TRANSISTOR MIKE PREAMP FOR PA

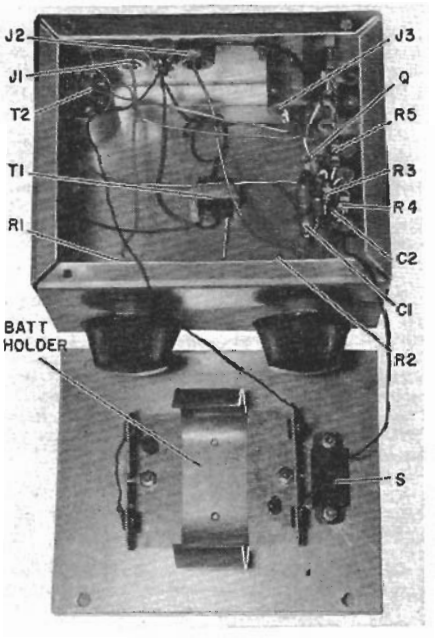
Single-transistor mixer-amplifier handles two low-impedance mikes with low noise and no hum

By JAMES E. PUGH, Jr.

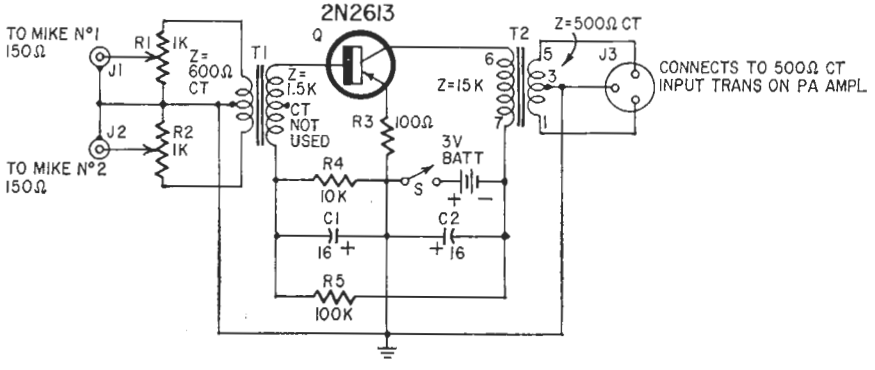
WHEN YOU ADD A MICROPHONE TO A PA system, or to a remote pickup, its output is often lower than required for the main amplifier. A small, single-stage transistor preamplifier like this one is fine for many such jobs. A dual input circuit handles two microphones with ease, there is enough gain for a wide range of uses, the noise level is very low, hum is nonexistent, and the tiny battery drain reduces operating costs to practically nothing.

A center-tapped input transformer (T1) accommodates the two low-impedance (150-ohm) microphones. The levels of the two inputs are controlled individually by R1 and R2. Conventional controls used here will do, but T-pads can replace them if it is necessary to maintain constant impedance over the full range of control settings.

The amplifier uses an inexpensive low-noise, high-gain transistor connected in a conventional common-emitter circuit. While nothing is very critical, check that the collector current of Q1 is in the

