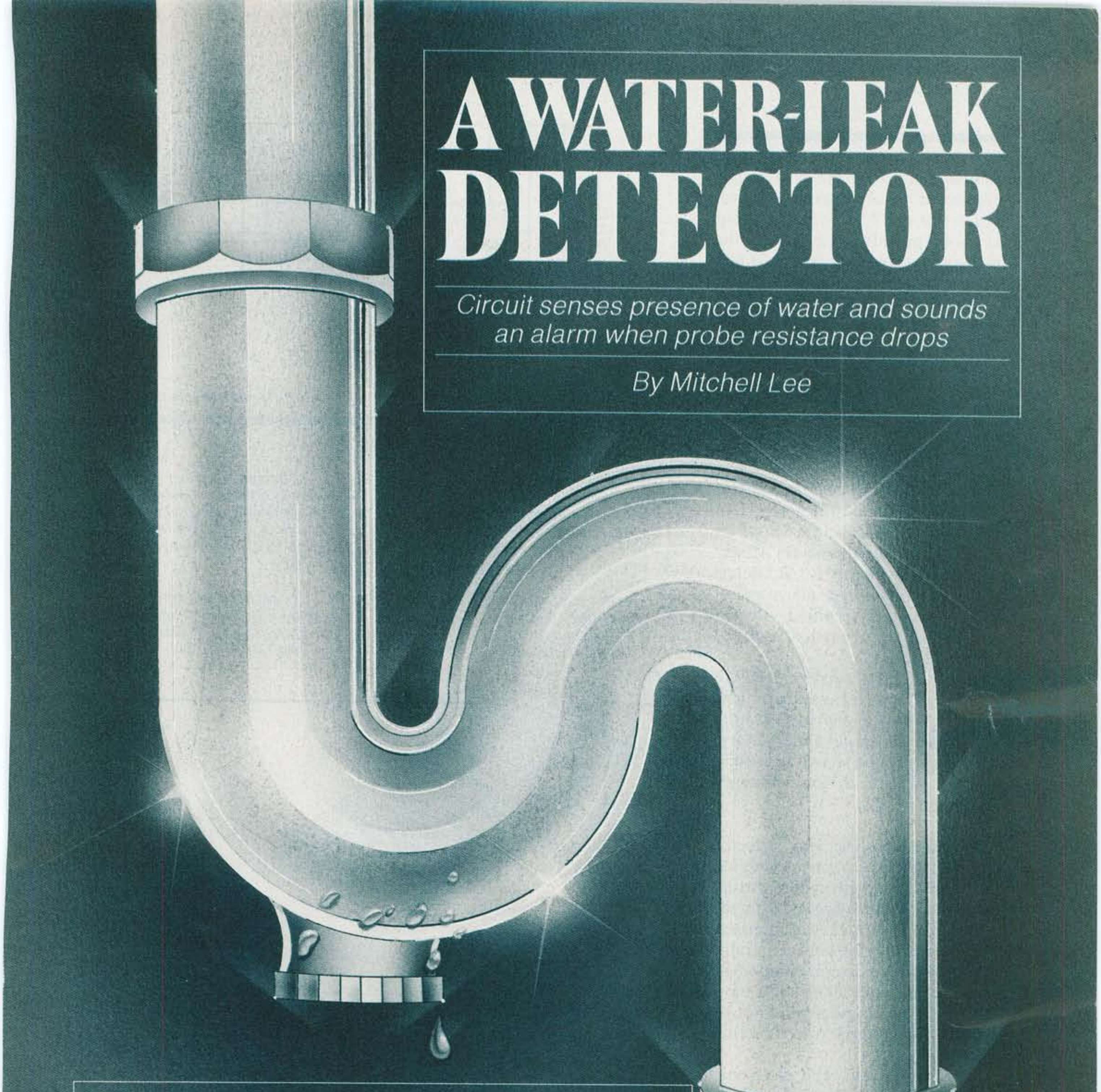
A WATER-LEAK DETECTOR

Circuit senses presence of water and sounds an alarm when probe resistance drops

By Mitchell Lee



WATER leaks are costly nuisances for any homeowner, especially when they go unnoticed for one or more days. A leak in a refrigerator ice maker, dish washer, hot water heater, evaporative cooler, or plumbing can spell disaster for cabinets, floors, and any items stored in the immediate vicinity. What every homeowner needs to avoid disaster is a device that will alert him of leaks when they first occur, *before* they have a chance to do extensive damage.

