The Squawker: A Light Detector

This simple device is used primarily as an aid for a blind amateur. Sighted amateurs, however, are sure to find at least one of the applications mentioned here suited to their purpose.

By Butch Bussen, WAØVJR
Box 142, Wallace, KS 67761

One of the more useful things I keep at my operating position is a little box you can hold in the palm of your hand. When exposed to a light source, the box makes a noise. I played around with this circuit several years ago and my friend, Jim Stewart, who built it for me, calls it the Squawker. It is aptly named, as it does emit some rather strange noises!

Description

The Squawker (shown in Fig 1) consists basically of a photocell and an audio oscillator powered by a 9-V battery. The amount of light reaching the photocell controls the oscillator frequency and hence, the pitch of the tone. With no light shining on the photocell, the pitch is so low that you can easily count the clicks produced by the 555 timer. When the Squawker is exposed to a bright light, it emits a high-frequency note. If you put a Squawker in your shirt pocket, you can drive everyone else in the room crazy just by walking around and allowing different light intensities to reach the photocell! Okay, so it's a neat little toy, but of what *good* use is this device?

Putting the Squawker to Use

I have several good uses for my Squawker. I am totally blind and have no light perception at all. Sometimes I go to my basement workbench with a sighted friend and forget that sighted people need a light, even if I do not. (When the power fails, guess who gets to run errands for everyone and start the generator!) I usually try and remember to turn *on* a light, but often forget to turn it *off*. If I am the last one to leave a room, the light is usually left on. Most people forget that I really do not need the light, so they leave it on for me.

Enter the Squawker. All I have to do is wave it around the room to see if the light was left on. Sure, most of the time I could feel the switch and tell if it is on or off. That is assuming that "up" is on and "down" is off. In my shop, however, I have three-way switches and the on or off position of one switch is determined by the position of the other switch. With the Squawker, I can go around the house and make sure all the lights are out before I leave the room or go to bed.

The amount of light reaching the photocell controls the pitch of the tone.

There are other times when I want to make sure a light is on. I sometimes want to be sure the yard light is on when someone is coming home late. Before I got the Squawker, I would sometimes turn the yard light on thinking I was doing someone a big favor only to discover later that the bulb was burned out! The Squawker is also handy for checking car tail lights, turn signals or trailer lights.

Have you ever stopped to think about all of the things that have LEDs on them these days and how much you depend on them? Take a look around the average ham shack and you will see what I mean. Try and imagine what it would be like if you could not see, or did not have all of those little LEDs. Is the clarifier on your transceiver off or on? Which line is blinking on your phone? You turn on your receiver and there is no audio output. How can you tell the receiver's even on? I have even used the Squawker to see if tube filaments are lit. My AEA PK-232 packet-radio modem has 21 LEDs on the front panel. That's almost enough to illuminate a small Christmas

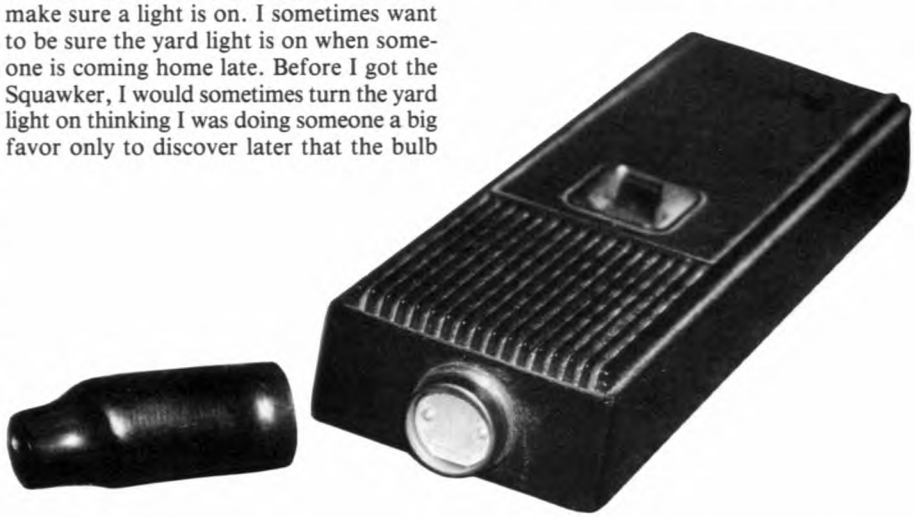

Fig 1—The Squawker. A salvaged cassette recorder microphone case is used as the enclosure. The photocell is the cylindrical light-colored object in the foreground. To the left of the Squawker is a piece of heat-shrink tubing used as a light shield when examining LEDs (see text).

