THE HUM SNIFFER

This sensitive instrument, using a prefab transistor amplifier, tracks down all sorts of hum and noise troubles

By LYMAN E. GREENLEE

Hum is a nasty word if you are working with hi-fi equipment. Finding and eliminating it can be time-consuming without proper instruments. Since they aren't usually cheap and handy, the solution is to build your own!

The hum checker in this article is built around Lafayette's model PK-544 5-transistor miniature push-pull audio amplifier. Output is 360 mw, with an input of only 300 μv. The amplifier is very inexpensive, and using it makes construction easy. Everything fits neatly into a stock Bakelite instrument case without crowding. It is battery operated so no hum gets into it from the power supply.

Uses of the Hum Sniffer include checking shielding for effectiveness, tracing paths of hum currents in chassis, orienting power transformers and chokes for minimum hum transfer, routing ac wiring for paths of minimum hum, searching out hidden power lines, locating power leaks, and as an ac voltmeter. With a diode input probe, the amplifier is also an excellent signal tracer, particularly useful for servicing transistor amplifiers.

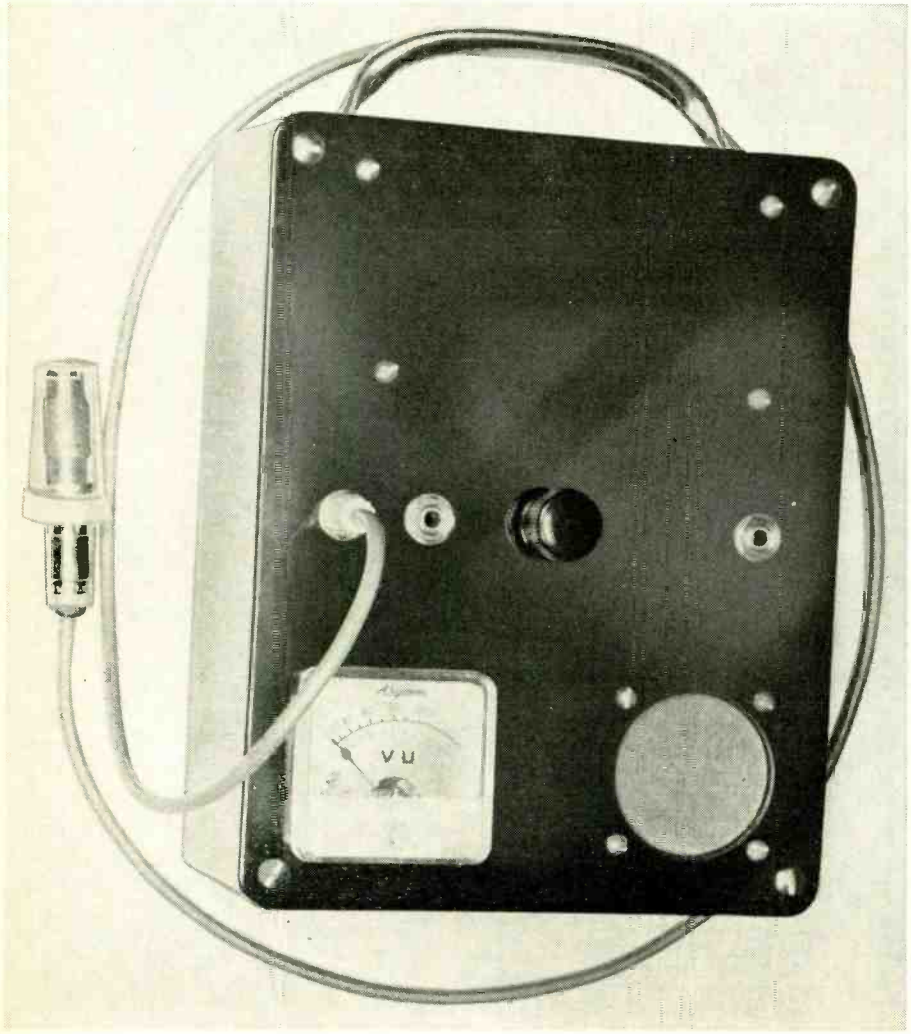
Fig. 1 shows the block diagram of the amplifier. Fig. 2 shows the connections for the two input jacks, to allow connection to either the first or second transistor, depending on the amount of gain required. Note that J1 is wired to short the input when the plug is removed. J2 opens the circuit between the first and second stages when the phone plug is inserted. The green wire to the volume control is broken at the X on the diagram (Fig. 1) and J2 inserted there.

