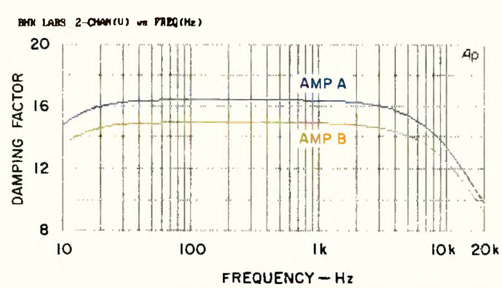

Fig. 6—Damping factor vs. frequency, 8 ohms.

Table I—Output noise levels. The IHF S/N was 94.5 dB for one of the amps and 93.0 dB for the other.

	Output Noise, μV	
Bandwidth	AMP A	AMP B
Wideband	163	169
22 Hz to 22 kHz	141	148
400 Hz to 22 kHz	58	69
A-Weighted	53	63

examination of the top and middle traces reveals slightly different behavior for each half cycle. This may be due to different leakage inductance and shunt capacitance in the coupling from each half of the output transformer primary to the secondary. At lower levels (not shown), where both output tubes are always conducting, this phenomenon disappears. At the level shown in Fig. 2, ±5 V, rise- and fall-times were about 3.2 μS for 8-ohm loads and about 3.6 μS for 4-ohm loads.

Total harmonic distortion as a function of power is presented in Fig. 3 for loads of 8, 4, and 2 ohms, together with SMPTE-IM distortion for 4-ohm loading. It is apparent that this amplifier is optimized for loads of 2 to 4 ohms. Figure 4 shows THD + N as a function of frequency for 4-ohm loading at several power levels. Figure 5 is a spectrum of the harmonic-distortion residue at an output of 10 watts into 4 ohms. Dominant distortion components are second- and third-order, with higher order components rapidly disappearing into the noise level. Distortion characteristics for the Premier Twelve are typical of the better tube amplifiers that I have measured.

Output noise for the Premier Twelve samples that I tested is listed in Table I. These noise values are extremely good, among the lowest I have obtained for power amplifiers.

Figure 6 shows damping factor as a function of frequency for both units, referenced to 8 ohms—as has been my practice. With the 4-ohm loads these amps are optimized for, damping factor would be half of that shown.

Dynamic power was measured for 8-, 4-, and 2-ohm loading, using the IHF tone-burst method. With 8-ohm loading, the amplitude attainable during the 20-mS burst didn't decrease noticeably with time, since there was little power-supply droop caused by filter-capacitor discharge at this impedance. Equivalent sine-wave power was 100 watts. With 4-ohm loading, the attainable power at the beginning of the burst was 171 watts, decreasing to 149 watts at the end of the burst. At 171 watts, 4-ohm dynamic headroom was 0.9 dB. Finally, with 2-ohm loading, the beginning and end power levels of the burst were 182 and 150 watts, yielding a dynamic headroom of 1.14 dB (using the 4-ohm power rating of 140 watts and the power at the beginning of the tone burst). Steady-state clipping power was 100 watts at 8 ohms, with a 2.7-ampere line-current draw; the results for 4 ohms were 148 watts at 3.5 amperes and for 2 ohms were 143 watts at 4.3 amperes.

Use and Listening Tests

The phono source equipment in my system during the review period included an Oracle turntable fitted with a Well Tempered Arm and Spectral Audio MCR-1 Select moving-coil pickup used with a Vendetta Research SCP-2C phono preamp.

OUTPUT NOISE IS EXTREMELY GOOD, AMONG THE LOWEST I HAVE SEEN IN POWER AMPS.

Digital sources were Krell MD-10 and PS Audio Lambda CD transports feeding a Sonic Frontiers SFD-2, a Stax DAC-Talent BD, and other (experimental) D/A converters. Other signal sources included Nakamichi's ST-7 FM tuner and 250 cassette recorder and a Technics open-reel recorder. Preamplifiers included a unit from Quicksilver Audio, a Forssell tube line driver, and a First Sound Reference II. Power amplifiers used for comparison were a Crown Macro Reference, a pair of Quicksilver M-135s, and an Arnoux MB300-A digital switching design. Loudspeakers used were B & W 801 Matrix Series 3s, augmented by an experimental subwoofer that has two JBL 1400Nd drivers.