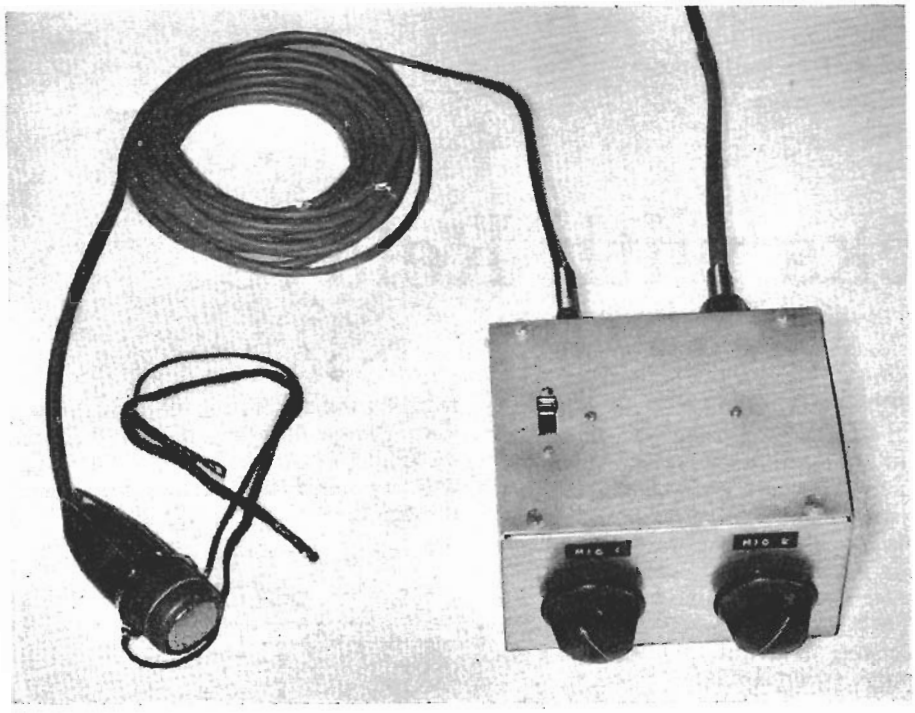


Author's model uses Amphenol screw-on connectors for mike inputs, and Cannon XLR-3-13 for output to amplifier.



Circuit uses low-noise 2N2613, found in many commercial hi-fi amplifiers' preamp stages.

BATT—3-volt battery (see text)
C1, C2—16-μf, 6-volt electrolytic
J1, J2—Shielded input jacks to suit
J3—Shielded output jack to suit
Q—2N2613 (RCA) or equivalent
R1, R2—1,000-ohm potentiometer, log taper
R3—100 ohms, ½-watt
R4—10,000 ohms
R5—100,000 ohms (see text)
S—spst switch
T1—600 ohms ct to 1,500 ohms (UTC SSO-20 or equivalent—see text)
T2—15,000 ohms to 500 ohms ct (UTC O-9 or equivalent—see text)
Metal case
Battery holder
Knobs for controls
Miscellaneous hardware



Mixer/preamp is small and light enough for any temporary PA job. Fidelity is as good as the transformers are.

region of 0.4 to 0.6 ma. This gives the lowest noise figure. Increase R5 to reduce the current and make R5 smaller to bring it up.

Two ordinary flashlight cells power the preamp. At this low current, they last a long time. If you want to hold the output level and the noise figure constant throughout the useful life of the battery, use a 2.7-volt mercury battery instead of dry cells.

A transformer with a different input impedance for other microphones, or with additional windings or taps, can be used if your needs are different. The output unit, T2, provides several impedance taps for a wide range of applications in audio work, but it too can be changed. If any substitutions are made, keep the secondary impedance of T1 and the primary impedance of T2 approximately as shown. Change the primary of T1 and the secondary of T2 to the values needed to match your mike and amplifier. Keep in mind that the impedance on either side of the center tap will be one quarter of the total end-to-end impedance.

Construction can be in any form that suits your needs, but build all circuit elements in a metal enclosure. Connect all grounds to a common point inside the case, and, if the PA amplifier has a ground bus, connect the preamp's ground point to it through a third wire in the cable between J3 and the PA amplifier's input jack. The case of the preamp can then be connected to the main amplifier chassis through the cable shield if there is any hum pickup.

[With the center-tapped transformer primary shown, two identical mikes connected with the same polarity will be 180° out of phase, and if both are situated to pick up sound from the same source (as, for instance, two mikes on a table for recording a conference), there may be partial cancellation at some positions of the mixer knobs. If you anticipate having such a setup frequently, reverse the phase of one of the microphones by transposing the two "hot" leads (leave the shield alone). Mark the reverse-phased mike to identify it, in case you wish to use it sometime with other mikes and conventional mixing equipment. With two different mikes, you may have to experiment.—*Editor*] END

BUILD A STEREO HEADSET AMPLIFIER

Compact, versatile battery-powered amplifier is ideal for private listening through high-quality stereo phones. Works direct from any stereo pickup cartridge—and it can drive a tube or transistor stereo power amplifier, too.

