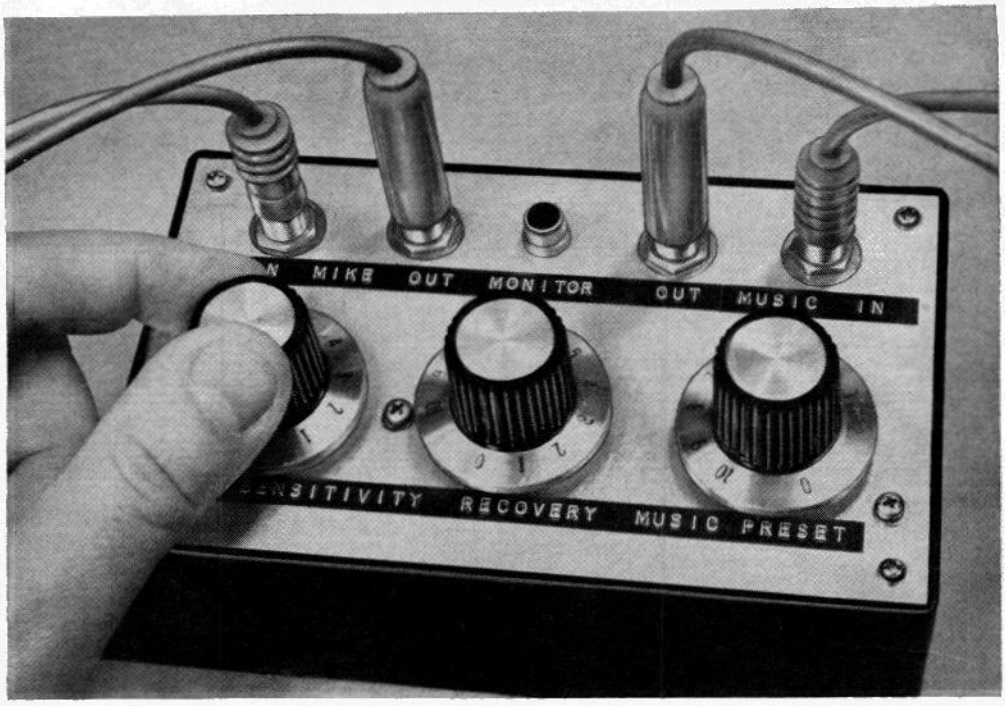


BUILD A VOX GAIN RIDER

VOICE-CONTROLLED MIKE MAKES MUSIC MURMUR

BY DAVID W. BEATY

ONE SURE WAY to spoil a good party is to interrupt the music—live or canned—to make an announcement and have the volume all wrong for speech, with acoustic feedback that shatters everyone's eardrums and entirely too long a delay just to let people know that "soup's on." All of this can be avoided if you equip your sound system with a "VOX Gain Rider." It's a simple circuit that responds to a voice input to a microphone and automatically lowers the volume of the music. This permits you to make your announcement easily and effectively—and the music will continue at its former level as soon as you are finished.

The VOX Gain Rider is battery-powered for portability and can be used in conjunction with any sound system and a high-impedance microphone. In fact, there are a number of ways in which it can be used: to turn off your hi-fi system when the telephone rings; to lower the volume when the baby cries upstairs; to cut down the din in the recreation room when you want to get a message through to the kids; or any suitable situation where one signal can take precedence over another.

Theory of Circuit Design. The schematic of the Gain Rider circuit is shown in Fig. 1. The audio signal from a high-impedance microphone—or similar source—is coupled to the circuit through *T1* which provides impedance matching. The proper amount of signal is taken from the arm of potentiometer *R1*