Connections to the output phone jack (J3) are shown in Fig. 3. Note the 10-ohm resistor R in series with the speaker voice coil. This resistor is required to get a full-scale reading from the VU meter. If a different speaker than the one specified is used, it may be necessary to change the value of this resistor to something between 5 and 15 ohms to obtain the required full-scale meter reading. The meter should read full scale with an input signal of 300 μv. Plugging an earphone into output jack J3 will alter the meter reading, but this will be of no consequence.

All parts except the battery can be conveniently mounted on the front panel. The amplifier and accessories should be placed in position as shown in the photos, and outlined with a pencil as a guide to drilling mounting holes. Parts layout is not critical and may be varied to suit your ideas.

It is a good idea to check out the amplifier by hooking it up temporarily before fastening it permanently to the panel. In fact, let it run for at least a couple of hours with a signal input to see that no parts are going to fail prematurely. The battery can be mounted in the bottom of the case with a strip of

Hum sniffer in its plastic case, about 5 x 7 x 2 inches, is easily portable.



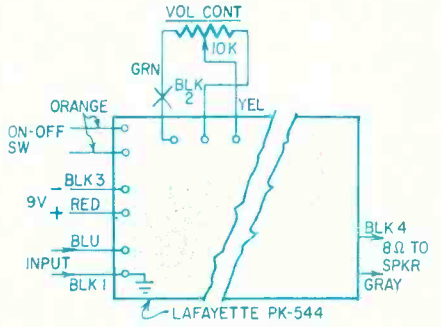


Fig. 1—Lafayette PK-544 transistor amplifier comes complete except for speaker, battery and volume control. Here's how to wire it for use in the Hum Sniffer.

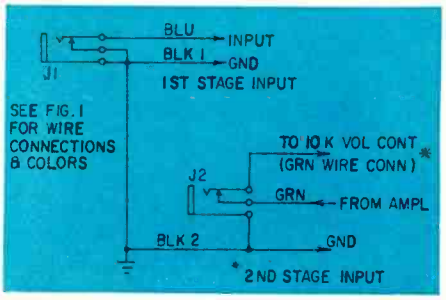
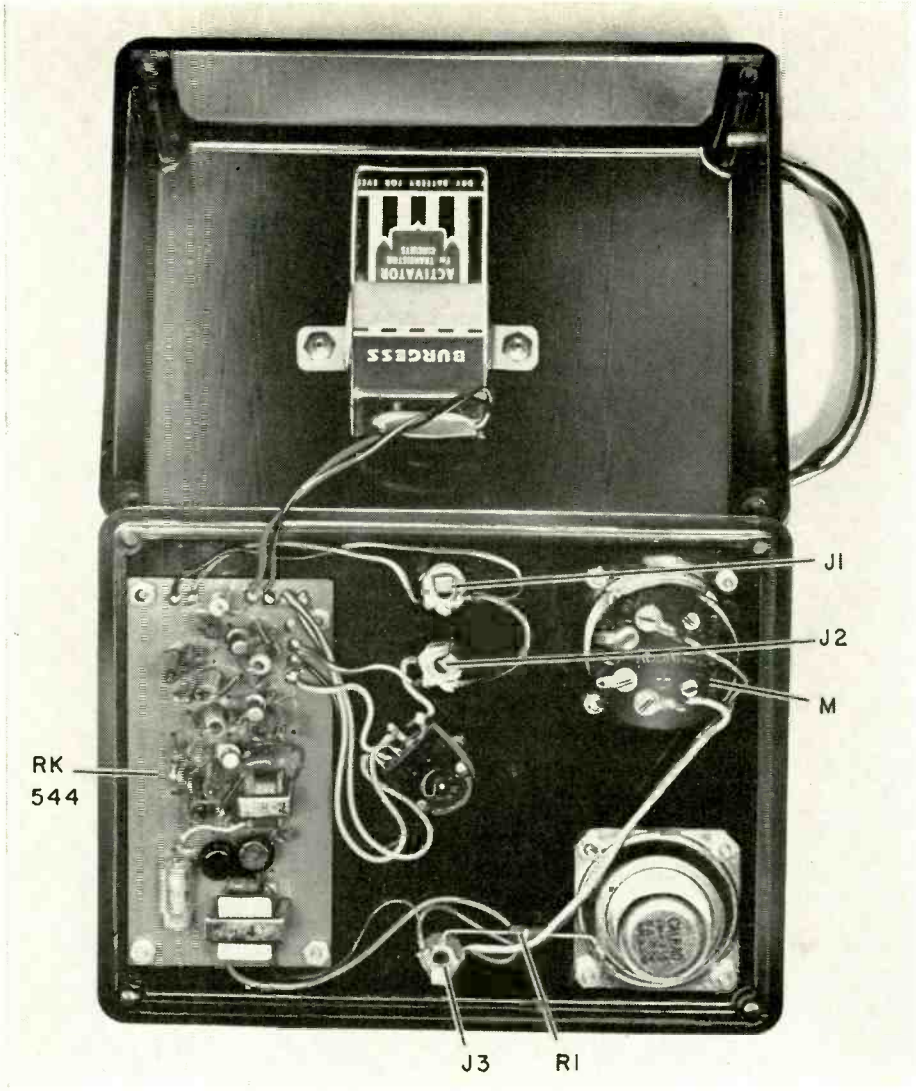