Boy, the Premier Twelves sure aren't your smooth, syrupy, and forgiving tube

KEF, *continued from page 78*

KEF recommends not placing the Q70 in a corner or near a side wall because the added bass boost will muddy the sound, and the nearness of the side wall will cause the stereo image to deteriorate. I placed the speakers in my customary locations, about 8 feet apart and well away from the side and rear walls. Listening was done from my couch, 10 feet away.

KEF also recommends that the Q70s be faced straight ahead, not toed in, to produce the best balance between direct and reflected sounds. I experimented with several aimings—including straight ahead, toed in, and cross-fired—but had no clear preference. The wide, very even coverage of the Q70s, on a three-dimensional basis, makes them somewhat less sensitive to room placement and aiming than other systems are. The majority of my listening was done with the Q70s toed in slightly.

Even though I listened critically to determine if there were any detrimental effects in high-frequency response when the systems were listened to on axis, rather than off axis, I was not able to draw a clear conclusion. With program material, I could hear no consistent difference, although with pink noise some slight comb-filtering roughness was evident in very high frequencies when I moved back and forth in front of the speakers.

The Q70s were somewhat more sensitive than my reference B & Ws. A reduction of 4 dB for the Q70s was required on my level-matching box to equal the level of the B & Ws. Initial listening to the Q70s evidenced a smooth, wide-range sound that changed very little with listening location or height. The main difference, compared to my reference speakers, was a reduction in bass level, particularly on rock kick drum and organ pedal notes.

The KEFs did particularly well on male and female speaking voices. I played a very good demo disc, the *Sheffield Drive* sampler (Sheffield Lab 10037-2), and heard a very dynamic sound and quite satisfying bass. The KEFs' overall sound was quite similar to the B & Ws' but had a slightly emphasized high end and less bass.

The Q70s could be played satisfyingly loud and clean on rock material, such as The Rolling Stones' *Voodoo Lounge* (Virgin Records 39782-2). On Jagger's solo voice, the KEFs exhibited some high-frequency sibilant roughness and emphasis as compared to the B & Ws. On the slower tracks where Jagger sings solo, the Q70s produced a very credible center image, with good stability and quite satisfying realism. (Although some reviewers have panned this album, I love it. Just one old guy listening to some other old guys play good old rock 'n' roll!).

THE KEF Q70s OFFER SOUND, PERFORMANCE, AND GOOD LOOKS BEFITTING MUCH MORE EXPENSIVE SPEAKERS.

On more sedate material, such as Mozart's Piano Concerto No. 19 (Perpetua PR 7013), the Q70s demonstrated an excellent soundstage while nicely reproducing the subtle shadings and nuances of the piano work.

On the pink noise stand-up/sit-down test, the Q70s exhibited no change at all when I stood up; the coverage was smooth and even at all of my positions! On this test, the Q70s were actually slightly better than the 801s, no mean feat! The KEFs' spectral balance on pink noise was quite accurate and extended but not quite as smooth as the B & Ws', and they had significantly less low bass. On third-octave band-limited pink noise, the KEFs did quite well at 40 Hz and above but generated only weak output at 31.5 Hz and no usable output at lower frequencies.

The Q70s' dynamic range capability was well demonstrated on big-band material, such as *For Duke* (RealTime RT1001). Here the solo trumpet work on track 1 was uncannily realistic, with the characteristically loud up-front horn sound reproduced quite faithfully and cleanly. Played at high levels, the big-band sound was reproduced with minimal compression and very little harshness.

In all my tests, the KEF Q70s performed flawlessly and demonstrated sonics, performance, and good looks befitting much more expensive speakers. They would make an excellent addition to any stereo or home theater system. *D. B. Keele, Jr.*