The leak detector circuit shown schematically in Fig. 1 senses the presence of water by monitoring the resistance between two probes that are placed so that the resistance is affected by the amount of moisture present. When this resistance drops below about 0.5 megohm, an alarm sounds to draw attention to the situation.

At the heart of the circuit is a National Semiconductor LM1801 battery-operated alarm, which contains a comparator, 500-mA output stage, low-battery detector, and two internal voltage sources. The positive input of the comparator at pin 5 of *IC1* is connected to an internal 5.8-volt source via pin 2; the negative input at pin 4 is pulled low by *R1*, with the probe connected between pin 4 and the positive supply line.

Under dry conditions, resistance across the probe is fairly high (greater than 5 megohms) and no output to alarm *A1* is present at pin 8 of *IC1*. When probe resistance drops below about 500,000 ohms, pin 4 of *IC1* is pulled higher than pin 5 and pin 8 goes low, at which point, *A1* sounds.

The on-chip low-battery detector alerts you whenever the potential at pin 12 of *IC1* falls below 6 volts by sounding *A1* for 30 ms every 45 seconds. Voltage divider *R2/R3* determines the low-voltage alarm point. With the values specified, *A1* will sound when battery potential drops below 8.2 volts.

Total standby current drain of the leak detector is less than 7 μA, allowing up to a year of operating life from a 9-volt alkaline battery. The alarm can be tested by closing *S1* to emulate a low-resistance across the probes.

Construction. The leak detector can be assembled on perforated board, using point-to-point wiring, or on a small home-brewed printed-circuit board. Whichever approach you elect to use, the only constraint is that you take care in component arrangement since all resistors have very high values and should not be shunted by any type of conducting material.

Once assembled, the electronic part of the project can be housed in any enclosure that will accommodate it and battery *B1*. If desired, probe connections can be made via banana jacks mounted on the enclosure.

Probe construction depends on the nature of the leak being detected. A pattern of interdigitated "fingers" (Fig. 2A) can be placed beneath an anticipated drip or on the floor beneath an appliance where leaking water usually occurs. This type of sensor can readily be fabricated from a printed-circuit board

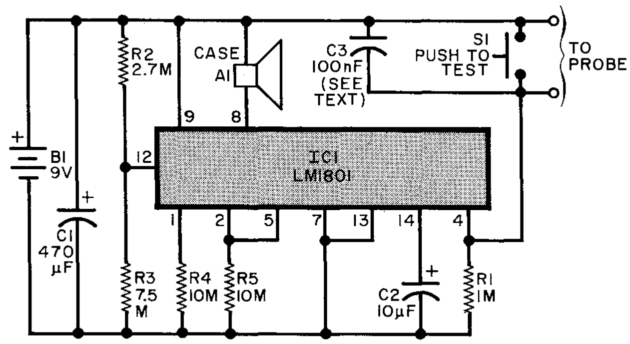


Fig. 1. The heart of the circuit is the LM1801 battery-operated alarm.

PARTS LIST

- A1—Buzzer (Radio Shack Cat. No. 273-049 or similar)
- B1—9-V alkaline battery with connector
- C1—470-μF, 10-V electrolytic
- C2—10-μF, 10-V electrolytic
- C3—100-μF disc capacitor (optional—see text)
- IC1—LM1801 battery-operated alarm
- R1—1-megohm resistor
- R2—2.7-megohm resistor
- R3—7.5-megohm resistor
- R4, R5—10-megohm resistor
- S1—Normally open pushbutton switch
- Misc.—Perforated or printed-circuit board; suitable enclosure; materials for sensor(s) (see text); IC socket; hookup wire; solder; etc.