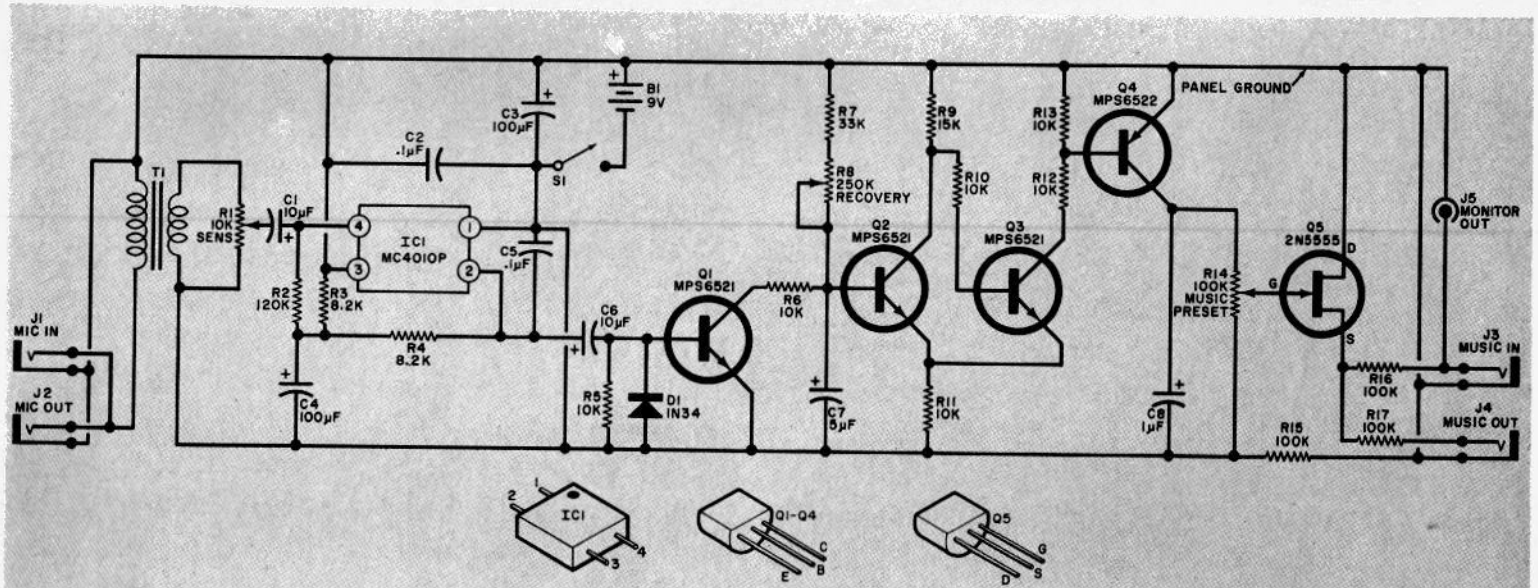


Fig. 1. The FET provides a fast-acting variable resistor between the music line and ground. When audio comes in on the microphone line, the music level drops to the preset value and jumps back to normal when the microphone input is no longer used. All parameters are controllable.

PARTS LIST

B1—9-volt battery
C1,C6—10-μF, 12-volt electrolytic capacitor
C2,C5—0.1-μF, 50-volt capacitor
C3,C4—100-μF, 12-volt electrolytic capacitor
C7—5-μF, 12-volt electrolytic capacitor
C8—1-μF, 12-volt electrolytic capacitor
D1—General-purpose diode (1N34 or similar)
IC1—Audio amplifier IC (Motorola MC4010P)
J1-J3—¼" phone jack
J4—Phono jack
Q1-Q3—Npn silicon transistor (Motorola MPS6521)
Q4—Pnp silicon transistor (Motorola MPS6522)
Q5—2N5555 n-channel FET (or similar)
R1—10,000-ohm potentiometer (with S1 attached)
R2—120,000-ohm, ¼-watt resistor
R3,R4—8200-ohm, ¼-watt resistor
R5,R6,R10-R13—10,000-ohm, ¼-watt resistor
R7—33,000-ohm, ¼-watt resistor
R8—250,000-ohm potentiometer
R9—15,000-ohm, ¼-watt resistor
R14—100,000-ohm potentiometer
R15-R17—100,000-ohm, ¼-watt resistor
S1—Spst switch (part of R1)
T1—Transformer 1000/200,000 ohms (Archer 273-1376)
Misc.—Plastic case with metal cover, battery clip, and clamp, spacers, knobs, panel marking, etc.
Note—An etched and drilled PC board is available from: Boyd Hansen, 557 Todd Loop, Los Alamos, NM 87544 for $2.25.