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RADIO-ELECTRONICS special 1966 Hi-Fi/Tape Recording Issue

Microphone preamp gets power through signal cable

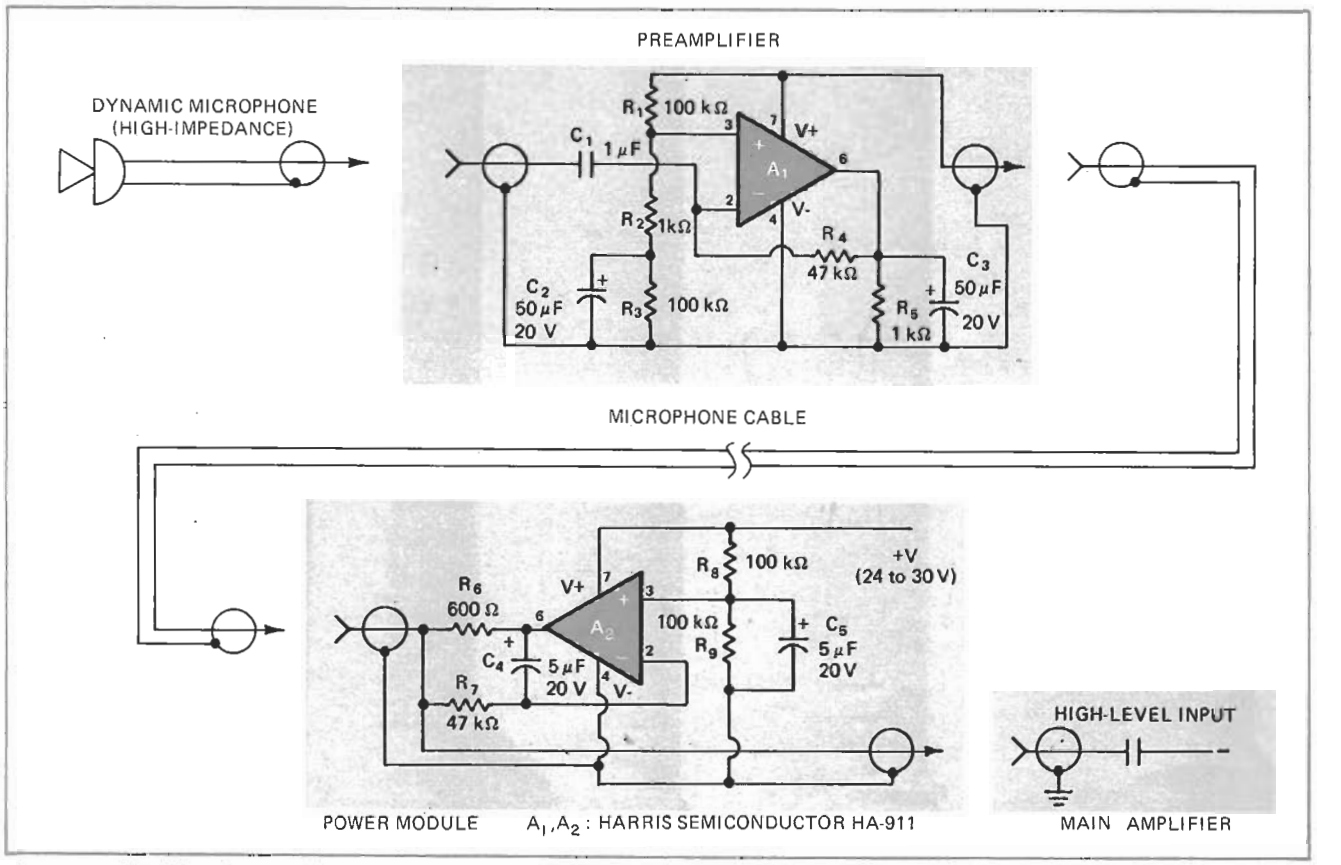
by Don Jones
Harris Semiconductor, Melbourne, Fla.

