# EQUIPMENT REPORTS

## *A. W. Sperry VH-600 Voltage Detector*

*Find out if an electric wire is live or dead, without a direct connection.*

CIRCLE 49 ON FREE INFORMATION CARD

YEARS AGO, ALMOST EVERY TECHNICIAN used the magic of *phantom coupling* to determine if an audio amplifier having a high input impedance was working. The technician simply put his (or her) finger on the amplifier's input terminal and hoped a loud 60-Hz hum would rattle the speaker—indicating that the amp was working. Today, that very same phantom coupling is used by an inexpensive (suggested list price $34.95) contact-less voltage detector, called a "Volt-Hound" *VH-600* (A. W. Sperry Instruments, Inc., 245 Marcus Blvd., Hauppauge, NY 11787), to tell if an electric wire is live or dead. Despite its low price, the "Volt-Hound" really works.

### Phantom coupling

The nature of phantom coupling is subject to some debate. One theory is that it is actually capacitive coupling to the local AC electric powerline. That theory works likes this: No matter how infinitesimal, there always is some capacitive coupling between a person and nearby electric wires, and between the person and ground. A very tiny, almost unmeasurable, electrical current flows between the electric wire, the person, and ground; hence, there is an electric voltage (or current) in the person's body. If the person touches the input to a high-impedance amplifier—which is voltage, not current sensitive—part of the voltage in the person's body is applied to the amplifier's input. As far as the amplifier is concerned, it is receiving a 60-Hz signal input, which is reproduced in the speaker.

Usually, hum can not be induced into a low-impedance amplifier input because the low impedance literally "loads down" the body, sharply reducing the voltage developed through that type of capacitive coupling.

Another explanation of phantom coupling claims that the magnetic field created by AC current flowing in a conductor induces an AC voltage in nearby objects, such as a service technician. However, that theory does not explain how voltage or current is induced in a body when no current is flowing through the conductor, because without current there is no magnetic field. The capacitive-coupling theory is, therefore, more viable.

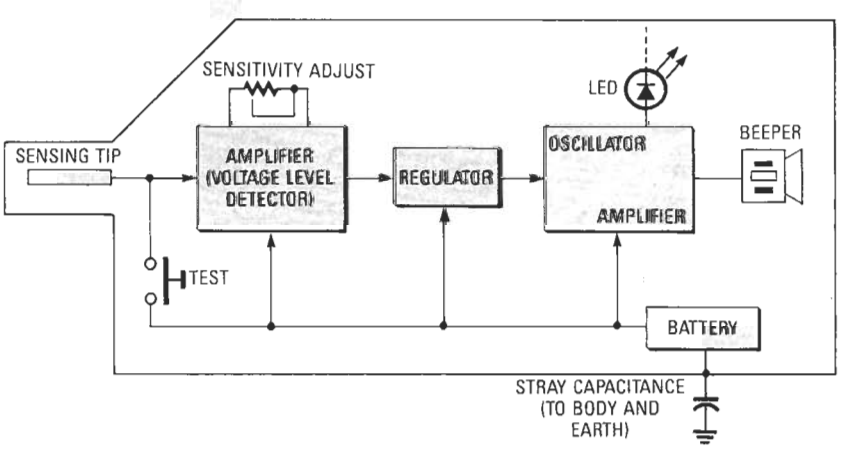


**FIG. 1—THE BLOCK DIAGRAM OF A VOLT-HOUND. The TEST switch only checks the battery, not the sensitivity of the device. The Regulator is the circuit stabilizes the input signal to produce a constant output for the Oscillator/Amplifier.**

### The Volt-Hound

The principle of capacitive coupling is used by the Volt-Hound to test electric wires to determine if they're live or dead. As shown in the photo, all that's needed to conduct the test is to place the unit near the wire. If the wire is live—connected to the powerline—the Volt-Hound will beep and flash a light, even if there is no current flowing in the wire. If the wire is actually dead—meaning there is no connection to the powerline—there is no sound or light indication.

### How it works

The Volt-Hound's block diagram is shown in Fig. 1. Note that there is a metal sensing tip, an Amplifier with a SENSITIVITY (gain) control, a Regulator that both amplifies and provides a constant output level,

and an Audio-Oscillator/Amplifier that produces a pulsing signal that eventually feeds the Beeper and the LED. A TEST switch feeds battery voltage to the amplifier input, which produces a beep and light if the battery is working. (The test switch checks only the battery; not the circuit operation.)

Figure 2 shows how the device works. When the Volt-Hound's detector—which is actually a metal plate—is positioned near a conductor that is carrying voltage, there is an effective capacitance between the conductor and the detector, and an effective capacitance between the detector and ground. Actually, the capacitance to ground is the capacitance from the detector to the user's hand, and the stray capacitance from the user to ground.

Notice that the effective capacitances form a capacitive voltage divider between the conductor and ground; hence, there is a minute AC voltage between the detector and ground. Since, as shown in Fig. 2, the detector is connected to the input of the amplifier, the "detected" AC voltage causes the test instrument to beep and light.

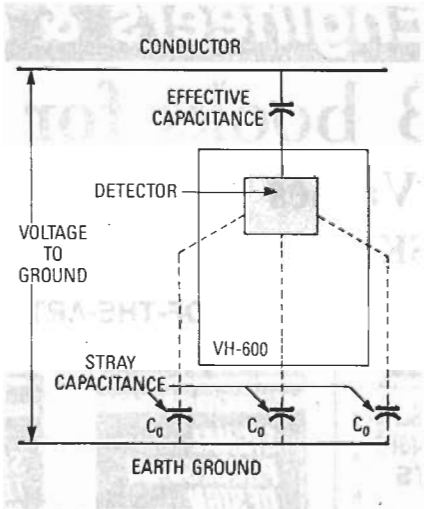


**FIG. 2—THE AC SIGNAL IS COUPLED from the conductor to the device by effective capacitance, and from the device to ground by electrostatic capacitance—what is usually called "stray capacitance."**

As you might expect, there can be a considerable variation in the stray capacitance to ground depending on whether the user is wearing rubber- or leather-soled shows, standing on wood or concrete, etc. That is the reason for the SENSITIVITY adjustment. In typical use, the user would position the test device near a known live electric conductor and adjust the SENSITIVITY control until there was just enough gain to produce a dependable audio and visual indication of live wires. Then the device would be positioned near wires to be tested. (Both the SENSITIVITY control and the two LR-44 button-type batteries that power the device are accessed by simply pulling the rear cover off.

While the phantom-coupling effect could probably be used to test for AC voltage of any reasonable value and frequency, the Volt-Hound is specifically designed for a 50/60-Hz working-range of 100–600 volts. Take particular note of the 100 volt low-end limit. Although lack of the beep and light does indicate a dead wire, it can also indicate a wire carrying less than 100 volts, so use common sense and care even if a wire is indicated as dead. **R-E**