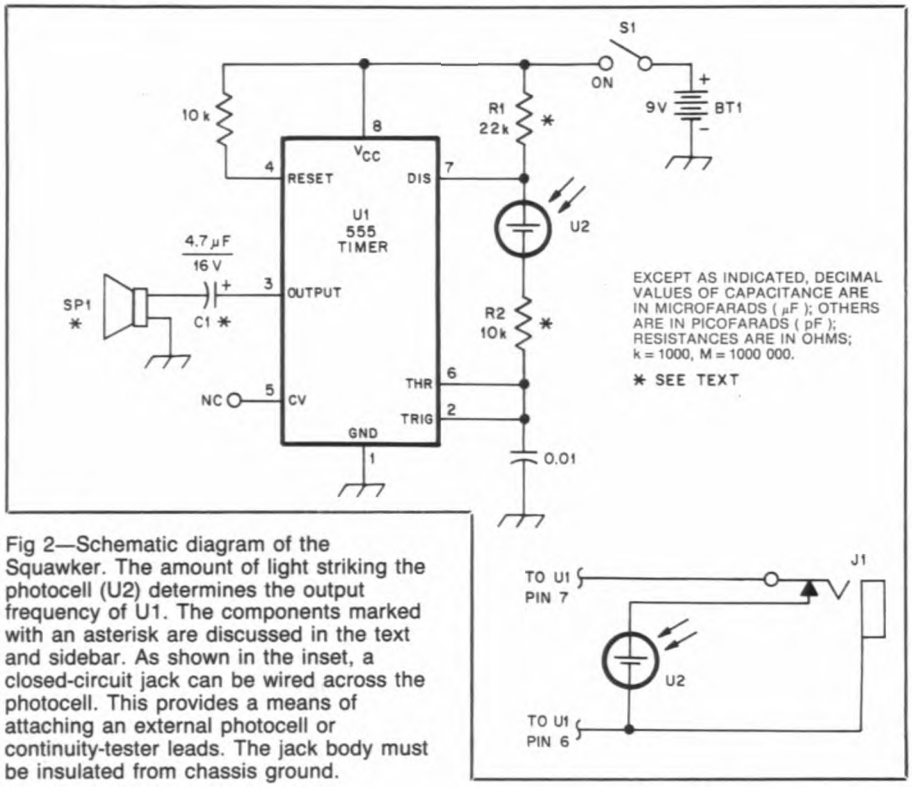

Fig 2—Schematic diagram of the Squawker. The amount of light striking the photocell (U2) determines the output frequency of U1. The components marked with an asterisk are discussed in the text and sidebar. As shown in the inset, a closed-circuit jack can be wired across the photocell. This provides a means of attaching an external photocell or continuity-tester leads. The jack body must be insulated from chassis ground.

tree! (Speaking of Christmas trees: The Squawker works fine for checking those Christmas-tree lights that worked okay last year, but for some reason never do when you unpack them!) For such a simple device, the Squawker has a multitude of uses.

Construction

The Squawker can be built in almost any kind of enclosure. It should be comfortable to hold in your hand. Mount the photocell at one end of the container so that it can be pointed easily at a light source. My Squawker is built in a salvaged Craig cassette recorder microphone case. The dynamic cartridge acts as the speaker, and the PAUSE switch turns the Squawker on and off. A standard 9-V battery fits nicely where the microphone cord was stored. Perf-board construction is adequate for a project this simple.

Parts values are not critical. U1 is a common 555 timer IC. I have used standard 8-Ω speakers and dynamic microphone cartridges as output transducers. Use whatever fits the box that contains the Squawker. Depending on the impedance of the speaker, you may have to change the value of the electrolytic capacitor, C1.