When a high-impedance microphone is at the end of more than 20 or 30 feet of cable, a preamplifier powered by batteries is often placed at the microphone to prevent high-frequency loss and to enhance the signal-to-noise ratio. But a preamp can be made much more compact if instead of using batteries it is powered remotely over the shielded or twisted-pair audio cable.

The hookup shown here is an unconventional application of an operational amplifier, but the performance will please any broadcaster or audio enthusiast. Performance is definitely high fidelity. Frequency response is better than ±1 decibel from 20 hertz to 20 kilohertz, and equivalent input noise is about 3 microvolts rms over this band.

The diagram shows the circuit arrangement. In the quiescent state, the output terminal (pin 6) of operational amplifier A_1 is biased by R_1, R_2, and R_3 to about half the power supply voltage, with negative feedback through R_4. However, the audio-output signal is not taken from pin 6; instead, the audio output comes from pin 7, the V+ terminal of the op amp. This output signal is inverted with respect to the normal amplifier output, so even though the audio-input signal from the microphone is fed into the inverting op-amp input terminal, the amplifier is actually noninverting. The gain (about 100) is determined by the ratio of R_1 and R_2, which form the feedback network from the V+ (audio-output) pin. The HA-911 op amp is used because its noise level (8 nV/Hz$^{1/2}$, 0.35 pA/Hz$^{1/2}$) and gain-bandwidth product (8 MHz) are many times better than those of general-purpose op amps.

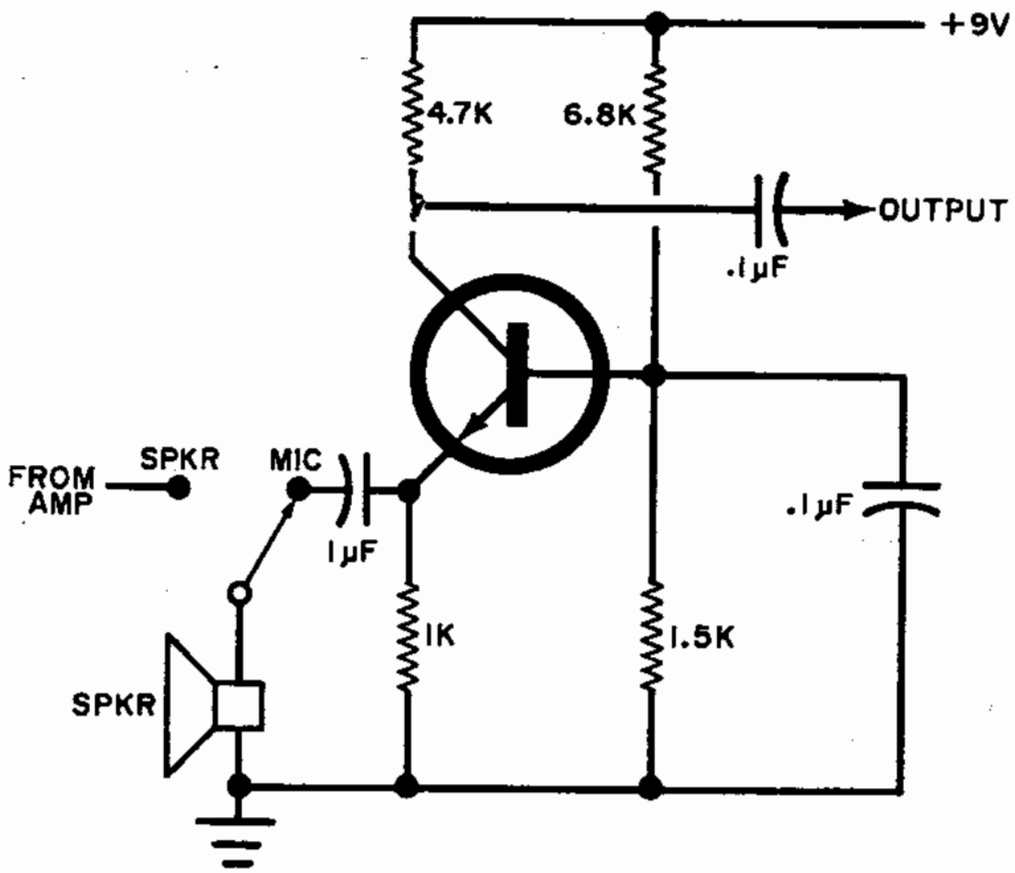
In the power module, op amp A_2 supplies about 12 V dc at 7 milliamperes through a 600-ohm termination to the cable; the dc power for the module can probably be obtained from the main amplifier. Instead of using the power module, the power for the preamp could be supplied to the cable through a passive choke in series with a dc supply, but 150 henrys would be required to obtain the same noise isolation from the dc line. □



