BY PAUL E. MILLER

BUILD A STEREO BLEND CONTROL

Vary channel separation to suit your taste with this inexpensive circuit.

AUDIO designers usually try to maximize their products' stereo separation. There are times, however, when a measure of crosstalk between channels is desirable. For example, the disquieting "orchestra in the cranium" effect experienced with stereo headphones can be mitigated by reducing the program material's channel separation. The stereo blender described here allows the user to vary channel separation to suit his taste. Also, the two channels can be transposed with adjustable separation—left input to right output, and vice versa. The blender employs inexpensive components, and can be bypassed at the touch of a switch.

About the Circuit. The schematic diagram of the stereo blender is shown in Fig. 1. The heart of the circuit is contained in two variable voltage dividers, comprising *R1* through *R4* and *R9* for the left channel, and *R5* through *R8* and *R10* for the right channel. Input signals are applied to the voltage dividers via coupling capacitors *C1* and *C2* and voltage followers *IC1A* and *IC1B*.

A dual 10,000-ohm, linear-taper potentiometer is used for *R9* and *R10*. When the potentiometer wipers are at one extremity of their travel, the stereo separation and spatial location of the input signals are preserved. At the other end, there is still no introduction of crosstalk but the channels are transposed. Adjusting the wipers for the center of their travel gives a complete "blend," with both inputs mixed equally and fed to both outputs. Between the center and either extreme, partial blending of the two channels is obtained.

The voltage dividers have an insertion loss of approximately 4.7 dB. This loss is compensated for by the gain introduced by *IC2A* and *IC2B*. To ensure that the voltage divider losses and op amp gains cancel each other, resistance tolerances should be kept fairly close. If this is done, no audible change in volume will occur when the project is switched on or out of the signal path.

Another reason for using close-tolerance resistors lies in an important characteristic of the voltage dividers. That is, the overall output should remain constant regardless of the setting of the dual potentiometer BLEND control. Actually,

the signal level at the output will be 3 dB below the input when the BLEND control is at its mid-position. But this loss is compensated for by the fact that the inputs are mixed equally and fed to each output. To maintain this relationship, actual resistances should be close to the components' nominal values.

Signals from the op amps are coupled to the output jacks via capacitors *C3* and *C4*, which also block any dc offsets generated by the gain stages. Fairly large values are required if output impedances are to be kept fairly low. At 20 Hz, a 1-μF capacitor has a reactance of approximately 8000 ohms. Therefore, the circuit should drive a load with a fairly high input impedance—a condition satisfied by most power amplifiers and tape deck record preamplifiers.

The output coupling capacitors must

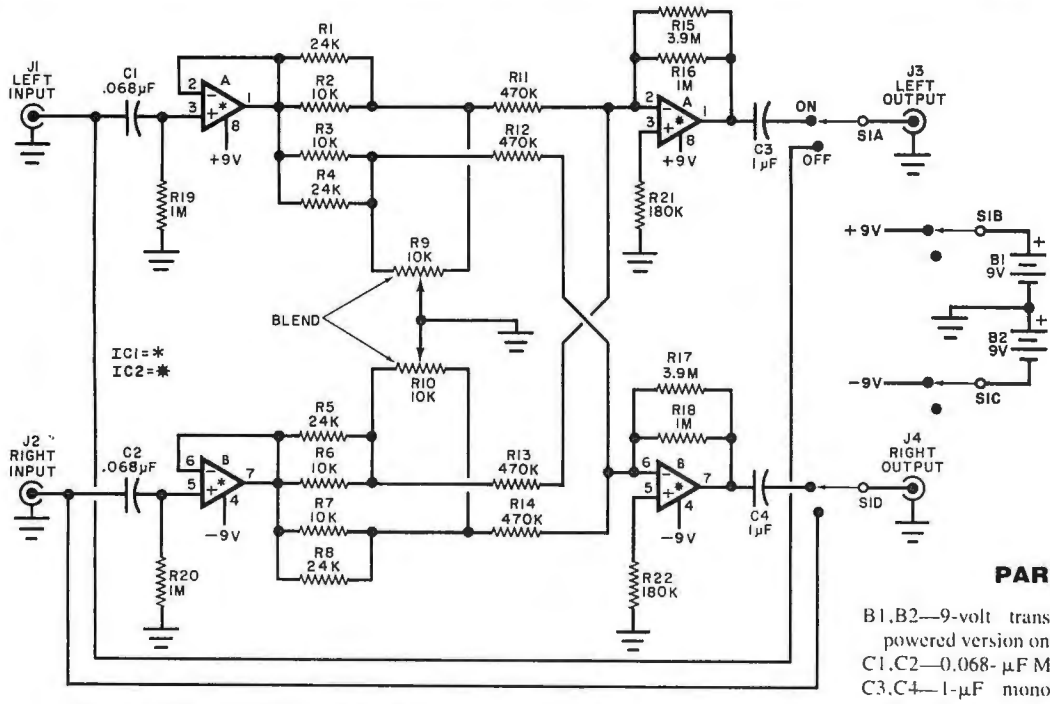

Fig. 1. Schematic diagram of the stereo blend.