IC 1 = MFC 4010 P - NOT MC 4010 P

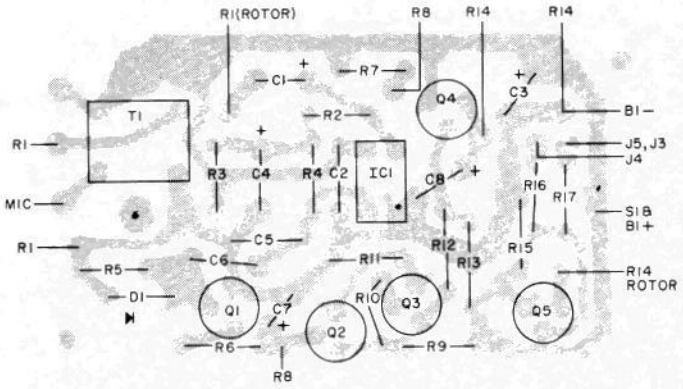
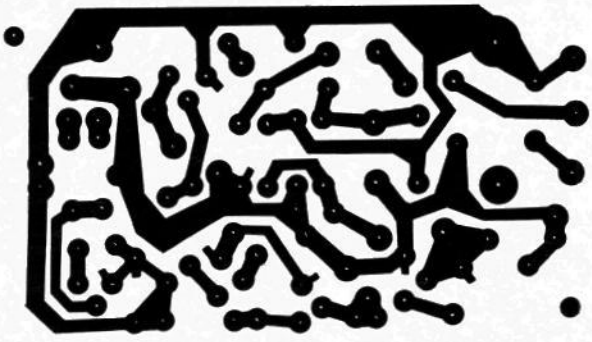
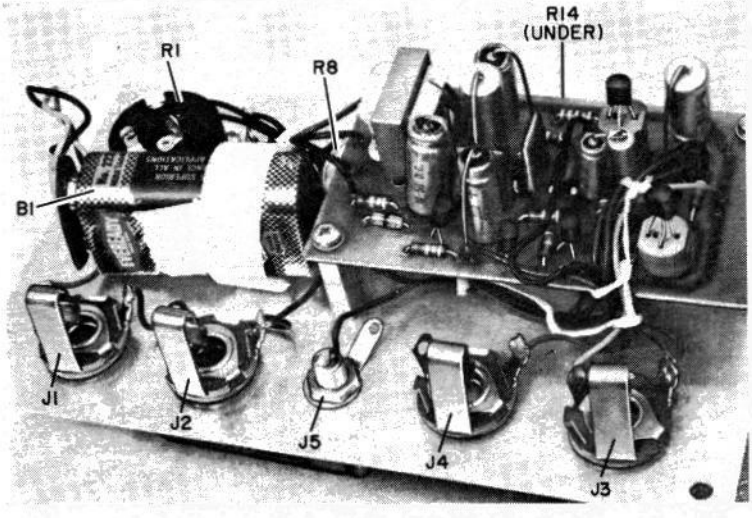


Fig. 2. Actual size PC board etching and drilling guide (right) and component layout and orientation (above). Observe the polarity of IC1, transistors, and electrolytic capacitors.



and applied to *IC1*, an audio amplifier module. The IC raises the signal level enough to saturate transistor *Q1* on each positive half cycle. This permits *C7* to discharge at a rate determined by the time constant of *R6* and *C7*. Capacitor *C7* receives its charge through *R7* and *R8*, the RECOVERY potentiometer. When a sufficient number of input cycles have occurred to allow *C7* to be discharged below the threshold of Schmitt trigger *Q2* and *Q3*,



Although the prototype used phone jacks, any other suitable type of connector may be used. A short length of plastic strip supports the 9-volt battery.