Two-way cable. Microphone cable carries power up to preamplifier and carries amplified signal down to main amplifier. Preamp, mounted at high-impedance microphone before long cable to preserve fidelity and suppress noise, is light and compact because its power is supplied through the cable, eliminating batteries. Although op amps are used in unconventional arrangements, performance is excellent.

Q. ***I have a speaker out on the patio that I use for background music. Is there any way that I can use this as a microphone so I can hear a baby's cry when the crib is out there?***

A. The following basic circuit will allow you to use the speaker as a microphone. The higher the impedance of the speaker, the greater the output from the circuit. You could try using an output transformer to take advantage of the voltage step-up ratio.



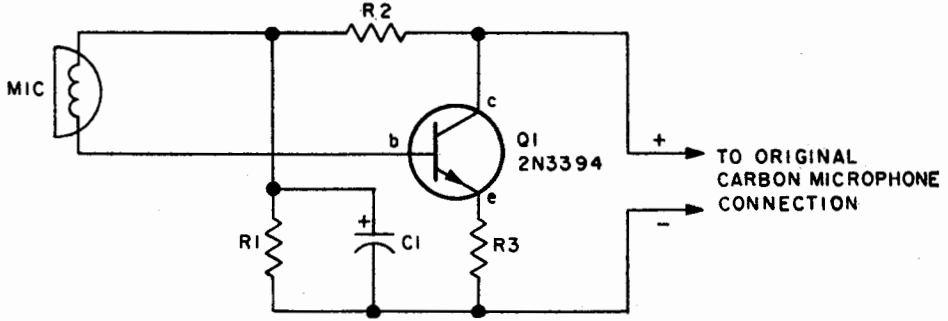
POPULAR ELECTRONICS Including Electronics World

96 Carbon Mike Converter

Good pitching beats good hitting—and a good magnetic mike beats a good carbon mike. This one-transistor carbon microphone converter takes a carbon mike input and converts it to the magnetic variety.

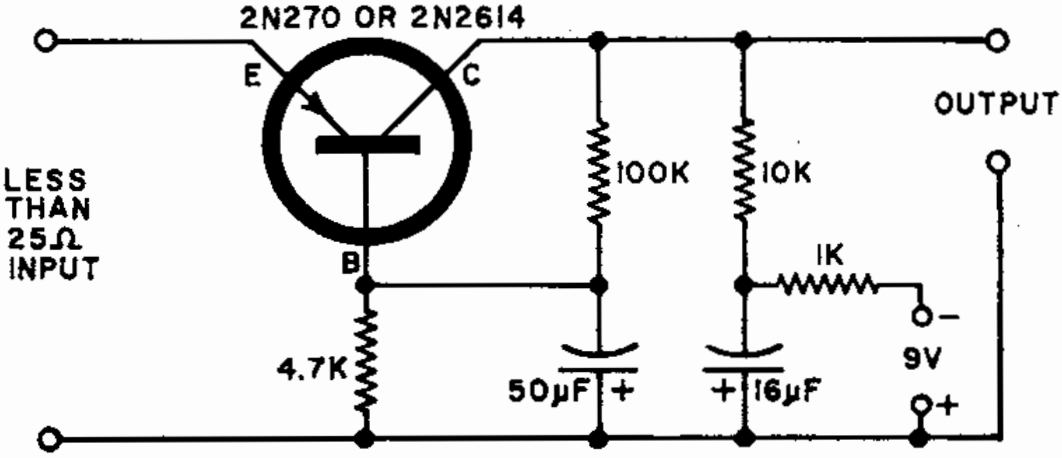
Note that no ground connection is used, even if the circuit is built in a metal cabinet. MIC is a replacement-type magnetic element that is substituted for the original carbon element. Using miniature components the entire converter amplifier can also be housed in the original microphone case.