Fig. 2—Two input jacks offer choice of sensitivities: high gain at J1, low gain at J2. Input impedance at J1 is a few thousand ohms; at J2, approximately 10,000.



The wiring shouldn't take more than half an hour.

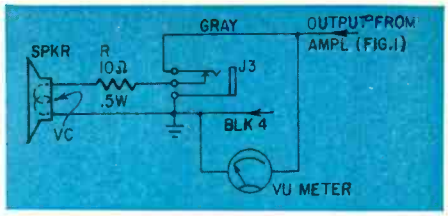


Fig. 3—Speaker and meter wiring. See text ofr details.

Bakelite case, 6¾ x 5¼ x 2¼ inches
Bakelite panel to fit case
Transistor amplifier, Lafayette model PK-544
Volume control, 10,000 ohms with switch (Lafayette VC-2 or equivalent)
1½-inch speaker (8 ohms) (Lafayette SK-61 or equivalent)
VU meter (Lafayette TM-10 or equivalent)
Miniature diode (1N34A, 1N60, etc.)
10-ohm, ½-watt carbon resistor
Miniature phone plugs (2) (Switchcraft 750 Tini-Plugs or equivalent)
Ferri-Loopstick (Lafayette MS-299 or equivalent)
Miniature phone jacks (3) (Switchcraft 42A Tini-Jax or equivalent)
Microphone cable (single conductor plus shield)
9-volt battery
.001-μf, 600-volt ceramic capacitor
Discarded ballpoint pen
Clip for ground connection from probe
Miscellaneous wire and hardware

tin and two screws, or it can be attached with tape.

The VU meter is supplied with a separate resistor, which may be discarded. Connect to the meter terminals directly. Connections for the internal pilot light are not used. Input and output leads must be well separated to prevent the possibility of feedback and oscillation.

Examine the amplifier for loose blobs of solder and any parts that might be shorting because they were bent out of position by packing or shipping. A small piece of fine brass screen was used as a speaker grille to prevent accidental damage to the cone.

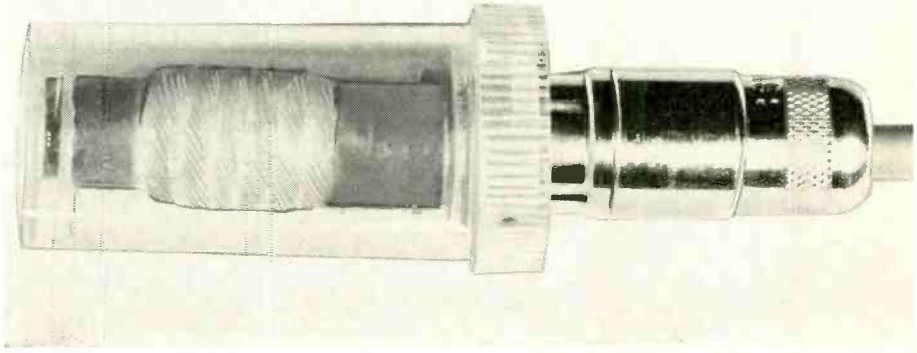
The "nose"

The input coil for hum exploration consists of a ferrite rod antenna coil mounted in a little plastic pillbox. Saw off the end of the antenna coil form and discard the mounting and tuning hardware, but be careful to save both leads from the secondary coil. Discard the primary winding, and mount the coil and powdered-iron core in the pillbox with a miniature phono connector. (These pillboxes can be obtained in many sizes from your local pharmacist.)

