commodate the circuit board can be used. The POWER switch and POWER and CW LED indicators are the only front-panel items. J2 (KEYED LINE), J1 (AUDIO IN), J3 (+12 V DC POWER) and P1 (COMPUTER) are on the rear apron of the enclosure.

Alignment

There are three alignment adjustments, all of which are for the receive mode. Start by loading (and running) the software and turning the unit on. Switch the receiver to a dummy antenna to eliminate any interfering signals, and tune the receiver to a strong signal from a frequency calibrator or any other stable signal source. Carefully adjust the receiver for peak audio output. You may need a *Y* connector so the receiver can feed the interface and a speaker.

Connect a pair of headphones to the junction of the 0.1-µF capacitor and 10-kΩ resistor at pin 3 of U4. Adjust the Tune (R1) control on the PC board for the loudest signal. The filter is sharp, so make the adjustment carefully.

Set the PC board Level pot (R2) to midrange and adjust the VCO pot (R3) until the CW LED (DS1) comes on. Decrease the Level setting slightly (adjust the control in a counterclockwise direction) and readjust the VCO pot, if required, to cause the CW LED to light. Continue to reduce the Level setting in small steps, each time readjusting the VCO setting, until you reach the point where operation of the CW indicator becomes erratic.

Now turn the Level control back (clockwise) to just past the point where the LED comes on with no sign of erratic operation. The Level threshold setting is critical for best operation of the receive demodulator. If the control is advanced too far, the LED will trigger on background noise and copy will be difficult. If you reduce the setting too far, the interface will trigger erratically, even with a clean beat note. If you have a reasonably good CW receiver (CW bandwidth crystal filters and/or good audio filtering), you can back down the Level control until the LED stops flickering on all but the strongest noise pulses, but where it will still key reliably on a properly tuned CW signal.

Software Installation

The software for this project is avail-|able from *ARRLWeb* (see page viii in the front of this book). The distribution files include MORSE2.EXE, a sample set-up file (CW.DAT), a sample logging file (LOG.DAT), the HELP text file (CWHELP.DAT) and the program QuickBASIC source code (MORSE2.BAS). To run the program log into the directory holding these files and type *MORSE <CR>*. The symbol <CR> stands for *Return* or *Enter*, depending on your keyboard.

The program menu permits you to enter or change the following items:

SPEED—Select a transmitting speed from 5 to 60 WPM. The program autocalibrates to your computer clock speed, and transmitting speeds are accurate to within 1%. On receive, the system automatically tracks the speed of the station you are copying up to 50 or 60 WPM.

YOUR CALL—You can enter your call sign so you never have to type it in routine exchanges. The call can be changed at any time if you want to use the program for contests, special events, or any other situation where you will be using another call.

OTHER CALL—If you enter the call of the station you are working (or would like to work), you can send all standard call exchanges at the beginning and end of a transmission with a single keystroke.

CQ OPTIONS—Select one of two CQ formats. The "standard" format is a 3x3 call using your call sign. The program also lets you store a custom CQ format, which is useful for contests.

MESSAGE BUFFERS—There are two message buffers. Either can be used for transmitting.

SIDETONE—Select on or off and a frequency of 400 to 1200 Hz.

WEIGHTING—Variable from 0.50 through 1.50.

DEFAULT SETUP—All the information discussed up to this point can be saved into a default disk file (CW.DAT). These choices will then be selected whenever you boot the program. Any setup can be saved at anytime.

LOGGING—The program supports a range of logging functions. It even includes the ability to check the log and let you know if you have worked that station before. If you have fully implemented the logging options, it will tell you the operator's name and QTH.

HELP FILES—If you forget how to use a function or are using the program for the first time, you can call up on-screen HELP files that explain every function.

AN EXPANDABLE HEADPHONE MIXER

From time to time, active amateurs find themselves wanting to listen to two or more rigs simultaneously with one set of headphones. For example, a DXer might want to comb the bands looking for new ones while keeping an ear on the local 2-m DX repeater. Or, a contester might want to work 20 m in the morning while keeping another receiver tuned to 15 m waiting for that band to open. There are a number of possible uses for a headphone mixer in the ham shack.