I have found some photocells that work better than others, but a common Radio Shack photocell (RS 276-116 or 276-1657), or even a surplus phototransistor, works fine. I used a 10-kΩ resistor in series with the photocell in my unit. You may want to experiment with this value *[see the sidebar.—Ed.]* depending on the photocell you use. With no resistor, the output tone of my Squawker went so high that I could not hear it! The more light the photocell sees, the less resistance it has, and the output tone increases in frequency. As the light decreases, the resistance increases and the frequency drops. With the 10-kΩ resistor in mine, I just can hear the tone at its highest frequency. If you turn on the Squawker in total darkness, it won't make a sound until it sees a little light to get it started.

Wiring Description

For sighted readers, the schematic diagram is shown in Fig 2. A circuit wiring description follows as it would be presented aurally to visually handicapped hams: Pin 1 of U1, the 555 timer, goes to ground and to the negative terminal of the 9-V battery. The positive terminal of the battery is wired to the arm of an SPST ON/OFF switch. The other side of this switch is the V_{CC} line. Pin 2 is bypassed to ground through a 0.01-µF capacitor. Pin 2 also is tied to pin 6. Pin 6 is connected through a 10-kΩ resistor (R2) to one side of the photocell. Pin 3 is wired to the positive end of a 4.7-µF electrolytic capacitor, (C1). The negative side of this capacitor is connected to one side of the speaker, and the other side of the speaker is grounded. Pin 4 is pulled high through a 10-kΩ resistor to V_{CC}. Pin 7 connects to the other side of the photocell and also through a 22-kΩ resistor (R1) to Pin 8. Pin 8 is wired to V_{CC}. Pin 5 is not used and remains unconnected.

You may want to wire a closed-circuit phone jack across the photocell so that when a cable is plugged into it, the Squawker's photocell is taken out of the circuit. If you use a metal enclosure, insulate the jack from chassis ground. You now have a light detector or a continuity tester. You can also hook another photocell to these test leads.

Applications Ideas

The Squawker is sensitive enough to tell if an LED is lit. I had to come up with a way to keep other light sources from shining on the photocell when concentrating the Squawker on one LED. On some equipment, several LEDs are mounted quite close together, and I need to know which one of the bunch is on. The solution is to use a piece of heatshrink tubing, preferably black, as a shield (see Fig 1). It should be just the right diameter to slip over the photocell, and about 1 inch long. Shrink one end down so that the piece of tubing is funnel shaped. With this piece of tubing slipped over the photocell, you can put the small end right over the LED in question. See Fig 3.

Here is an idea that works quite well for

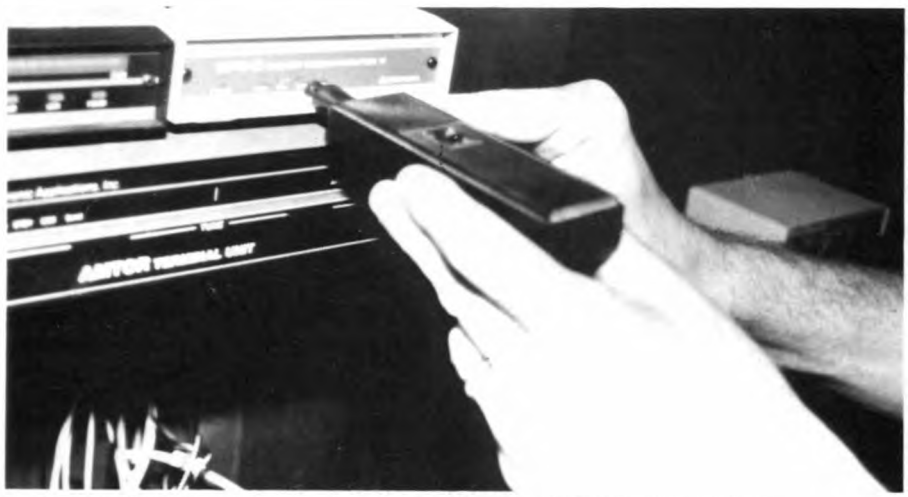

Fig 3—The Squawker being used to check LEDs on a KPC-2 packet modem.