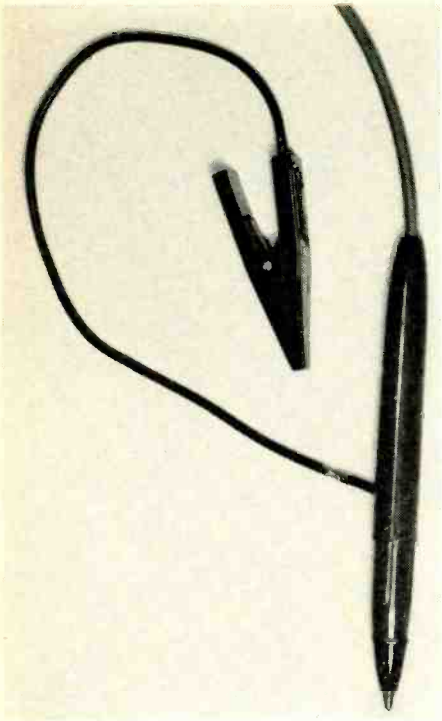
The method of mounting the coil and phono jack should be clear from the photo of the completed hum-pickup assembly. Make up a test lead (3 feet of microphone cable) with a phono plug on one end and a miniature phone plug on the other to connect the hum coil to the amplifier (Fig. 4). You may prefer to solder the antenna-coil leads direct to the microphone cable and omit the extra phono plug and jack. This will be less work but does not make quite as neat a job.

The amplifier is also an excellent signal tracer. Construction details of a suitable diode input probe are shown in Fig. 5 and the photographs. I mounted the diode and capacitor (this isolating capacitor is necessary to keep high dc voltages from the amplifier's input capacitor) in a discarded ballpoint-pen shell. There is plenty of room if you use subminiature parts. The ballpoint of the pen was used as the probe. Cut off the ink cartridge about ½ inch from the tip and solder the diode to it. (Quite a few of these ink cartridges are plastic. Discard the plastic part and solder the diode to the metal tip after cleaning out the ink.) A few drops of plastic cement will hold the pieces together after assembly.

The positive side of the diode should go toward the capacitor, as



Closeup of hum probe. Housing is clear plastic pill bottle. RCA type phono jack and plug make neat, removable connection that lets cable (shielded, of course) be used elsewhere.



Rf probe is built inside discarded ballpoint pen. Metal ballpoint is probe tip! See Fig. 5 for details.

shown in the diagram. Use 3 feet of microphone cable to couple the probe to the amplifier through a miniature Switchcraft phone plug.

Testing and using the Sniffer

Plug the hum-pickup coil into the first input jack (J1) and turn the volume control on full. Bring the hum coil close to a source of hum, such as a soldering iron. The meter should read full scale as the coil approaches the hum source. The speaker or a sensitive earphone plugged into J3 will give an indication with hum levels too low to give a meter reading.

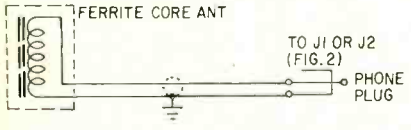


Fig. 4—Ferrite antenna, cut short and wired to tiny phone plug, is sensitive hum probe.

For most uses, you will be interested only in comparative indications of hum strength. The volume control may be set at a level that gives a good hum indication (satisfactory meter reading) when the probe is held in the 60-cycle ac field. As you take steps to reduce the hum (without moving the probe) you can gauge your success by watching the meter. Actual hum voltages are not important for such applications. The relative meter readings are what count. The ear is not reliable and cannot be depended on to judge relative hum levels.