The mixer shown in **Figs 22.47** and **22.48** will allow simultaneous monitoring of up to three rigs. Level controls for each channel allow the audio in one channel to be prominent, while the others are kept in the background. Although this project was built for operation with three different rigs, the builder may vary the number of input sections to suit particular station requirements. This mixer was built in the ARRL Lab by Mark Wilson, K1RO.

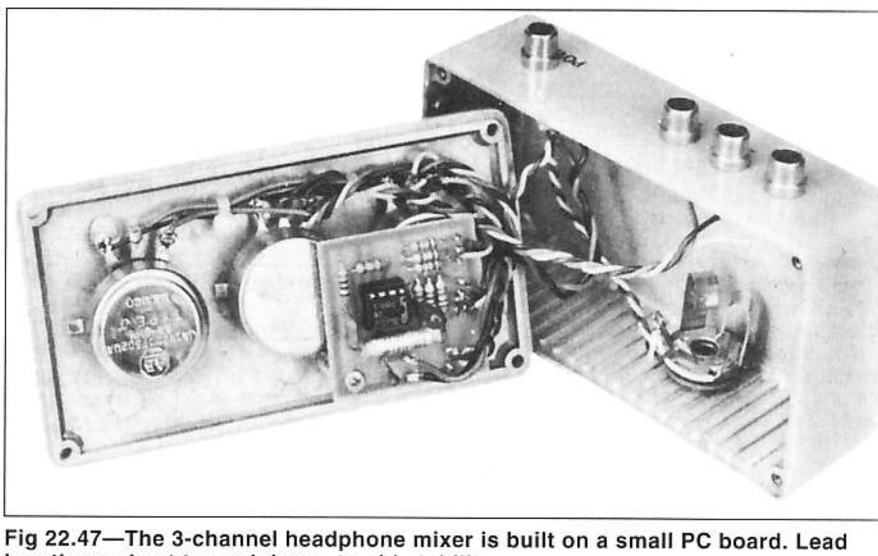

Fig 22.47—The 3-channel headphone mixer is built on a small PC board. Lead length was kept to a minimum to aid stability.

CIRCUIT DETAILS

The heart of the mixer is an LM386 low-power audio amplifier IC. This 8-pin device is capable of up to 400-mW output at 8 Ω—more than enough for headphone listening. The LM386 will operate from 4- to 12-V dc, so almost any station power supply, or even a battery, will power it.

As shown in Fig 22.48, the input circuitry for each channel consists of an 8.2-Ω resistor (R1-R3) to provide proper termination for the audio stage of each transceiver, a 5000-Ω level control (R4-R6) and a 5600-Ω resistor (R7-R9) for isolation between channels. C1 sets the gain of the LM386 to 46 dB. With pins 1 and 8 open, the gain would be 26 dB. Feedback resistor R10 was chosen experimentally for minimum amplifier total harmonic distortion (THD). C2 and R11 form a "snubber" to prevent high-frequency oscillation, adding to amplifier stability. None of the parts values are particularly critical, except R1-R3, which should be as close to 8 Ω as possible.