Note: The LM1801 integrated circuit is available for $1.79 from Digi-Key Corp., Highway 32 South, PO Box 677, Thief River Falls, MN 56701 (800-346-5144).

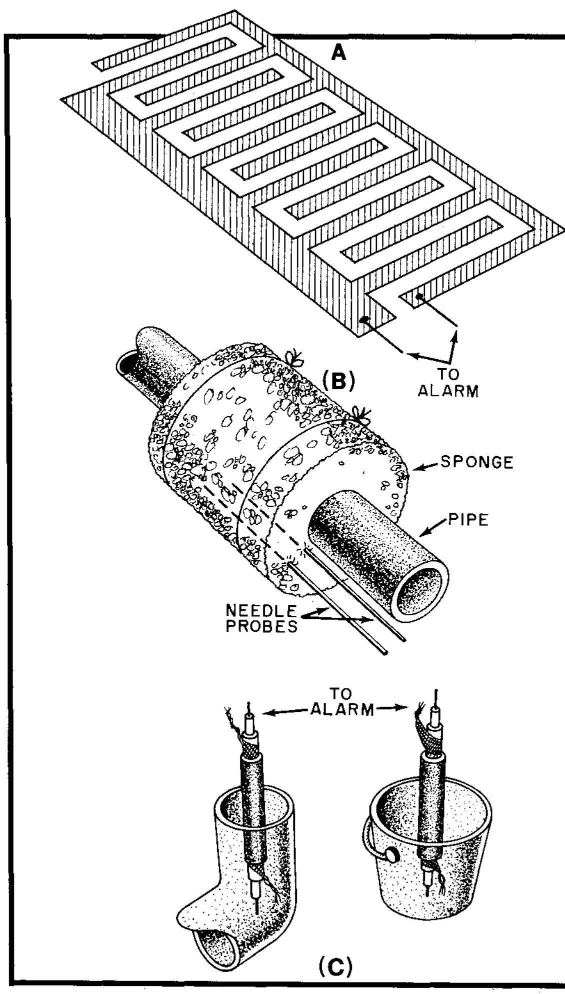


Fig. 2. An interdigitated type of probe or sensor is shown at (A). The arrangement at (B) can be used if water is likely to run down a pipe. The end of a coax cable can be used as a probe in an overflow pipe or drip bucket as shown at (C).

edge connector by soldering together alternate traces.

Where leaking water might run down the underside of a pipe, the probe arrangement shown in Fig. 2B would prove most useful. To fabricate it, first wrap a dry sponge around the pipe and tie it in place. Then push two lengths of heavy bus wire (the "probes") into the sponge parallel to and along the underside of the pipe. Using this arrangement, water running down the underside of the pipe will be intercepted and absorbed by the sponge. When the sponge gets wet, it will create a relatively low-resistance path between the probe wires, tripping the alarm.

As shown in Fig. 2C, the unterminated end of a length of coaxial cable makes an excellent leakage probe for a drip bucket or an overflow pipe. The probe tips are formed from the exposed braid and center conductor of the cable.

Multiple probes can be connected to the leak detector simply by tying them into the input circuit in parallel, to permit monitoring of several different locations simultaneously. If a sensor is to be located remotely from the electronic package, it is a good idea to wire a capacitor (*C3* in Fig. 1) across the probe input at the electronic package to reduce noise pickup. In most cases, remotely located sensors can be interconnected with the electronic package via twisted-pair 20-to-30-gauge insulated hookup wire.

A final note: probes and other sensors subject to oxidation (for example, copper) should be periodically cleaned. ◇