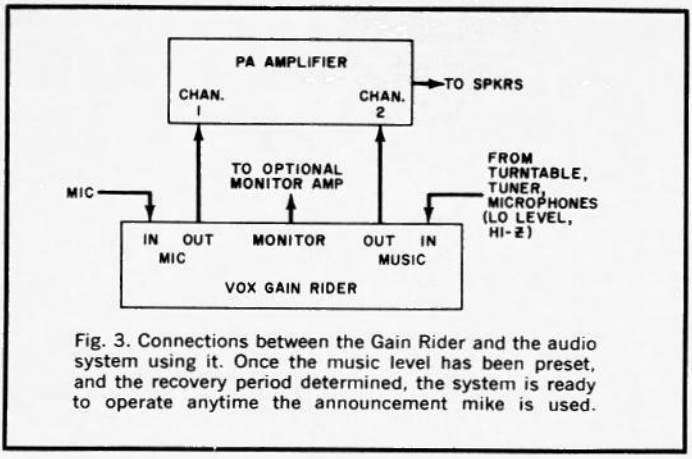
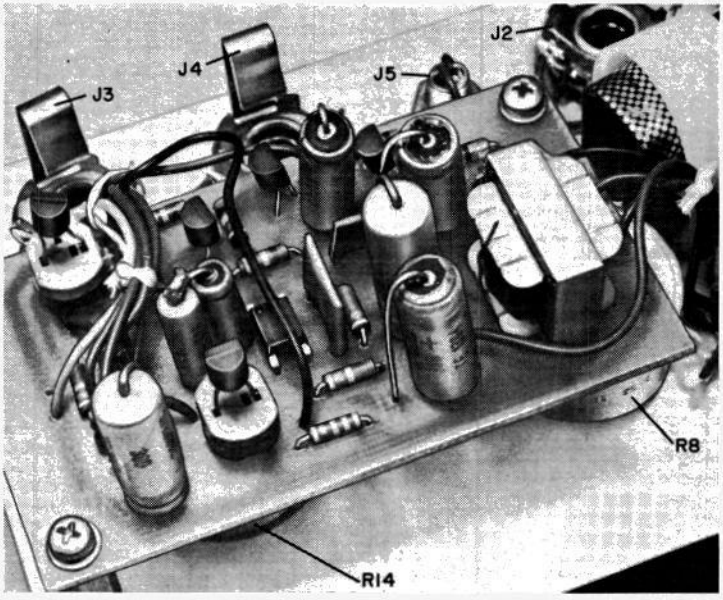


Fig. 3. Connections between the Gain Rider and the audio system using it. Once the music level has been preset, and the recovery period determined, the system is ready to operate anytime the announcement mike is used.

the latter saturates. This causes *Q1* to conduct and places its collector at approximately the level of the supply voltage. Occasional narrow noise pulses on the input are not sufficient to allow *C7* to discharge enough to fire the Schmitt trigger.

With *Q1* conducting, the potential at the wiper of *R14* is raised to a maximum of 9 volts, depending on its setting. This provides the gate signal for field effect transistor *Q4*. The latter acts as a voltage-variable resistor to reduce the level of the signal between *J3* and *J4*. The signal from the microphone thus cuts off the music signal and takes over the amplifier system. When the microphone signal is removed, transistor *Q1* is not saturated and capacitor *C7* is recharged through resistors *R7* and *R8*.

Construction. The circuit is built up on a printed circuit board using the foil pattern and component layout shown in Fig. 2. Note that the various electrolytic capacitors are mounted "standing up" with one lead soldered



To conserve board space, note that the capacitors are mounted "on end." The use of transistor sockets is optional, as is the type of phone jacks shown.