To avoid destruction of Q1, the unit must be connected properly the first time. The

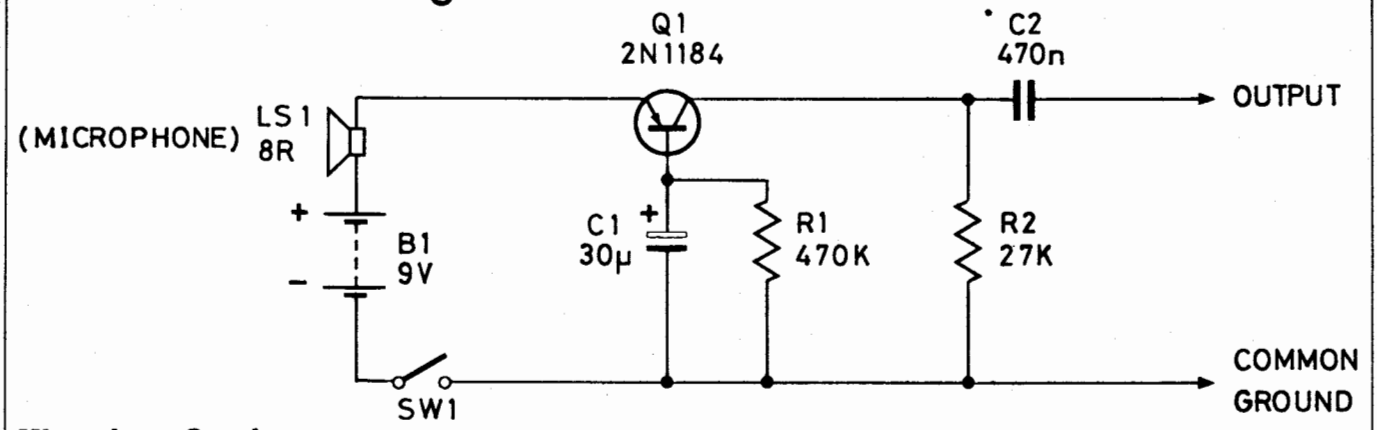


Dynamic Mike Replacement. *My new transceiver specifies the use of a high-impedance microphone. Unfortunately, the only microphones that I have at hand are of the low-impedance variety. How can I use these mikes in a high-impedance circuit?*

The simplest method would be to use an in-line low-to-high-impedance transformer. These transformers are commonly available, but cost between $8.00 and $10.00. The circuit shown in the diagram below will do approximately the same job, however. If



you do make this impedance converter/preamplifier, make sure that the input and output leads are carefully shielded and isolated from one another. Just about any good low noise audio transistor will work in this circuit. Make sure to wire up the mike switch so as to prolong the life of the mercury cell.