constantly monitoring a particular LED. Hook the external photocell through a high-value fixed resistor or potentiometer. Set the resistance so that when an LED is illuminating the photocell, the speaker ticks very slowly. Choose the resistor and photocell that gives you just the right ticking noise. The goal is to create a sound that is not objectionable and can be ignored easily. But if you want to, you can listen for the "tick tick tick" and know that the LED is on. There is an LED on my Kantronics KPC-2 that is illuminated when I have unacknowledged packets. I tape the external photocell assembly to the front of the KPC-2 so that it sees only the LED I want to monitor. Admittedly, this is a bit haywire and may not be much for looks, but it sure beats taking your hands off the keyboard and holding the Squawker in place to check the LED. A better approach is to build a similar circuit inside your modem and let the voltage that feeds the LED also go to a gate that turns the oscillator on and off.

Another Squawker Version

I tried some modifications to the simple circuit presented by Butch in Fig 2. Using values of 100 kΩ for R1 and R2 produced some positive results. The upper end of the frequency range was lowered and the audio output level increased considerably. With a 9-V battery, in fact, I found it desirable to introduce a volume control between the negative end of C1 and the speaker. A 500-Ω thumbwheel trimmer potentiometer works well for this purpose. The resistance value changes also allowed the circuit to operate at low volume with a supply voltage as low as 3 V. I used an RS 276-116 photocell and found it to be quite sensitive.

I built my version of the Squawker—see Fig 4—in a plastic box (RS 270-220) that measures 13/16 × 2 × 4 in (HWD). The small speaker and subminiature ON/OFF switch were salvaged from my junk box, although similar items are also available from Radio Shack and other parts-supply houses.

A piece of pad-per-hole perf board and point-to-point wiring are used to mount the components. I used a socket for the IC. (The volume control is omitted in this version of the Squawker, but there's more than enough room on the board for a subminiature potentiometer.) The photocell is secured with epoxy cement in a hole drilled in one end of the enclosure. Pieces of double-stick tape secure the battery and perf board within the box. Small notches were made in the box cover to clear the outer edge of the speaker rim.

To make the speaker grill, a pattern of small holes was drawn on a paper template. The template was then taped to the box, and a punch used to locate the center of each hole. The holes were drilled slowly, as the plastic is quite soft and is easily deformed. Dabs of epoxy cement fasten the speaker to the box cover. A 7555 IC (CMOS version of the 555) can be used for U1 if you want to reduce the battery current drain. Without altering the circuit in any other way, however, the audio output level will be considerably lower with the 7555 than with the 555.—*Ed.*