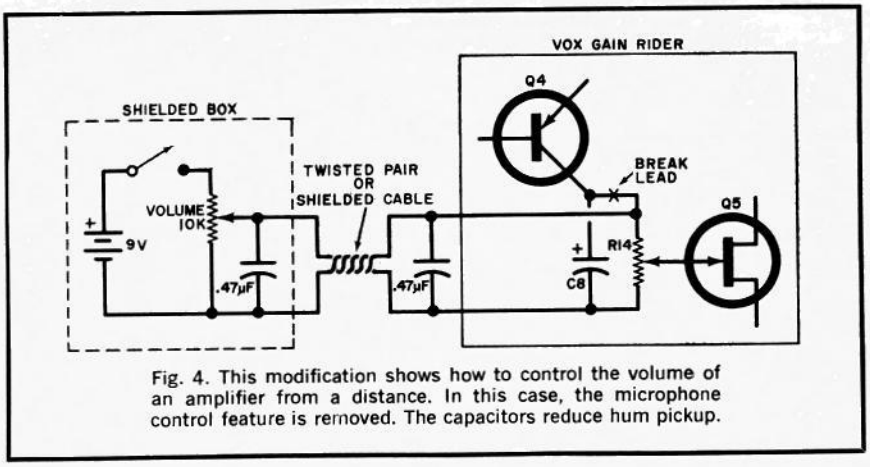


Fig. 4. This modification shows how to control the volume of an amplifier from a distance. In this case, the microphone control feature is removed. The capacitors reduce hum pickup.

directly into its hole and the other lead bent over to reach the other hole. To conserve space, ¼-watt resistors are suggested; though, if you make your own board layout and have the room, you may substitute ½-watt resistors. Observe the location coding for *IC1*; and when installing this and the other semiconductors, use a low-power soldering iron and fine solder.

The prototype shown in the photos was built on the metal cover plate of a 6″ × 3½″ × 2″ plastic box. The three potentiometers and five input/output jacks were mounted across the top of the panel and suitably marked. The battery was held in place by a plastic band attached to the chassis. A conventional 9-volt transistor radio battery can be used since the drain is only 6 milliamperes.

Testing and Operation. All connections to and from the Gain Rider circuit should be made with shielded audio cable to reduce 60-Hz hum. Connect a turntable, AM/FM tuner, or any other low-level high impedance audio source to the music input jack *J3*. Connect an amplifier and speaker to the music output jack *J4*. Set the amplifier controls for the desired sound level. Set the Gain Rider SENSITIVITY control *R1* for minimum and connect a high-impedance microphone to *J1*. Connect an audio cable from the microphone output jack *J2* to the other channel on the amplifier. All of the above connections are shown in Fig. 3.

Set *R14* (MUSIC PRESET) and *R8* (RECOVERY) to minimum (should be maximum counterclockwise). Then adjust the amplifier gain control for a sound level slightly higher than that normally used.

While speaking slowly into the microphone, advance the SENSITIVITY control until the music level drops suddenly. Continuing to speak slowly into the microphone, advance *R1* until the music level drops suddenly with each word. It may be necessary to pause between words to allow the music level to recover. Record this setting of *R1* for future reference.

Speaking into the microphone at normal level, adjust *R8* (RECOVERY) until the music level does not recover between normally spaced words, but does recover in a suitable time after you stop speaking. Record the setting of *R8*.

Obtain the desired level of music while you are talking by adjusting *R14* (MUSIC PRESET).

Once the three potentiometers are set as described above, the VOX Gain Rider is ready for use.

Remote Control. The VOX Gain Rider can be used to control the level of a sound system from a remote location by using the modification circuit shown in Fig. 4. The remote control unit is connected to the system through a reasonable length of twisted pair or shielded cable. The capacitance value may have to be increased if the amount of stray pickup is too high.

Helpful Hints. Note that the setting of *R1* (SENSITIVITY) depends on the type of input—electric guitars, organs, FM receivers may take different settings. It should also be noted that when used with live performances, the ambient noise level may be sufficient to trigger the circuit unless a good cardioid microphone or a "close-speaking" type is used. If a permanent installation is desired, any well-filtered 9-volt dc power supply may be used to replace the battery. -30-