ELECTRONIC COIN TOSS

We call upon fate to make those fair decisions we cannot make ourselves

By Bob Scott

MANY AFFAIRS OF THE HEART, ATHLETIC EVENTS, AND business deals have been decided by the flip of a coin. Often, when we cannot come to an immediate decision on a question, we'll toss a coin to decide the issue. The simple electronic device decribed here can be used as an electronic *coin toss* game to decide such *important* issues as who pays for the coffee, or who takes the lunch break first. When properly adjusted to provide a 50-50 chance of heads and tails, the Electronic Coin Toss Game can be used to demonstrate and study the laws of probability.

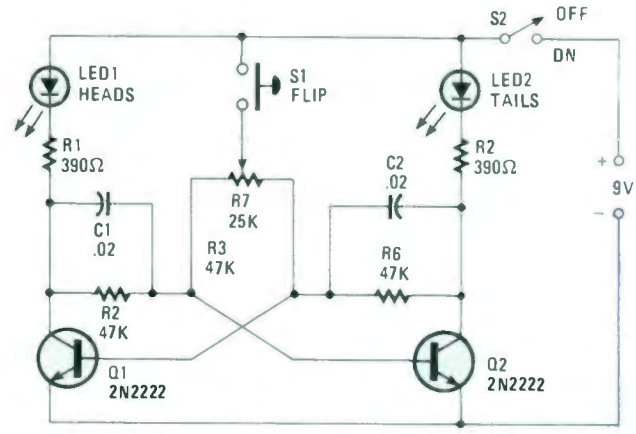


FIG. 1—BALANCE is the theme of this schematic diagram so that the coin flips fall equally heads as well as tails.

Inside the Circuit

The circuit diagrammed in Fig. 1 was developed from a heads-or-tails game circuit that is seen often in hobby magazines in one form or another. Two general-purpose NPN silicon transistors are connected in an Eccles-Jordan flip-flop circuit that has two steady states of equilibrium. One is when Q1 is conducting and Q2 is cut off; the other is when Q1 is cut off and Q2 is conducting. The circuit remains in a given state until some outside influence causes the conducting transistor to cut off and the non-conducting transistor to turn on. The transistors have light-emitting diodes (LED's) in their collector circuits to show which transistor section is conducting at a given instant. The conducting transistor causes its corresponding LED to glow. One LED is marked HEADS and the other TAILS.

When the ON-OFF switch is first closed, pure chance causes one transistor to be turned on and the other turned off, thereby lighting either the HEADS or TAILS indicator. When we press the FLIP switch, S1, the circuit is converted into a free-running multivibrator oscillating at approximately 700 Hz. The LED's are alternately on and off but the switching is so rapid that both LED's appear to glow continuously. As soon as flip switch S1 is released, the circuit stops oscillating and remains in the state it was in at the very instant that S2 opened. *(Continued on page 95)*

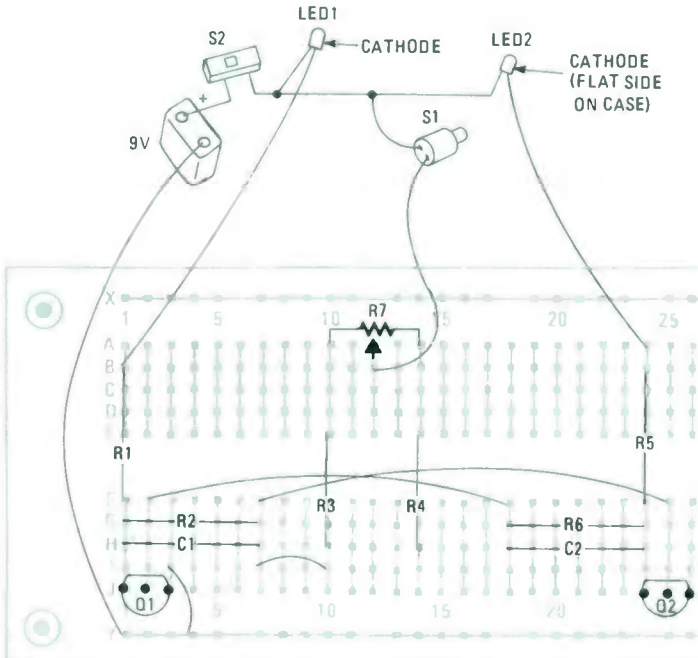
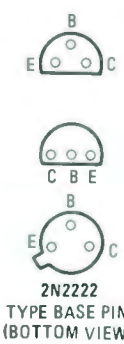


FIG. 2—USING A STANDARD solderless breadboard, your wired version of the Electronic Coin Toss should look like the diagram shown at left.



PARTS LIST FOR ELECTRONIC COIN TOSS

SEMICONDUCTORS

LED1, LED2—Light-emitting diode (Both red, or one red and one green)

Q1, Q2—2N2222 general purpose NPN silicon transistor

RESISTORS

R1, R5—390-ohm, 1/4-watt resistor

R2, R3, R4, R6—47,000-ohm, 1/2-watt resistor

R7—25,000-ohm, subminiature potentiometer, printed-circuit mount

ADDITIONAL PARTS AND MATERIALS

C1, C2—.02-μF, ceramic trimmer

S1—SPST, subminiature, normally-open, push-button switch

S2—Miniature slide switch

9-volt transistor battery and terminal clips, predrilled printed-circuit board or printed-circuit board material, wire, solder, etc.

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If all components in the circuit could be exactly matched, the chances of either transistor being on at the instant S2 is released would be exactly even—a 50:50 chance. However, the adjustable trimmer potentiometer, R7, is included so that you can compensate for variances in the components' values. If you have access to a oscilloscope, check the waveform at either collector while S2 is held closed. Adjust the trimmer for equal on and off periods.

Putting It Together

The circuit layout is shown in the photo and in Fig. 2. Most of the components are on a small piece of printed-circuit board (half of a 300 PC Experimenters board from Global Specialties Corp. or Radio Shack Experimenters PC board No. 276-174). The switches and LED's are mounted on a 2 × 4½-inch piece of blank PC board. The LED anodes, and all + 9-volt DC connections, are soldered to the copper foil.

Run off 100 tosses and record the fall of the coin. The count should be no further than 52:48 from a 50:50 expectation. If the gap is larger, reset S1 slightly, and do it again. After all, give the suckers a break! ■