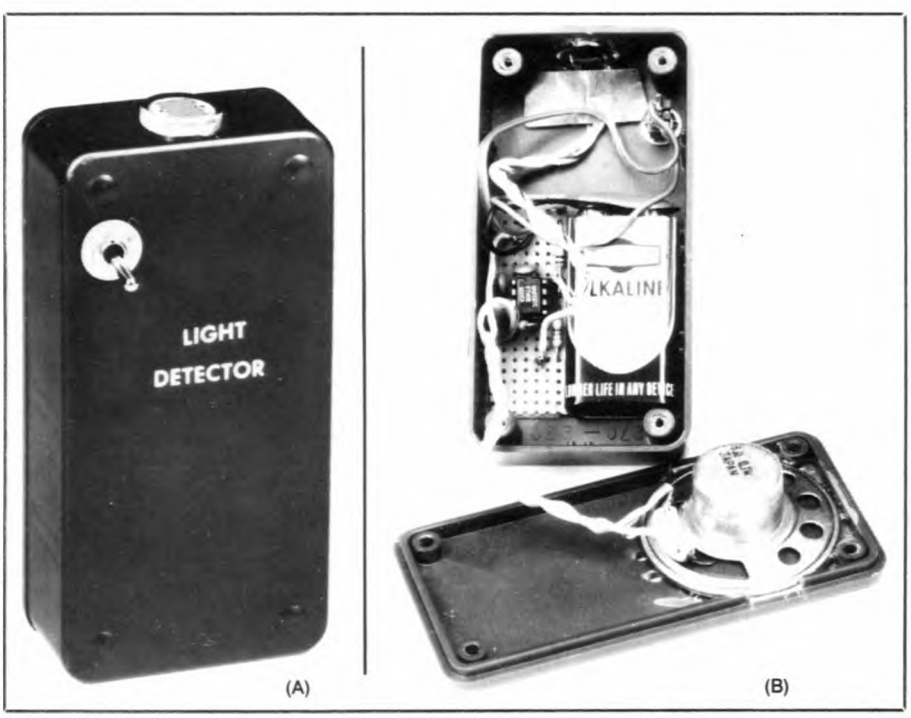

Fig 4—Another version of the Squawker. At B, an inside view of the assembly. See sidebar for construction information.

The Squawker is sensitive enough to tell if an LED is lit.

That is the Squawker! It is a neat little circuit whose usefulness depends only on your imagination. Try it—it makes a great weekend project!

Butch Bussen was first licensed in 1961. His Novice call, WNØHGV, expired without his being able to make a single QSO. In 1968, Butch obtained his General class license. Butch has been an active amateur ever since. He attended the School for the Blind in Kansas City, Kansas for 11 years and attended a local high school during his senior year. No Braille textbooks were available, so learning materials had to be placed on audio tape. Because no cassette recorders existed then, Butch carried around a 7-inch reel-to-reel deck.

Butch graduated from high school in 1966 and attended a local vocational technical school for the next three years. There he studied electronics and took a two-year telephone course and a two-year electricity course in three years. It was about that time he got back into Amateur Radio.

After completing vocational school, Butch worked part time for an uncle doing construction work. He also did some work for a local TV repair shop. Not much TV work, Butch says, just radios, stereos and tower work. Butch acted as the troubleshooter and let someone else do the soldering. Butch and his wife, Nancy, KAØNVF, have two children. Terra is 13 and Chris is 16.

For the past several years, Butch has run a small shop out of his home doing citizen band radio, commercial two-way radio, and satellite TV sales and service. A little over three years ago, he got his first computer, and now enjoys writing and marketing special talking software. [You'll be seeing more from Butch in an upcoming article series, "Amateur Radio and the Blind." You'll learn how he combines computers and Amateur Radio to operate the various modes.—Ed.] QST

Strays

I would like to get in touch with . . .

☐ hams for VHF and eyeball QSOs during my visit to southern and western USA Jul-Sep. Hans Prader, OE5FOL, A-4553 Schlierbach 352, Austria.

☐ hams who lived in Laurelton, New York 1955-1970. Rob Brownstein, NS6V, 3881 Winkle Ave, Santa Cruz, CA 95065.

☐ Masons and Order of Eastern Star members in Michigan, for starting a newsletter and net. Send QSL card to Wells Chapin, W8GI, Michigan Masonic Homes, 1200 Wright, Alma, MI 48801.

☐ anyone who writes music, for forming a musicians net on 2 meters. Bill Copeland, WB6RVE, PO Box 163, Perris, CA 92370.

Feedback

☐ In "A CW Keying Interface" (Apr 1987 *QST)*, the pin numbers for the emitter and collector of the optoisolator (U3) in Fig 1 on p 52 are incorrect. Please change the labels to show the emitter connected to pin 4, and the collector to pin 5.

☐ The MV2109 tuning diode specified in "Tuning Diode Applications and a VVC-Tuned 40-m VFO" (Sept 1987 *QST*, p 25-29) is no longer available from BCD Electro. Similar MV-series tuning diodes can be ordered from Circuit Specialists in capacitance values from 6.8 pF to 100 pF. Contact Circuit Specialists, PO Box 3047, Scottsdale, AZ 85257, tel 1-800-528-1417. A catalog is available. Also, the telephone number for BCD Electro has been changed to 214-343-1770.

☐ An error exists in Fig 2 on p 36 in "The Squawker: A Light Detector" (Jul 1987 *QST*). In the optional circuit shown in the inset, the lead from the junction of the shell of J1 and U2 is incorrectly shown as routed to U1, pin 6. The connection should be made between U2 and the top end of R2. (Thanks to Lou Beaubien, VE7CGE, for spotting this one.)