The goal is zero hum, and lower

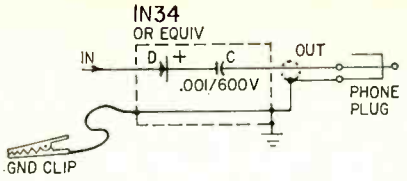


Fig. 5—Rf probe turns Sniffer into signal tracer.

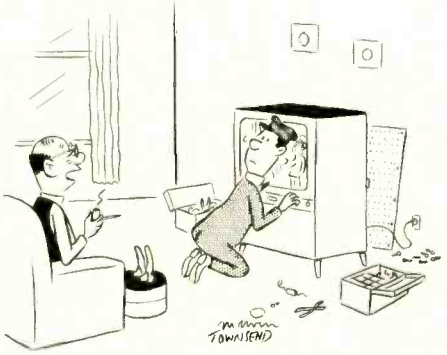
meter readings indicate progress toward that goal with an accuracy not approached by merely listening.

If you wish, you can calibrate the meter with a particular microphone to indicate actual sound levels, or with a particular coil to measure actual hum field strengths. For that, you will need suitable known-accurate instruments.

Other uses

The amplifier is also useful as a signal tracer. The diode probe may be plugged into either the first or second stage of the amplifier, depending on the amount of gain you need. The second stage input is useful primarily for checking high-output devices such as crystal phono pickups. A small microphone plugged into the first stage jack (J1) turns the amplifier into a useful listening device. This feature is also useful for checking microphones for defects. Use of the earphone avoids feedback from speaker to mike. However, this feedback can be employed to good advantage when checking microphones for gain.

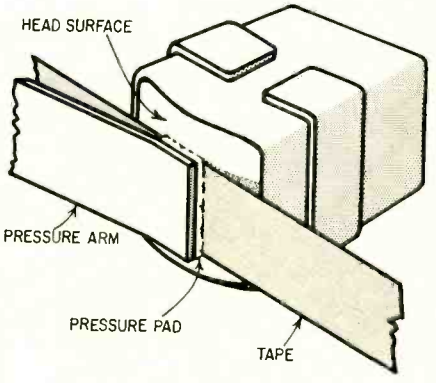
A transistor amplifier is particularly useful for tracing a signal through such equipment as small portable tape recorders. Most transistor signal tracers lack gain. This Lafayette PK-544 amplifier is "hot" enough that performance is more like what you'd expect from a vacuum-tube signal tracer, and there are the advantages of quiet, hum-free operation, no line cords *and* no shock hazards while working on ac-dc transformerless equipment. END



"I'd think with the two of you working on my set you could find out why it shows a double image."

Tips on Tape Head Care

EVERY SERIOUS TAPE USER OUGHT TO give at least a passing thought now and then to the wear on his machine's recording and playback heads as the tape quite literally grinds past them. That smooth, satiny-looking iron oxide coating on the tape is actually used commercially (in a slightly different form) as an abrasive!



In a recent *Customer Engineering Bulletin* (CEB No. 3), Nortronics Co., Inc. (8101 W. 10th Ave., Minneapolis 27, Minn.), maker of tape recording heads and electronics, puts forth a few startling statistics on tape-head wear. The table here gives very approximate useful lifetimes for high-quality nickel-alloy heads (which, sadly, are rather soft), depending on the speed and the kind of tape pressure control used.

TAPE HEAD LIFE EXPECTANCY

Pressure Pads	Tape Lifters	Most-Used Speed 1.875	3.75	7.5	Probable Head Life (Hours)
Yes	Yes			*	500–600
Yes	No			*	300–400
Yes	No		*		500–600
Yes	No	*			700–800
No	No			*	1,000–2,000
No	Yes			*	2,000–4,000

Life depends greatly on condition of tape, make of head and even ambient dust and humidity.

You'll see at a glance that while pressure pads are a simple and effective way of keeping the tape in intimate contact with the heads, they're murderous to the critical head surfaces. This is true especially of pressure pads that press against only a small area of the head (see drawing) or ones that press with a force of more than about ½ ounce.

Not only does premium-quality tape from a reputable manufacturer save wear on heads, but *used* tape (in good condition) is less abrasive than new tape.

When you clean tape heads, never use stiff brushes, pipe cleaners or any tools that might scratch the highly polished surface. Use lens-cleaning tissue or cotton swabs. END