Microphone Speaker

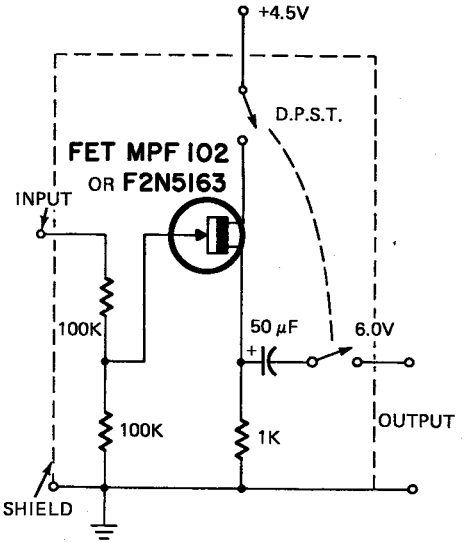
J. Smith

What do you do if you need a microphone in a hurry — the shops are closed and your friends are on holiday? Or you are just a little short of money? The answer is to build the following circuit from your odds and ends box. This circuit uses a small speaker as a microphone, one transistor and only four other parts, draws only about 2 mA of current from a 9 volt battery so an on/off switch is not really necessary.

The transistor shown is 2N1184 and is a PNP germanium medium power type but is not critical — try the ones you have first before buying this new type. The components too are not critical and the prototype was found to work OK with 20% variation in values. The output is high impedance and is fed into the mic input of a tape recorder or pick-up input of an amplifier.

MIKE MATCHING PREAMP

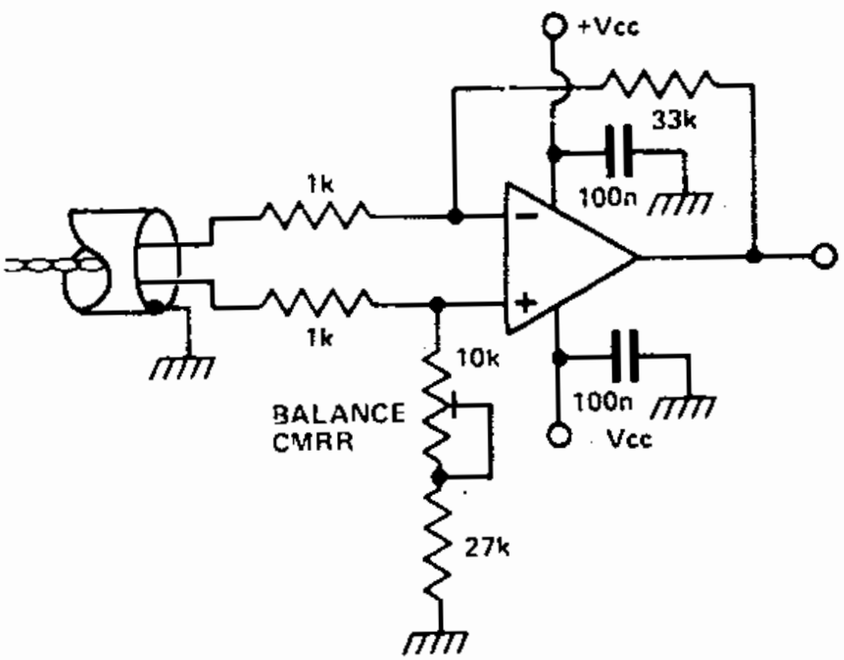
When a crystal microphone is fed into a 600-ohm input, the signal level output of the microphone is about 44 dB



lower than the level available into a high input impedance.

The simple matching amplifier shown here is for feeding the crystal microphone into a low-impedance input. For an adjustable gain control use a 200,000-ohm potentiometer in place of the fixed input voltage divider.—*H.E. Goldstine* **R-E**

ELECTRONIC BALANCED INPUT MICROPHONE AMPLIFIER



It is possible to simulate the balanced performance of a transformer electronically with a differential amplifier. By adjusting the presets the resistor ratio can be balanced so that the best CMRR is obtained. It is possible to get a better CMRR than the one you would obtain from a transformer. Also, a transformer can itself pick up mains hum, it is expensive and heavy. So, electronic balancing can be quite competitive. One problem is obtaining a truly differential low noise amplifier. I would suggest a RC4136 which is a quad low noise op amp.

Middle Mike control.