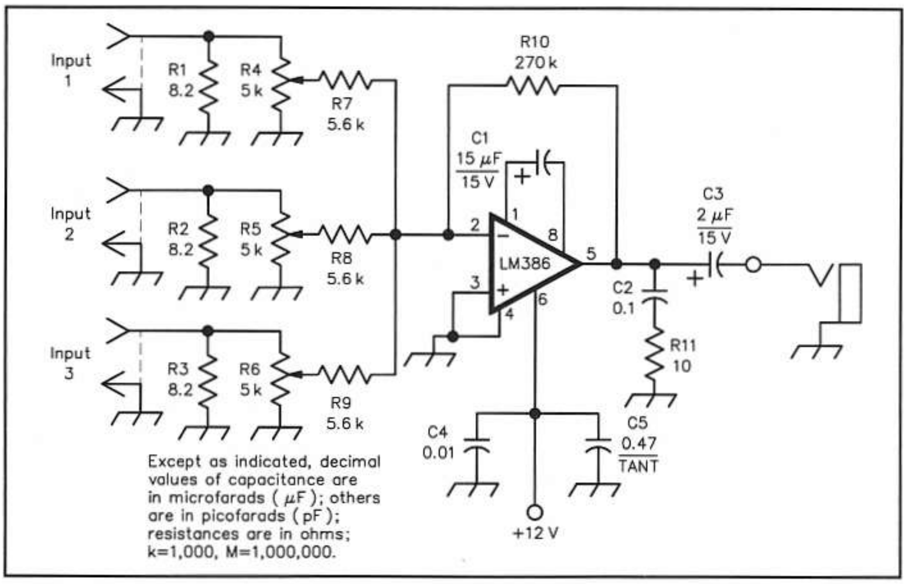

Fig 22.48—Schematic diagram of the LM386 headphone mixer. All resistors are ¼ W. Capacitors are disc ceramic unless noted.

CONSTRUCTION

Most of the components are arranged on a small PC board.[1] Perfboard will work fine also, but some attention to detail is necessary because of the high gain of the LM386. Liberal use of ground connections, short lead lengths and a bypass capacitor on the power-supply line all add to amplifier stability.

The mixer was built in a small diecast box. Tantalum capacitors and ¼-W resistors were used to keep size to a minimum. The '386 IC is available from RadioShack (cat. no. 276-1731). A 0.01-µF capacitor and a ferrite bead on the power lead help keep RF out of the circuit. In addition, shielded cable is highly recommended for all connections to the mixer. The output jack is wired to accept stereo headphones.

Output power is about 250 mW at 5% THD into an 8-Ω load. The output waveform faithfully reproduces the input waveform, and no signs of oscillation or instability are apparent.

[1]See the **References** chapter for a template.

AN "UGLY TRANSFORMER" FOR HEAVY-LOAD STATIONS

There is definitely a place for less-than-pretty construction methods and components in Amateur Radio! The phrase *Ugly Construction*, pertaining to circuit boards, is attributed to Wes Hayward, W7ZOI, while the *Ugly Amplifier* was made famous by Rich Measures, AG6K. Transforming away inefficient 120-V ac supply or "copper losses" en route to the shack is the perfect application for the *Ugly Transformer* project described here! For example, vintage radio enthusiasts—especially those with a thirst for kW power levels—will find that many of yesteryear's RF power amplifiers use a 110-120-V plate transformer. The Hallicrafters HT-33B, shown in **Fig 22.49**, is typical of such equipment. AC power line requirements of the HT-33B are specified at 117 Volts and 2350 Watts! Assuming a power factor of 0.95 (nearly unity), this still correlates to greater than 21 A of line current! Even a dedicated branch circuit would have quite a job transferring that current over an appreciable length from the service box without a considerable voltage drop, and accompanying power loss, across the service conductors. Also, not every shack (or the larger structure/dwelling it is part of) lends itself to easily accessible electrical service modifications like installing such a high-current, dedicated supply line. The project described below was created to meet the needs of a high-load, 120 V ac ham station without the need for invasive modifications to existing 120-V service wiring. This project was designed and built by ARRL *Handbook* Editor Dana G. Reed, W1LC.

The heart of this project is a surplus (or new) 240 to 120 V ac control transformer. The transformer cost me $20 on the surplus market. Its nameplate indicates Type SZO, Model D46192 made by HEVI-DUTY Elec-

Fig 22.49—Typical of ham gear from the 1950s and early '60s, this classic Hallicrafters HT-33B Linear Amplifier features a 117 V ac plate transformer. The magnetic circuit breaker on the front panel trips at a line current of 22 Amps! Many existing 110 to 120 V ac branch circuits would be unsuitable for such a load.