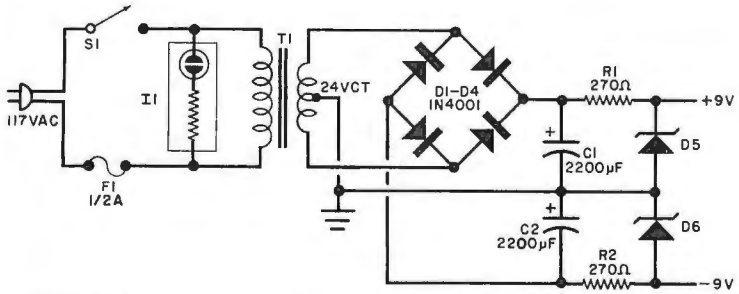

Fig. 2. Ac power supply features zener diode regulation.

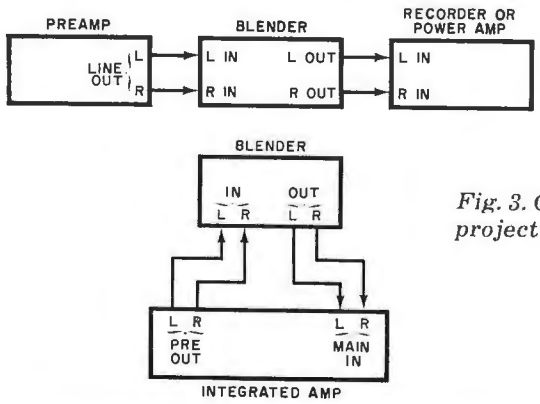

Fig. 3. Connecting the project to your system.

PARTS LIST

B1,B2—9-volt transistor batteries (battery powered version only)
C1,C2—0.068- μF Mylar capacitor
C3,C4—1-μF monolithic or nonpolarized electrolytic
IC1,IC2—MC1458 or 5558 dual op amp
J1 through J4—RCA phono jack
The following are 1/4-watt, 5% (or better) fixed resistors.
R1,R4,R5,R8—24,000 ohms
R2,R3,R6,R7—10,000 ohms
R11 through R14—470,000 ohms
R15,R17—3.9 megohms
R16,R18,R19,R20—1 megohm
R21,R22—180,000 ohms
R9,R10—dual 10,000-ohm, linear-taper potentiometer
S1—4pdt (battery powered version) or dpdt (line powered version) toggle or slide switch
Misc.—IC sockets or Molex Solderons, printed circuit or perforated board, shielded or coaxial cable, hookup wire, suitable enclosure, battery clips, battery holders, machine hardware, solder, etc.

AC SUPPLY PARTS LIST

C1,C2—2200- μF, 25-volt electrolytic capacitor
D1 through D4—1N4001 rectifier
D5, D6—9.1-volt, 1-watt zener diode
F1—1/2-ampere fuse
I1—Neon indicator assembly with integral current-limiting resistor
R1, R2—270-ohm, 1/2-watt, 10% tolerance carbon composition resistor
S1—spst switch
T1—24-volt center tapped, 85-mA transformer (Stancor No. P8394 or equivalent)
Misc.—Line cord, fuse holder, terminal strips, strain relief, hookup wire, machine hardware, solder, etc.

be nonpolarized because the ac signals are not riding on a large dc level. The author suggests the use of monolythic capacitors because of their high capacitance-to-volume ratio. Other types can be used if space permits. Nonpolarized electrolytics, which are commonly used in speaker crossovers, are readily available in unit quantities.

Much smaller coupling capacitors are used at the project inputs. Although they have fairly high capacitive reactance at audio frequencies, the resistance of *R19* and *R20* and the very high input impedances of the voltage followers prevent significant signal attenuation.

Two 9-volt transistor batteries power the circuit of Fig. 1. Total current drain is fairly low, so fairly long battery life can be expected if the project is used intermittently. However, you might prefer to power the project from the ac line. A suitable regulated bipolar supply is shown schematically in Fig. 2.

In the battery-powered version, *S1* is a 4pdt switch. The circuit is inserted into the signal path and the batteries connected to the op amps when the switch is placed in its ON position. The batteries are disconnected and signals at the input jacks routed directly to the output jacks, effectively removing the project from the signal path, when the switch is placed in the OFF position. In the line-powered version, *S1* becomes dpdt switch and is used only to insert or remove the circuit from the signal path. To keep the line-power ac away from the low-level signal lines, a separate spst switch is used to control the primary of the power supply.

Construction. The circuit can be assembled on either a printed circuit or perforated board. Shielded wire or small diameter (RG-174-U) coax should be used for all signal leads. If the line-powered supply is to be housed in the same enclosure as the signal processing circuitry, the two should be physically isolated as much as possible. A metal utility box should be used to house the project.

Use. The blender should be connected to your audio system as shown in Fig. 3 by means of shielded patch cords terminated with suitable connectors. As mentioned earlier, it can be used to make listening through stereo headphones more enjoyable. The project also allows home recordists to introduce interesting special effects when taping program material. Imaginative users will no doubt find other applications. ◇